Effects of the affiliation of banking and commerce on the firm’s investment and the bank’s risk

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Abstract

This paper examines how the affiliation of banking and commerce affects the firm’s investment efficiency and the bank’s risk exposure. The bank’s holding of a borrowing firm’s equity reduces the agency conflict between the firm and the bank, but increases the monitoring need of uninformed debtholders. Thus, the firm’s investment efficiency is maximized when the bank’s equity share is between zero and its debt share. The bank’s risk exposure can increase in two ways. With a large equity share, the bank has more incentives to allow the firm to undertake risky projects. The firm, when it has control over the bank, may force the bank to finance its risky projects. © 2000 Elsevier Science B.V. All rights reserved.

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1 The views expressed are those of the author and do not necessarily reflect those of the Federal Reserve Bank of New York or the Federal Reserve System.
1. Introduction

Mutual ownership between banks and firms is a common practice in many countries such as Germany and Japan. In the United States, lawmakers are considering repealing the Glass–Steagall Act of 1933, which separates banking from other industries. Many studies recognize the benefits of the affiliation of banking and commerce. The agency conflict between shareholders and debt-holders in a commercial firm is reduced when a bank holds both the equity and debt of the firm (Prowse, 1990; Calomiris, 1993). Other benefits include economies of scope and product diversification (Benston, 1994; Saunders, 1994). The main fear, raised mainly by political interest groups, is that the affiliation of banking and commerce may undermine the stability of the banking system. Banks may make improper transactions with their affiliates that increase the riskiness of bank assets rather than improve economic efficiency. Increased bank risk, of course, is an economic and political concern because of the difficulty of pricing deposit insurance and possible externalities of bank failures.

To help assess the benefits and costs, I present a theoretical model analyzing how the tie between the bank and the firm through equity ownership affects the firm’s investment efficiency and the bank’s risk exposure. There are three agents in the model: managers acting in the interest of shareholders (firm), a bank that is informed about the firm’s profitability, and uninformed (nonbank) debt-holders. The bank can potentially serve as a delegated monitor for uninformed debtholders, a critical role of the bank recognized in the banking literature (e.g., Chan, 1983; Diamond, 1984). In the model, the conflict between the firm and the bank results in inefficient investment choices, namely, undertaking negative net present value (NPV) projects and passing up positive NPV projects. This inefficiency is minimized when the bank holds the equal shares of the firm’s equity and debt. The optimum share of the bank’s equity holding, however, is likely to be smaller than its debt share because the monitoring need of other debtholders increases with the bank’s equity holding. The model suggests an additional cost of the bank’s equity holding. The bank’s incentives to allow riskier projects may increase the riskiness of both the debt and equity of the firm, thereby increasing the riskiness of the bank’s investment in the firm. In the cases where the firm controls the bank, the bank’s risk exposure may increase without any efficiency gain.

This study is related to Berlin et al. (1996) and John et al. (1994). Berlin et al. show how the debt–equity structure of a bank’s claim affects its ability to play a constructive role in mitigating conflicts among various claimants of the firm. In their model, the bank’s equity claim on the firm serves as a means to credibly subordinate its claim to those of uninformed claimants. My model focuses on the role of the bank’s equity holding in resolving conflicts between equity-holders and debtholders with equal seniority. Interestingly, the two models
produce strikingly different optimal equity holdings of the bank (either very small or very large in Berlin et al.). John et al. examine how bank–commerce interrelationships affect the risk exposure of banks under the assumption that the firm’s capital structure is determined by the bank’s choice between equity and debt. In contrast, this study assumes that the firm’s capital structure is exogenously determined. While the analyses of John et al. seem appropriate for small firms started by entrepreneurs, my analyses are better suited for cases that banks invest in stocks of established firms.

The next section presents a model showing how the interaction among the firm, the bank, and uninformed debtholders affect the firm’s investment choices. Section 3 considers alternative modeling assumptions that may affect the paper’s results. Section 4 discusses policy implications of the paper’s results. Lastly, the paper’s findings are summarized.

2. Agency conflicts and investment choices

The model mimics a situation where a firm with long-term debt faces changed investment opportunities. Since the terms of debt are based on the return distribution of the initial project, switching to a project with a different return distribution transfers wealth between shareholders and debtholders. When the firm’s managers, who act in the interest of shareholders, are better informed about new investment opportunities, debtholders do not know the motive behind the firm’s project choice. The firm may choose an opaque project either because it is expected to yield a high return or because it is of high risk, which transfers wealth from debtholders to shareholders (moral hazard). This moral hazard problem results in conflicts between shareholders and debtholders and lowers investment efficiency. The bank, which is better informed than other debtholders, can improve the situation by serving as a delegated monitor.

2.1. Structure of the economy

The economy has two periods. At the beginning of the first period \(t_1\), a firm finances a risky project (initial project) with equity and two-period debt, which are held by a bank and nonbank investors.  

\(^2\)To be politically feasible, any legislation allowing banks to hold commercial firms’ equity would have to limit banks’ exposure to their commercial affiliates. With unlimited exposure, the benefit of the safety net covering banks may be transferred to commercial affiliates because the failure of a large commercial affiliate can lead to the failure of the bank. Thus, the presence of other investors is almost essential when the firm is large.
(ratio of debt to equity) is exogenously determined. The bank’s choice between equity and debt thus affects its shares of equity and debt, but not the capital of the firm. In other words, a large equity holding by the bank is offset by a small holding by other investors, and vice versa. All agents are risk neutral, and the opportunity costs of both debt and equity are the risk-free rate of return ($R_f$). At $t_1$, all agents know the firm’s financial structure and the distribution of the return on the initial project.

At the beginning of the second period ($t_2$), an exogenous shock can change the firm’s investment opportunities. The shock makes the initial project unavailable and presents two new investment opportunities; one is transparent and safe (transparent project) and the other is opaque and risky (opaque project). While the return distribution of the transparent project is public information, that of the opaque project is private information that is available to managers of the firm and the bank, which has access to inside information and an expertise in processing information.

