Tying Lending and Underwriting: Scope Economies, Incentives, and Reputation

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Abstract

Informational economies of scope between lending and underwriting are a mixed blessing for universal banks. While they can reduce the cost of raising capital for a firm, they also reduce incentives in the underwriting business. We show that tying lending and underwriting helps to overcome this dilemma. First, risky debt in tied deals works as a bond to increase underwriting incentives. Second, with limitations on contracting, tying reduces the underwriting rents as the additional incentives from debt can substitute for monetary incentives. In addition, reducing the yield on the tied debt is a means to pay for the rent in the underwriting business and to transfer informational benefits to the client. Thus, tying is a double edged sword for universal banks. It helps to compete against specialized investment banks, but it can reduce the rent to be earned in investment banking when universal banks compete against each other. We derive several empirical predictions regarding the characteristics of tied deals.

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Perhaps it was not such a bright idea to offer credit to investment-banking clients at less-than-market rates—even though this has been a chief calling card over the past few years for those commercial banks that wanted to get into the juicy business of investment banking. After all, it is precisely the riskiest borrowers, those who have trouble borrowing elsewhere, that are most likely to take up aspiring investment banks on their offers of credit. (Economist, "Thanks a bundle," August 24, 2002)

1 Introduction

For many years, the Glass-Steagall Act prevented commercial banks from doing investment-banking business. But in the late 1980s the strict separation of the financial services industry in the United States was relaxed, and in 1999 it was finally repealed by the Gramm-Leach-Bliley Financial Modernization Act. This development was much anticipated by those commercial banks that were eager to enter the investment banking business. At the same time, the regulatory change also raised the concerns of critics who feared potential conflicts of interest associated with universal banking, which was the primary justification for the Glass-Steagall Act.

Academic research has kept abreast of this discussion and analyzed the potential costs and benefits of universal banks versus functionally separated investment and commercial banks.[1] However, the role of a universal bank's ability to tie lending and underwriting, i.e., to provide credit to its investment-banking clients, has largely been ignored in the theoretical literature even though it is a widespread practice. For example, Drucker and Puri (2005) find that 20% of seasoned equity offerings in the first half of 2001 involved a loan from the underwriter to the issuer. Moreover, reports in the popular press, such as the *Economist*, suggest that tying is a main competitive weapon for universal banks and plays an important role in winning investment-banking clients. The exact source and mechanism of the competitive advantage is, however, less clear.

The aim of this paper is to partially close this gap by providing a detailed theoretical analysis

[1] See, e.g., Benston (1990), Kroszner and Rajan (1994), Puri (1994, 1999), Boot and Thakor (1997), Gande et al. (1997), Gande et al. (1999), Kanatas and Qi (1998, 2003), Ber et al. (2001) and, for a survey of the theoretical and empirical literature, Rajan (1996).

of different aspects of tying. We thereby address two main questions. First, why and when does tying occur? Second, what are the implications of tying for the choice of underwriters and for competition in the underwriting business?

The literature has focused on informational economies of scope in lending and underwriting as a main advantage of universal banking. Informational economies of scope can directly lead to a potential tying benefit if a firm needs debt and equity and the cost of monitoring or building a relation is lower when lending and underwriting are provided by the same financial institution (Drucker and Puri, 2005).[2] Informational economies of scope are also important if a firm needs bank debt after a failed attempt to issue securities and the universal bank employs its information advantage to allow lending at a lower cost. Kanatas and Qi (2003) show that this cost savings results in a rent for the universal bank after a failed underwriting and therefore reduces incentives to exert underwriting efforts. However, a universal bank may provide debt not only after a failure of underwriting, but also prior to underwriting in a tied deal. We show that risky debt in tied deals increases effort incentives in underwriting and thus provide a novel role for tying above and beyond informational economies of scale.

Consider a firm that needs to raise equity in an initial public offering or seasoned equity issue. If the equity issue fails, the firm can alternatively approach a bank to lend funds, but in this case it will engage in risk shifting and pursue an operating strategy that has a lower value. The firm already has some risky debt outstanding, the value of which is also negatively affected by risk shifting. To exert effort in underwriting, the investment bank has to be provided with incentives, which the firm may offer in the form of a bonus for successful underwriting. Underwriting services can be obtained from a specialized investment bank or a universal bank. The main difference is that a universal bank can also lend funds to firms. This difference is important for two reasons. First, the universal bank can lend after failure of the equity issue, as in Kanatas and Qi (2003). Second, the universal bank can take on the outstanding debt in a tied

[2] Gande et al. (1997), Yasuda (2005), and Bharath et al. (forthcoming) find that previous lending generally is associated with lower yields for the bond and lower underwriting fees. Bond underwriting is the area where commercial banks are likely to have the greatest information advantage from their lending relationship. As Drucker and Puri (2005) and Bharath et al. (forthcoming) suggest, this benefit also seems to be present in equity underwriting.