Debtholders are protected against the shock by a covenant giving them an option to redeem debt early in the event of the shock. Early redemption of debt forces the firm to choose the transparent project, which can be easily financed at fair terms reflecting the return distribution of the project. The firm also repays or renegotiates the long-term debt when it voluntarily chooses the transparent project. On the other hand, refinancing the opaque project is not possible because it is prohibitively costly to verify the quality of the project. Thus, the firm can choose the opaque project only if it is acceptable to both shareholders and debtholders.

To focus on conflicts between shareholders and debtholders, I assume that no nonbank investor holds both debt and equity and that managers act in the best interest of shareholders. Understanding the managers’ behavior, nonbank shareholders do not challenge the firm’s (managers’) decision. The bank’s decision depends on the average return on equity and debt weighted by its shares. The bank, when it has both equity and debt and finds the firm’s decision disagreeable, either demands the redemption of debt or exercises its voting right as a shareholder. Since other shareholders vote for the firm’s decision, the latter option is effective only when the bank has a controlling share of equity. Investment projects are lumpy in this economy. Thus, the redemption of debt either by the bank or by nonbank debtholders forces the firm to choose the transparent project. Nonbank debtholders, who are assumed to be homogeneous, use the same decision criterion. Provided that the firm and the bank agree to choose the opaque project, nonbank debtholders estimate the expected return on debt based on the bank’s incentives to serve their interest (the bank’s relative holdings of equity and debt) and limited information about the return distribution of the opaque project. They demand the debt redemption if the estimated return on debt is lower than its opportunity cost. In sum, to be chosen, the opaque project must be acceptable to the
firm, the bank, and nonbank debtholders when the bank does not have a controlling share of equity. The selection of the opaque project requires an agreement between the bank and nonbank debtholders if the bank has a controlling share of equity.

At $t_1$, the return on debt per unit and per period ($R_D$) is contracted based on the capital ratio of the firm and the distribution of the return on the initial project such that the expected return on debt ($E(D)$) equals its opportunity cost ($R_f D$). For simplicity, the risk-free rate of return is assumed to be 0 ($R_f = 1$). Given that $E(D)$ is $D$, the expected per-unit return on equity ($E(R_K)$) is greater than or equal to 1 when the expected per-unit return on investment ($x$) is greater than or equal to 1. $^3$ Thus, the firm undertakes the initial project at $t_1$ if $x$ is greater than or equal to 1. If the shock occurs at $t_2$, $E(D)$ and the expected return on equity ($E(K)$) depend on the return distributions of new projects and the project choice. The firm, the bank, and nonbank debtholders choose between the transparent and the opaque project based on the revised estimates of $E(D)$ and $E(K)$.

2.2. Expected wealth of shareholders and debtholders

The per-unit return on the initial investment can be either $R_H$ with probability $p$ (high-return state) or $\theta R_H$ with probability $1-p$ (low-return state). Thus, the expected per-unit return on the investment in the first period,

$$x = pR_H + (1-p)\theta R_H.$$  \hspace{1cm} (1)

To model the conflicts between shareholders and debtholders, we need to assume that debt is risky initially; the firm’s asset falls short of the debt payment in the low-return state and is enough to repay debt in the high-return state. This assumption implies that $p$ and $\theta$ of the initial project ($\theta_1$) are strictly greater than 0 and less than 1.

In the absence of the shock, the same project is available in the second period. If the shock occurs at $t_2$, the initial project must be replaced by either a transparent project or an opaque project, of which return distributions differ from that of the initial project. The transparent project yields the risk-free return with certainty. The opaque project is either riskier or safer than the initial project. For simplicity, I hold $p$ of the opaque project the same as that of the initial project and let $\theta$ of the opaque project ($\theta_2$) be either 0 (riskier

$^3$ When $E(R_K)$ is greater than 1, new shareholders pay a premium such that they earn the risk-free return. Only old shareholders (entrepreneur) make an abnormal profit. Thus, the bank and other investors are indifferent between equity and debt at $t_1$. 
than the initial project) or 1 (safer than the initial project) with the equal probability. The expected return on the opaque project \( x_2 \) is drawn from a distribution \( f(x_2) \), which is assumed to be independent of \( \theta \). In other words, the outcome of \( \theta \) affects only the variance, not the expected return on the project.

Under the above assumptions, the expected return on the firm’s equity at \( t_1 \),

\[
E(K_1) = p(R_{H1A} - R_D D) = p \left( \frac{x_1 A}{p + (1 - p) \theta_1} - R_D D \right),
\]

where \( A \) is total assets \( (K + D) \), and subscript 1 stands for the first period. Equityholders keep the difference between the asset and the liability in the high-return state and receive nothing in the low-return state.

The expected return on debt at \( t_1 \),

\[
E(D_1) = pR_D D + (1 - p) \theta_1 R_{H1A} = pR_D D + \frac{(1 - p) \theta_1 x_1 A}{p + (1 - p) \theta_1}. \tag{3}
\]

Debtholders receive the contracted amount in the high-return state and take the total asset in the low-return state.

At \( t_1 \), \( R_D \) is determined such that \( E(D_1) \) equals the opportunity cost of debt \( (D) \). Setting Eq. (3) equal to \( D \) and solving for \( R_D \),

\[
R_D = 1 + \frac{1 - p}{p} \left( 1 - \frac{\theta_1 R_{H1A}}{D} \right) = 1 + \frac{1 - p}{p} \left( 1 - \frac{\theta_1 x_1 A}{p + (1 - p) \theta_1 D} \right). \tag{4}
\]

Holding \( R_D \) constant, changes in \( \theta, x, \) and \( A/D \) at \( t_2 \) transfer wealth between shareholders and debtholders.

The firm fails at the end of the first period if the first-period return turns out to be low \( (\theta_1 R_{H1}) \). In the high-return state \( (R_{H1}) \), the firm pays \( (R_D - 1) \) \( D \) to debtholders and distributes the rest of the income among shareholders such that its capital structure \( (A/D) \) remains the same at \( t_2 \). In the absence of the shock, therefore, the expected returns on equity and debt in the second period are the same as those in the first period, and no wealth transfer occurs in the second period.

If the shock occurs at \( t_2 \), the expected returns on equity and debt depend on the project choice and the return distribution of the opaque project. The transparent project, which yields the risk-free rate of return \( (\theta \) in this economy), can be refinanced at fair terms. Thus, the expected returns on debt and equity are their opportunity costs, \( K \) and \( D \), if the transparent project is chosen. Old debtholders may either continue to lend to the firm at new terms or earn the opportunity cost elsewhere.
Provided that the opaque project is chosen, the expected return on equity,

\[ E(K_{2r}) = p \min \left\{ (R_{HR}A - R_D D), 0 \right\} = p \min \left\{ \left( \frac{x_2}{p} A - R_D D \right), 0 \right\} \]

and

\[ E(K_{2S}) = \min \left\{ (R_{HS}A - R_D D), 0 \right\} = \min \left\{ (x_2 A - R_D D), 0 \right\}, \]

where subscript 2 denotes conditions where the shock has occurred and the opaque project is chosen, subscript \( R \) stands for the case where the opaque project is riskier than the initial project \( (\theta = 0) \), and subscript \( S \) stands for the case where the opaque project is safer than the initial project \( (\theta = 1) \). Comparing Eqs. (2) and (5), \( E(K_{2r}) > E(K_1) > E(K_{2S}) \) when \( x_1 = x_2 \). That is, holding the expected return on the project constant, the expected return on equity is larger when the opaque project is riskier (wealth transfer from debtholders) and smaller when the opaque project is safer than the initial project (wealth transfer to debtholders). Thus, when the opaque project is safer than the initial project, shareholders want to choose the transparent project over the opaque project unless the expected return on the opaque project is high enough (higher than \( x_1 \)) to compensate for the wealth transfer.

The expected return on debt when the opaque project is chosen,

\[ E(D_{2r}) = p \max \left\{ \frac{x_2}{p} A, R_D D \right\} \]

and

\[ E(D_{2S}) = \max \{x_2 A, R_D D\}. \]

Comparing Eqs. (3) and (6), \( E(D_{2r}) < E(D_1) < E(D_{2S}) \) when \( x_1 = x_2 \). Thus, the opaque project offering an expected return that is the same or higher than \( x_1 \) may not be acceptable to debtholders when it is riskier than the initial project. In sum, the shock favors shareholders when the opaque project is riskier \( (\theta = 0) \) and favors debtholders when the opaque project is safer \( (\theta = 1) \) than the initial project.

2.3. Project choice

The firm, the bank, and nonbank debtholders choose between the transparent and the opaque project based on the expected return on the two projects at \( t_2 \). While the expected return on the transparent project is the opportunity cost of capital (both equity and debt) for all agents, the expected return on the opaque project differs across agents because of potential wealth transfer.

The firm wants to choose the transparent project over the opaque one if

\[ E(K_2) < K. \]

That is, the firm prefers the transparent project if the opaque project offers a lower return on equity than the transparent project does.
The bank maximizes the expected return on its investment in the firm. Thus, the bank chooses the transparent project if the expected return on the opaque project for the bank,

\[ E(B_2) = \alpha E(K_2) + \beta E(D_2) < \alpha K + \beta D, \]

where \( \alpha \) is the bank’s share of the firm’s equity, and \( \beta \) the bank’s share of the firm’s debt. The return on the bank’s investment is the average of returns on equity and debt weighted by the respective share.

Nonbank debtholders do not observe the outcomes of \( h_2 \) and \( x_2 \) that determine the return distribution of the opaque project. When the bank holds both debt and equity \( (\alpha > 0) \), nonbank debtholders estimate the expected return on debt conditional on the selection of the opaque project based on the bank’s incentives to serve debtholders’ interest and the distribution of \( x_2 \). They force the firm to choose the transparent project if the estimated net return on debt conditional on the selection of the opaque project,

\[ E(D_{2E}) = \int_{x_R^*}^{\infty} \{E(D_{2R}) - D\} f(x_2) \, dx + \int_{x_S^*}^{\infty} \{E(D_{2S}) - D\} f(x_2) \, dx + u \]

\[ \equiv Y + u < 0, \]

where \( x_R^* \) and \( x_S^* \) are the lowest levels of \( x_2 \) acceptable to the firm and the bank to choose the opaque project, respectively, when \( \theta = 0 \) and when \( \theta = 1 \). \( f(x_2) \) is the probability density function of \( x_2 \), and \( u \) is a random variable with mean 0. The estimated net return on debt increases (decreases) when the firm and the bank are more likely to choose the opaque project when \( E(D_2) \) is greater (less) than \( D \). The random variable \( u \) deviates from 0 if nonbank debtholders are not accurately informed about \( f(x_2) \).

2.4. Investment efficiency

Given that all agents are risk neutral, the socially optimal solution is to maximize the expected output. Provided that the shock occurs, the expected output gain (output net of the opportunity cost of capital) in the second period
\[ E(X) = A \left[ \frac{1}{2} (1 - Z) \int_{x_R}^{\infty} (x_2 - 1)f(x_2) \, dx + \frac{1}{2} (1 - Z) \int_{x_S}^{\infty} (x_2 - 1)f(x_2) \, dx \right] \]

\[ \equiv \frac{1}{2} (1 - Z)A(X_R + X_S), \]

\[ x_R^* = g_R(\alpha, \beta; C), \]

\[ x_S^* = g_S(\alpha, \beta; C), \]

\[ Z = h(\alpha, \beta; C), \]

where \( Z \) is the probability that nonbank debtholders force the firm to choose the transparent project by demanding early redemption, and \( C \) is a binary variable indicating whether the bank has a controlling share of equity.