deal. The contribution of our paper concerns this second effect. We show that tying has several benefits for the firm and affects the competition for underwriting that exists between investment banks and universal banks. First, risky debt in a tied deal provides additional incentives in the underwriting business. Debt works as a bond to increase incentives in underwriting as the value of the debt is negatively affected if the underwriting fails. This benefit is present even in the absence of limitations on the possible contracts for underwriting services. Second, limitations of contracting may result in a rent to be earned in the underwriting business. Tying reduces this rent. One reason is, again, the additional incentives from debt, which substitutes for monetary incentives. In addition, a below-market rate of return on the tied debt is a means to pay for the rent in the underwriting business. Because of competition between commercial banks, the benefits of tying accrue to the commercial banks' clients. Thus, tying is a double-edged sword for universal banks. On the one hand, it helps to compete against specialized investment banks and may be a prerequisite for entering the market. On the other hand, it may reduce the rent to be earned in investment banking.

Our model helps to explain two phenomena of tied deals, which are addressed in the *Economist* quote above and confirmed by the empirical findings of Drucker and Puri (2005): debt in tied deals often exhibits high risk and less-than-market rates. The rationale for high risk is that the incentive effect increases in the risk of the debt, while adjusting the terms of the credit is a means to pay for rents in the underwriting business. If incentives stem from reputation, an alternative to reducing the rate is reducing the underwriter fee. In addition to that, we derive several further, empirically testable hypotheses. With respect to the choice of underwriter, our model predicts that universal banks providing tied deals are most likely to be chosen i) by firms with quite transparent business plans, ii) by firms which are little focused, e.g., conglomerates, (iii) by less innovative firms, and (iv) if hot issue markets prevail.

Our model is related to that of Kanatas and Qi (2003). However, the focus differs in that our objective is to analyze the role of tying. We also contribute to the analysis of Kanatas and Qi more directly by carving out the implications of contracting problems and the role of incentives from reputation rents in investment banking. When rents from future business are an important incentive, the incentive effect of a universal bank's ability to earn a rent from lending after failed underwriting may be reversed.[3] A universal bank may have greater incentives to exert effort in underwriting than a specialized investment bank, even in the absence of tying.

We focus on equity underwriting, but the benefit of tying is also present for other investment-banking services whenever the quality of the investment-baking service affects the value of the client's outstanding debt. Examples include corporate restructurings and mergers and acquisitions where the quality of advice affects not only a firm's outstanding equity, but also its risky debt positions.

Hakenes (2004) also raised the notion that a loan can serve as a mechanism to harmonize the interests of a firm and a bank, thereby alleviating problems that arise from asymmetric information. In his model, the loan makes it credible for a bank (the risk manager) to obtain the information required for the risk management process.

The paper proceeds as follows. In the next section we outline the model and explore the differences between specialized investment banks and universal banks in a model with double-sided moral hazard and potential limitations on contracting. We introduce tying in Section 3 and analyze its role in overcoming the incentive problems of universal banks. In Section 4 we extend the analysis by considering the role of reputation. In Section 5 we discuss our findings by carving out the main empirical hypotheses emerging from our theoretical analysis. In Section 6 we summarize our results.

2 The Basic Model

We consider a firm in a risk-neutral economy with an investment opportunity to expand an existing business field. For example, the firm needs to make a further investment in one particular area to bring its existing products or ideas to the market.

The investment decision is intertwined with a choice of strategy, A, B or C. Strategy A is the first-best strategy. However, it is not contractible and provides the firm with the flexibility to switch to strategy C. Strategy B is the second-best strategy; it is less flexible than strategy A and contractible.

[3] The role of reputation in investment banking is analyzed by, e.g., Booth and Smith (1986) and Chemmanur and Fulghieri (1994). We extend this literature by introducing tying in a model with reputation.

Given strategy A, the project's payoffs are $\overline{\pi}_A$ with probability $q_A \in (0,1)$ and $\underline{\pi}$ with probability $(1-q_A)$, where $\overline{\pi}_A > \underline{\pi}$. The expected payoff is $V_A \equiv \underline{\pi} + q_A(\overline{\pi}_A - \underline{\pi})$. The risk-free rate is normalized to zero, and we assume that the expected payoff exceeds the required investment I, i.e., $V_A > I$. Without investment, the firm's payoff is normalized to zero.