Clearly, the expected output is maximized when \( x_R^* = x_S^* = 1 \) and \( Z = 0 \). The conflict between the firm and the bank results in two types of inefficiency by causing \( x^* \) to deviate from 1: type 1 inefficiency, which is to undertake negative net present value (NPV) projects \( (x^* < 1) \), and type 2 inefficiency, which is to pass up positive NPV projects \( (x^* > 1) \). The possibility of each type of inefficiency depends on the bank’s shares of equity and debt \( (\alpha \text{ and } \beta) \) and whether the bank has a controlling equity share. If nonbank debtholders believe that the bank is not reliable as a delegated monitor \( Z > 0 \) and demand debt redemption, the firm’s asset yields the risk-free return, which is 1 per unit. In this economy, therefore, the optimal regulation on the firm–bank affiliation is the one that minimizes type 1 and type 2 inefficiencies, while preserving the bank’s reliability as a delegated monitor.

To maximize Eq. (10) with respect to \( \alpha \) and \( \beta \), we need explicit expressions of \( g_R, g_S, \) and \( h \), which involve probability density functions. Since the solutions involve many complicated terms even when a relatively simple probability density function is assumed, it is difficult to interpret them. Furthermore, using specific probability density functions can result in loss of generality. Thus, I derive key results from general properties of \( g_R, g_S, \) and \( h \) without explicitly solving Eq. (10). To facilitate the interpretation of key results, I will first focus on the conflict between the firm and the bank (properties of \( x_R^* \) and \( x_S^* \) to be highlighted in Proposition 1 and Lemma 1) and consider the incentives of nonbank debtholders later (properties of \( Z \) to be highlighted in Propositions 2 and 3). In this model, what matters is not the absolute levels but the relative levels of \( \alpha \) and \( \beta \). Thus, we can focus on only one of the two variables in analyzing the maximization problem.
Proposition 1. At \( z = \beta \neq 0 \), the expected efficiency loss arising from the conflict between the firm and the bank (deviations of \( x_R \) and \( x_S \) from their maxima) is zero when the bank has a controlling share of equity, and is minimized when the bank has a noncontrolling share of equity.

A formal proof is provided in Appendix A. When \( z \) equals \( \beta \), the bank equally weights the interests of shareholders and debtholders. Thus, no inefficiency results from agency conflicts if the investment decision is solely up to the bank (controlling share). Without a controlling share, the bank cannot block the firm’s attempt to serve the interest of shareholders, which results in an efficiency loss. The efficiency loss is still minimized at \( z = \beta \) because no inefficiency arises when the return distribution of the opaque project favors shareholders, i.e., when the firm’s decision is not binding.

Lemma 1. An increase in \( z \) holding \( \beta \) constant reduces both type 1 and type 2 inefficiency arising from the conflict between the firm and the bank when \( z < \beta \), and a decrease in \( z \) holding \( \beta \) constant reduces both type 1 and type 2 inefficiency when \( z > \beta \).

It is intuitive that the efficiency loss decreases as the bank’s interest becomes more balanced (see Appendix A for a formal proof).

Based on these results, the socially optimal solution is to let the bank own the equal share of the firm’s equity and debt. These results hold under the assumption that nonbank debtholders completely delegate monitoring to the bank. When \( z \) equals \( \beta \), however, nonbank debtholders may not completely rely on the bank. The return distribution of the opaque project differs from that of the initial project. While a change in the expected return of the project changes the expected returns of both equity and debt in the same direction, a change in the variance of the project return transfers wealth between shareholders and debtholders. In particular, holding the expected project return constant, a larger variance of the project return decreases the expected return on debt because debtholders with fixed claims do not benefit from extremely high returns but seriously suffer from extremely low returns. Thus, an increased variance of the project return makes some positive NPV projects unacceptable to debtholders. For a bank holding the equal share of equity and debt, however, the wealth transfer between shareholders and debtholders does not matter because the bank’s loss (gain) as a debtholder is completely offset by its gain (loss) as a shareholder. Thus, the bank does not have incentives to protect the interest of debtholders when the project is of positive NPV, even though the net expected return on debt may be negative. When \( z \) equals \( \beta \), therefore, nonbank debtholders need to make decisions based on the bank’s incentive to serve their interest and limited information about the distribution of the project return.
**Proposition 2.** Holding $\beta$ constant, the probability that nonbank debtholders demand redemption ($Z$) increases with $z$.

Appendix A provides a formal proof. With larger $z$, the bank has a stronger incentive to choose the opaque project when it is riskier. Thus, larger $z$ induces nonbank debtholders to estimate larger wealth transfer to shareholders and hence a lower expected return on debt, which increases the probability that they demand the redemption of debt. Early redemption would force the firm to pass up all positive NPV projects. This result leads to the following proposition.

**Proposition 3.** The total efficiency loss resulting from the conflict between the firm and the bank and that between the firm and nonbank debtholders is minimized at $z^* \in [0, \beta]$.

**Proof.** By Proposition 1 and Lemma 1, both $X_R$ and $X_S$ in Eq. (10) continuously decrease as $z$ deviates from $\beta$ in either direction. Thus, for every $z \in [\beta, 1]$, there exists $z \in [0, \beta]$ at which $X_R + X_S$ is no smaller. By Proposition 2, $Z$ at $z \in (\beta, 1]$ is greater than that at $z \in [0, \beta)$. Therefore, the combined efficiency loss is minimized at $z^* \in [0, \beta]$.

It is rather intuitive that $0 \leq z^* \leq \beta$ because the reliability of the bank as a delegated monitor decreases with $z$. The exact value of $z^*$ depends on the responsiveness of $X$ and $Z$ to $z$. In the case that even a small $z$ relative to $\beta$ induces nonbank debtholders to estimate a low expected return on debt and to demand debt redemption (large magnitude of $\partial Z/\partial x$ even at a low level of $x$), $z^*$ may be close to 0. If nonbank debtholders believe that the bank is fairly reliable as a delegated monitor until $z$ reaches $\beta$ (small magnitude of $\partial Z/\partial x$ for all $z \in (0, \beta)$), $z^*$ can be $\beta$. A more plausible case is that larger $z$ makes nonbank debtholders increasingly more skeptical about the bank’s reliability as a delegated monitor ($\partial^2 Z/\partial x^2 > 0$). In this case, $z^*$ is likely to be substantially greater than 0 but less than $\beta$.

**2.5. Riskiness of the firm’s assets**

The project choice shown above suggests that the bank’s equity ownership also influences the riskiness of the firm’s assets.

**Proposition 4.** Holding $\beta$ and $Z$ constant, the expected variance of the firm’s asset increases with $z$.

The bank heavily weighs the shareholders’ interest when $z$ is large. Thus, as shown in the proof of Lemma 1, large $z$ increases the probability that the
opaque project is chosen when it is riskier (smaller $x_R^s$), while decreasing the probability when it is safer (larger $x_S^s$). In expected value terms, therefore, the variance of the firm’s asset increases with $x$.

When the firm’s asset becomes riskier, of course, both the equity and debt of the firm are riskier. With large $x$, therefore, the bank’s investment in the firm is riskier not only because equity is riskier than debt but also because the bank may allow the firm to pursue riskier investments. Lacking accurate information, nonbank debtholders may not be able to completely block the firm’s attempt to undertake riskier projects. Assuming that the social cost of bank failures is larger than the private cost because of the possibility of bank failure contagion and the difficulty of pricing deposit insurance, the socially optimal level of $x$ is lower than the one at which the firm’s investment efficiency is maximized.

2.6. Firm’s ownership of the bank’s equity

When the firm owns a noncontrolling share of the bank’s equity, the firm’s ownership may not significantly affect the bank’s lending decisions. The firm’s ownership of a controlling share of the bank, however, would align the interest of the bank with that of the firm. In this case, the monitoring burden is entirely on nonbank debtholders who have only limited information about the distribution of the project return. Nonbank debtholders relying on limited information may often fail to block the firm’s attempts to undertake socially inefficient investments, while mistakenly forcing the firm to liquidate some projects that benefit both shareholders and debtholders. The resulting efficiency loss can be very large.

We can apply Eq. (10) to this situation by redefining $x_R^s$ and $x_S^s$ as the lowest levels of $x_2$ acceptable to the firm respectively when $\theta = 0$ and when $\theta = 1$ and $Z$ as the probability that nonbank debtholders demand debt redemption when the firm chooses the opaque project. Since the firm is not monitored by the bank, $x_R^s, x_S^s$, and $Z$ do not depend on $x, \beta$, and $C$ anymore.

The firm may want to undertake an opaque project of negative NPV when its return distribution is in favor of shareholders ($\theta = 0$) and pass up an opaque project of positive NPV when the return distribution favors debtholders ($\theta = 1$). When the investment decision is left to the firm, therefore, $x_R^s$ is strictly less than 1 (large type 1 inefficiency), and $x_S^s$ is strictly greater than 1 (large type 2 inefficiency). Given that $x_R^s < 1$ and $x_S^s > 1$, the firm’s decision to choose the opaque project is a strong signal that the return distribution is in favor of shareholders. Thus, if the firm chooses the opaque project, nonbank debtholders estimate a low expected return on debt, which in turn increases the probability of early redemption. In sum, the firm’s ownership of the bank results in small $X_R$ and $X_S$ and large $Z$, all of which contribute to increasing the efficiency loss. In addition, the firm’s asset is likely to become risky.
because the firm’s investment decision is biased toward risky projects. In the context of this model, therefore, the firm’s ownership of the bank is not desirable.

2.7. Numerical example

This section presents a numerical example to clarify the analytical results of the model. Let us assume that $K = 2$, $D = 8$, $R_{H1} = 1.3$, $\theta = 0.5$, and $p = 0.6$. Then $x_1 = 1.04$ from Eq. (1), and $R_D = 1.125$ from Eq. (4). If the low return is realized at the end of the first period, the firm goes bankrupt because the firm’s asset falls below its debt obligation. Debtholders receive the remaining asset ($\theta R_{H1} A = 6.5$) and suffer a net loss of 1.5 ($8 - 6.5$). Shareholders lose all of the equity (2). There is no second period in this case. In the high-return state, the firm pays interest (net gain = $0.125 \times 8 = 1$) to debtholders and dividends (net gain = $13 - 10 - 1 = 2$) to shareholders at the end of the first period. Thus, if it does not fail in the first period, the firm starts the second period with the same capital structure ($K = 2$ and $D = 8$). In the absence of the shock, the same project continues, and the expected returns on equity and debt remain the same.

If the shock occurs, the expected returns on equity, debt, and the bank’s investment (combination of equity and debt) depend on the outcomes of $\theta_2$ and $x_2$. The firm, the bank, and nonbank debtholders choose between the transparent and the opaque project based on the expected returns. It is further assumed that $\beta$ is fixed at 0.5 and that the expected return of the opaque project ($x_2$) is uniformly distributed between 0.5 and 1.5.

The firm wants to choose the transparent project if (see Eqs. (5) and (7))

$$E(K_{2R}) = p \min \left\{ \frac{x_2 A - R_D D}{p}, 0 \right\} = \min \{(10x_2 - 5.4), 0\} < 2 \quad \text{when } \theta = 0$$

and

$$E(K_{2S}) = \min \{(x_2 A - R_D D), 0\} = \min \{(10x_2 - 9), 0\} < 2 \quad \text{when } \theta = 1.$$  

Fully informed debtholders would want to choose the transparent project if (see Eq. (6))

$$E(D_{2R}) = p \max \left\{ \frac{x_2 A}{p}, R_D D \right\} = \max \{10x_2, 5.4\} < 8 \quad \text{when } \theta = 0,$$

and

$$E(D_{2S}) = \max \{x_2 A, R_D D\} = \max \{10x_2, 9\} < 8, \quad \text{when } \theta = 1.$$
The bank wants to choose the transparent project if (see Eq. (8))
\[ E(B_{2R}) = x \min\{(10x_2 - 5.4), 0\} + 0.5 \max\{10x_2, 5.4\} \]
\[ < 2x + 4 \quad \text{when } \theta = 0, \]
and
\[ E(B_{2S}) = x \min\{(10x_2 - 9), 0\} + 0.5 \max\{10x_2, 9\} \]
\[ < 2x + 4 \quad \text{when } \theta = 1. \]

The critical levels of \( x_2 \) derived from the decision criteria of the firm and the bank (see the proof of Proposition 1),
\[ x_R^* = 0.74 + \frac{0.13}{x}, \]
\[ x_{SC}^* = 0.8 + 0.4x \quad \text{for } x_2 \leq 0.9 \quad \text{and} \quad x_{SC}^* = 1.1 - \frac{0.05}{x} \quad \text{for } x_2 > 0.9, \]
\[ x_{SN}^* = 1.1. \]

The net expected return on debt conditional on the selection of the opaque project (see Eq. (9)),
\[ Y = \int_{x_R^*}^{1.5} (5.4 - 8) \, dx + \int_{x_{SC}^*}^{0.9} (10x - 8) \, dx + \int_{0.9}^{1.5} (9 - 8) \, dx \quad \text{for } x_{SC}^* < 0.9, \]
\[ Y = \int_{x_R^*}^{1.5} (5.4 - 8) \, dx + \int_{x_{SC}^*}^{1.5} (9 - 8) \, dx \quad \text{for } x_{SC}^* \geq 0.9. \]

The maximum expected gain from the opaque project (see Eq. (10)),
\[ MG = \frac{1}{2} 10 \left[ \int_{1}^{1.5} (x_2 - 1) \, dx + \int_{1}^{1.5} (x_2 - 1) \, dx \right] = 1.25. \]

Type 1 and type 2 inefficiency,
\[ Type1 = -5 \left[ \int_{x_R^*}^{1} (x_2 - 1) \, dx + \int_{x_{SC}^*}^{1} (x_2 - 1) \, dx \right] \quad \text{for } x_R^* < 1 \text{ and } x_{SC}^* < 1, \]
\[ Type2 = 5 \left[ \int_{1}^{x_R^*} (x_2 - 1) \, dx + \int_{1}^{x_{SC}^*} (x_2 - 1) \, dx \right] \quad \text{for } x_R^* > 1 \text{ and } x_{SC}^* > 1. \]

Table 1 tabulates \( x_R^*, x_{SC}^*, Type1, Type2, Total(Type1 + Type2), Gain (MG - Type1 - Type2) \), and \( Y \) against \( x \) for the case that the bank has a controlling
As Proposition 1 states, at a \( \hat{a} = \hat{b} = 0.5 \), both Type1 and Type2 are zero, and Gain is maximized in the case of a controlling share. In the case of a non-controlling share, Type2 is positive, but both Type1 and Type2 are at their minima when \( a = b = 0.5 \). The table also shows that Type1 and Type2 decrease as \( a \) approaches \( b \) from either direction (Lemma 1). In both cases, \( Y \) decreases with \( a \) which means \( Z \) increases with \( a \) (Proposition 2). In addition, \( Y < 0 \) at \( a = b = 0.5 \). Thus, the bank with the equal share of equity and debt is not reliable as a delegated monitor in this example. Given that the error term \( (u) \) in Eq. (9) has mean 0, \( Z > 0 \) when \( Y < 0 \). Assuming for simplicity that

\[ Y_{critically \ depends \ on \ the \ distribution \ of \ x_{2}} \text{, this is a likely but not a general result.} \]
u = 0, Z = 1 when Y < 0, and Z = 0 when Y ≥ 0. In this case, the optimal level of α at which the expected output is maximized is between 0.2 and 0.3 (Proposition 3).

Now suppose that the firm controls the bank. Then from the firm’s decision criteria above, \( x_R^* = 0.74 \) and \( x_S^* = 1.1 \). At these values of \( x_R^* \) and \( x_S^* \), \( Type1 = 0.1690, \) \( Type2 = 0.0250, \) \( Total = 0.1940, \) \( Gain = 1.0560, \) and \( Y = -1.5760. \) In this example, \( Gain \) is larger than those in some cases of the bank’s ownership of the firm (α ≤ 0.2 in Table 1). The significantly negative Y, however, suggests that nonbank debtholders are highly unlikely to allow the firm to choose the opaque project. Thus, the conflict between the firm and nonbank debtholders can eliminate all potential gains from the opaque project.

3. Alternative assumptions

This paper has adopted key assumptions mainly from two branches of the banking literature: moral hazard models focusing on conflicts between debtholders and shareholders and delegated monitoring models in which banks monitor borrowing firms on behalf of debtholders. The literature on corporate governance also emphasizes conflicts between shareholders and managers (e.g., Hirshleifer and Thakor, 1992; Jensen, 1986). Managers may maximize their own utility instead of acting in the best interest of shareholders. In this case, shareholders need to monitor managers and may want to delegate the monitoring to banks. Depending on the objectives of managers, incorporating the shareholder–manager conflict can change the optimal shareholding of the bank. The key result of this paper should hold if the shareholder–manager conflict is independent of the shareholder–debtholder conflict. For example, the shareholder–manager conflict may be only about the operating expense that is unrelated to the project choice. It is reasonable to assume that holding their own interest constant, managers act in the interest of shareholders who have the voting power. Then the role of the bank should remain the same. The result would be similar when the objective of managers was more closely aligned with that of shareholders than that of debtholders. On the other hand, a close alignment of the managers’ and the debtholders’ interest is likely to increase the optimal shareholding of the bank. In addition, introducing some uncertainties about managers’ behavior would complicate the results. Future research modeling various objectives of managers may produce interesting results.

In my model, the bank is not actively involved in the refinancing of debt. If the bank were allowed to freely lend to the firm in the second period, the efficiency loss would be smaller. Bank debt may completely replace nonbank debt when nonbank debtholders mistakenly redeem debt. This case is unrealistic because the bank may face financing constraints. Regulation may also limit the bank’s exposure to any single borrower. It is possible, however, that
the bank signals the quality of the opaque project by marginally changing its shares of equity and debt. Credible signaling can prevent inefficient debt redemption and hence reduce the efficiency loss. The possibility of signaling by the bank is a potentially interesting topic for future research. Interesting issues include conditions under which signals are credible and the extent to which efficiency gains can be realized.

4. Policy implications

Many policymakers and academic researchers recognize that the affiliation of banking and commerce may improve economic efficiency. The main policy concern is whether or not the affiliation would increase the riskiness of banks and hence the liability of deposit insurance. If it does, the issue is what form of the affiliation would minimize the risk while improving economic efficiency.

The previous section shows that the bank’s ownership of a commercial firm may increase the riskiness of the bank. Since the firm is allowed to undertake riskier projects, both the equity and debt of the firm may become riskier. This problem is more serious when the firm controls the bank, depriving the bank of its monitoring ability.

Currently, the US banking laws do not allow the affiliation between banks and commercial firms. Banks can own commercial firms’ equity only in exceptional circumstances (for example, as a means to recover loan losses from failing firms), and bank holding companies are severely restricted from investing in nonbanking organizations. The Federal Reserve Act, however, contains a few relevant provisions governing banks’ transactions with their affiliates such as the holding company, other banks controlled by the same holding company, and bank subsidiaries. For example, Section 23A limits the bank’s lending to an affiliate to 10% of the bank’s equity. In addition, loans to affiliates must be collateralized. Section 23B requires that banks make transactions including lending and asset purchases with their affiliates at fair-market terms.

These rules intended to limit the bank’s risk exposure can improve investment efficiency in some cases but may make the most efficient outcome unattainable. Suppose that similar lending restrictions were applied to the banking-commerce affiliation; the bank is allowed to make only a limited amount of collateralized loans to the firm. The bank has incentives to lend to an affiliate to enable the firm to undertake risky projects if the bank mainly holds equity (\( \alpha \) is much larger than \( \beta \)) or if the firm controls the bank. This type of lending would increase bank risk and lower efficiency by making it more difficult for uninformed debtholders to protect the value of debt. Thus, in the situation that the bank mainly holds the firm’s equity, the lending restrictions might improve investment efficiency as well as reduce the bank’s risk exposure. The lending restrictions, however, would make it difficult for the bank to maintain the most
efficient mix of equity and debt holdings derived above ($\beta \geq \alpha \geq 0$). Furthermore, the bank holding only collateralized debt would not have incentives to serve debtholders’ interest. The efficiency loss, of course, is greater when nonbank debtholders cannot rely on the bank as a delegated monitor. Lending restrictions, therefore, can seriously limit the market’s ability to improve economic efficiency.

The model developed in this paper does not offer direct implications about the requirements of fair market terms. In general, preventing price distortions should improve economic efficiency. Affiliated firms may make transactions at concessionary terms mainly to gain at the expense of third parties (e.g., avoiding taxes and transferring wealth from uninformed agents).

In recent years, US lawmakers introduced many financial reform bills that would allow the affiliation of banking and commerce, but most of them proposed restricted equity ownership: for example, minority shares or nonvoting shares only. These restrictions also have mixed implications. Based on the model presented above, while the firm’s influence over the bank results in large efficiency losses, the bank’s influence over the firm is desirable; the agency conflict is minimized when the bank has a controlling share of the firm. Thus, although restricting equity ownership can be effective in preventing the firm from controlling the bank, it may limit the potential gain from the bank’s control over the firm.

In sum, the affiliation of banking and commerce in restricted forms may produce smaller efficiency gains. Nevertheless, bank regulators may need to limit the bank’s risk exposure if deposit insurance cannot price the increased risk caused by the bank’s equity holdings. In such cases, the most efficient restriction based on the analyses of this paper is to limit the maximum share of the bank’s equity holding to its share of the firm’s debt.

5. Conclusion

This paper has analyzed the effects of the affiliation of banking and commerce on the firm’s investment efficiency and the bank’s risk exposure. The bank’s holding of the commercial firm’s equity has both positive and negative effects on investment efficiency. The efficiency loss resulting from conflicts between the firm and the bank decreases with the bank’s equity holding until the bank’s equity share becomes equal to its debt share. An increase in the bank’s equity share, however, increases the monitoring need of uninformed debtholders, which results in efficiency losses. Investment efficiency, thus, is likely to be maximized when the bank’s equity share is greater than zero but less than its debt share. The potential efficiency gain is greater when the bank has a controlling share. The firm’s ownership of the bank, however, does not improve investment efficiency.
The affiliation of banking and commerce can increase the bank’s risk exposure in two ways. With a larger equity holding, the bank has more incentives to allow the firm to undertake risky projects, which result in increased riskiness of both debt and equity of the firm and hence increased riskiness of the bank’s investment in the firm. When the firm controls the bank, the firm may force the bank to provide necessary funds to undertake risky projects at the expense of debtholders. Then, of course, the bank’s investment in the firm becomes riskier. Increased bank risk is problematic if deposit insurance premiums do not fully reflect the increased risk or if bank failures have negative externalities.

Based on the findings of this paper, allowing the affiliation of banking and commerce in a restrictive manner may reduce potential efficiency gains. For example, when the bank is not allowed to lend to its commercial affiliate, investment efficiency may not improve. The bank’s influence over the firm may improve investment efficiency, while the firm’s influence on the bank’s lending decisions can worsen investment efficiency.

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Appendix A. Proofs of propositions and lemmas

Proof of Proposition 1. Only the bank’s decision matters when it has a controlling share of equity. The bank prefers the opaque project to the transparent one if

\[ E(B_2) = xE(K_2) + \beta E(D_2) \geq xK + \beta D. \]

When \( \theta = 0 \),

\[ E(B_2) = xE(K_{2R}) + \beta E(D_{2R}) = \beta x_2 A \quad \text{for} \quad x_2 \leq \frac{pRD_D}{A}, \]

\[ = x(x_2 A - pRD_D) + \beta pRD_D \quad \text{for} \quad x_2 > \frac{pRD_D}{A}. \]

The first case is irrelevant because from Eqs. (3) and (4), \( E(B_2) < xK + \beta D \) at \( x_2 = (pRD_D)/A \). Setting the second line of the above equation equal to \( (xK + \beta D) \) and solving for \( x_2 \)

\[ x_2^* = 1 - \left( 1 - \frac{\beta}{x} \right) \left( 1 - \frac{pRD_D}{A} \right). \]
Thus, $x^*_R = 1$ when $\alpha = \beta$. When $\theta = 1$,
\[
E(B_2) = \alpha E(K_{2S}) + \beta E(D_{2S}) = \beta x_2 A \quad \text{for } x_2 \leq \frac{R_D D}{A},
\]
\[
= \alpha (x_2 A - R_D D) + \beta R_D D \quad \text{for } x_2 > \frac{R_D D}{A}.
\]
Setting the above equation equal to $(\alpha K + \beta D)$ and solving for $x_2$,
\[
x^*_C = 1 - \frac{1 - \frac{\alpha}{\beta}}{A} \frac{K}{A} \quad \text{for } x_2 \leq \frac{R_D D}{A},
\]
\[
= 1 + \frac{1 - \frac{\beta}{\alpha}}{2} \frac{(R_D - 1)D}{A} \quad \text{for } x_2 > \frac{R_D D}{A},
\]
where subscript $C$ stands for the case with a controlling share. Thus, in both cases, $x^*_C = 1$ when $\alpha = \beta$.

The opaque project must be acceptable to both the bank and the firm when the bank does not have a controlling share of equity. That is,
\[
E(B_2) \geq \alpha K + \beta D \quad \text{and} \quad E(K_2) \geq K.
\]
When $\theta = 0$, the firm’s decision is not binding because the return distribution is in favor of shareholders. Thus, $x^*_K$ is the same as the case of a controlling share.

When $\theta = 1$, it is the firm’s decision that is binding because the return distribution favors debtholders. Setting $E(K_{2S})$ from Eq. (5) equal to $K$ and solving for $x_2$,
\[
x^*_N = 1 + \frac{(R_D - 1)D}{A},
\]
where subscript $N$ stands for the case of a noncontrolling share. In this case, $x^*_N$ is independent of $\alpha$ and $\beta$. Thus, the overall inefficiency without a controlling share is minimized when $\alpha = \beta$. \(\square\)

**Proof of Lemma 1.** From the proof of Proposition 1, when $\alpha < \beta$, $x^*_R > 1$ (type 2 inefficiency) and $x^*_S < 1$ (type 1 inefficiency). Differentiating $x^*_R$ and $x^*_S$ with respect to $\alpha$:
\[
\frac{\partial x^*_R}{\partial \alpha} = -\frac{\beta}{\alpha^2} \frac{(1 - pR_D)D}{A} < 0,
\]
\[
\frac{\partial x^*_C}{\partial \alpha} = \frac{1}{\beta} \frac{K}{A} > 0 \quad \text{for } x_2 \leq \frac{R_D D}{A},
\]
\[
\frac{\partial x^*_S}{\partial \alpha} = \frac{\beta}{\alpha^2} \frac{(R_D - 1)D}{A} > 0 \quad \text{for } x_2 > \frac{R_D D}{A},
\]
\[
\frac{\partial x^*_S}{\partial \alpha} = 0.
\]
Thus, as \( \alpha \) approaches \( \beta \) from below, both \( x_R^* \) and \( x_S^* \) approach 1, reducing both types of inefficiency.

When \( \alpha > \beta \), \( x_R^* < 1 \) and \( x_S^* > 1 \). Thus, as \( \alpha \) approaches \( \beta \) from above, both \( x_R^* \) and \( x_S^* \) approach 1, reducing both types of inefficiency. \( \square \)

**Proof of Proposition 2.** From Eq. (9)

\[
Z = P(u < -Y) = W(-Y),
\]

where \( W \) is the cumulative distribution of \( u \).

\[
\frac{\partial Y}{\partial \alpha} = -[E\{D_{2R}(x_R^*)\} - D]f(x_R^*) \frac{\partial x_R^*}{\partial \alpha} - [E\{D_{2S}(x_S^*)\} - D]f(x_S^*) \frac{\partial x_S^*}{\partial \alpha} < 0,
\]

since

\[
[E\{D_{2R}(x_R^*)\} - D] < 0, \quad \frac{\partial x_R^*}{\partial \alpha} < 0, \quad [E\{D_{2S}(x_S^*)\} - D] > 0, \quad \frac{\partial x_S^*}{\partial \alpha} > 0.
\]

When \( \theta = 0 \), wealth is transferred from debtholders to shareholders. Thus, \( (E(D_{2R}) - D) < 0 \) at \( x_R^* \), where the net gain from the opaque project is 0 either for the firm or the bank. Similarly, \( (E(D_{2S}) - D) > 0 \) at \( x_S^* \) because of wealth transfer from shareholders. Therefore,

\[
\frac{\partial Z}{\partial \alpha} = \frac{\partial W}{\partial Y} \frac{\partial Y}{\partial \alpha} > 0. \quad \square
\]

**References**