The firm has no funds to finance the expansion. It can either take on a bank loan or issue equity, using the underwriting service of a specialized investment bank or a universal bank. The firm already has some risky debt outstanding with a repayment obligation $D_0 > \underline{\pi}$ from previous rounds of investment.[4] This captures the observation that firms generally have some debt outstanding prior to issuing equity through a seasoned equity offering or initial public offering in a "second" round of financing.[5]

Debt financing If the firm uses debt to finance its expansion, the debt level may affect the choice of strategy. In particular, the firm may engage in risk shifting and pursue the riskier strategy C. In this case the project's payoffs are $\overline{\pi}_C$ with probability $q_C \in (0,1)$ and $\underline{\pi}$ with probability $(1-q_C)$, where $\overline{\pi}_C > \overline{\pi}_A$, $q_C < q_A$, and $V_A > V_C \equiv \underline{\pi} + q_C(\overline{\pi}_C - \underline{\pi})$. Thus, strategy C realizes a higher payoff than strategy C if it is a success, but the expected payoff is lower. As the choice of strategy A is not contractible, for a given total debt repayment obligation $D > \underline{\pi}$, the firm will choose strategy C if $q_A(\overline{\pi}_A - D) < q_C(\overline{\pi}_C - D)$. The maximum total D for which the firm still chooses strategy A is given by

$$\hat{D} = (q_A\overline{\pi}_A - q_C\overline{\pi}_C)/(q_A - q_C). \tag{1}$$

The model introduces a potential risk-shifting problem in the simplest possible manner, which provides the rationale for equity financing in our model. For $D_0 > \hat{D}$, incentives to shift to strategy C already stem from the initial debt. We assume $D_0 \leq \hat{D}$. Thus, $\hat{D}_1 = \hat{D} - D_0$ puts an upper bound on the amount of credit that can be raised to finance the project expansion while retaining incentives to choose strategy A.

[4] It is not necessary that the firm has been entirely debt-financed. It suffices that the firm's balance sheet contains some (risky) debt.

[5] See, for example, Berger and Udell (1998), Table 1C, who find that young firms are financed with a very high level of debt.

Raising credit costs c (monitoring cost, due diligence, etc.). We denote the present value of debt given the credit repayment obligation D and strategy s as $P_s(D)$. To finance strategy A completely with debt, the firm has to raise $P_A(D) = I + c$.

Lemma 1 *The firm can finance the project entirely with debt and still chooses strategy A if $P_A(\hat{D}_1) \geq I + c$. The firm will not choose strategy A if the project is entirely debt financed and $P_A(\hat{D}_1) < I + c$. Instead, it has to use (some) equity.*

In the following we assume that $P_A(\hat{D}_1) < I + c$. Thus, the firm has to use equity to pursue strategy A. However, for our analysis it is important to also define the firm's expected payoff if it has to use debt after a failed equity issue. If the firm receives debt instead of equity to pursue strategy A, it will instead choose strategy C, resulting in an expected payoff V_C. (Recall that it is not possible to commit to strategy A.) Debt holders anticipate the firm's incentives and the firm has to bear the adverse consequences of its risk shifting incentives. Thus, when the firm has to use debt after a failed equity issue, it may be ex ante optimal to choose a strategy that allows for more commitment than strategy A so as to reduce the risk shifting problem. For example, the firm can start at a smaller scale or choose to invest in an already existing, different business field that involves less flexibility and where more collateralizable tangible assets are available compared to the business field to which strategy A is devoted. We denote the ex-ante optimal strategy under debt financing as B. To simplify the notation, we assume that strategy B requires an investment I and results in payoffs $\overline{\pi}_B > D_0$ with probability $q_B \in (0, 1)$ and $\underline{\pi}$ with probability $(1 - q_B)$, where $\overline{\pi}_B > \underline{\pi}$, $V_B \equiv \underline{\pi} + q_B(\overline{\pi}_B - \underline{\pi}) > I$, and $V_A > V_B > V_C$. We assume that strategies A and B are mutually exclusive because they involve different strategies to enter a market or because of a limit to the firm's ability to simultaneously grow and invest in different business areas, e.g., a lack of talent and frictional cost of change in the organization. $V_{AB} \equiv V_A - V_B > 0$ is the difference in the expected payoff with equity financing and the expected payoff with debt financing. The higher V_{AB}, the more severe are the inventive problems of debt financing.

Equity financing To raise equity, the firm needs the underwriting service of an investment bank. We model the equity issue as follows. With probability $p(e, i)$, the required amount of equity can be raised at no discount, i.e., the price equals the promised payment to equity holders. The equity issue fails (is withdrawn) with probability $1 - p(e, i)$. In the latter case no equity can be raised. The success probability depends on the firm's as well as the investment bank's efforts, which are both unobservable and denoted by e and i, respectively. Both parties' costs of effort are $c(e) = .5e^2$ and $c(i) = .5i^2$. We assume that $p(e, i) = \min\{\alpha_e e + \alpha_i i, 1\}$ with $\alpha_e < \alpha_i$. This captures the idea that the investment bank's effort is more productive for issuing equity than the firm's. In the remainder of the paper we will assume that there exists an interior solution and use $p(e, i) = \alpha_e e + \alpha_i i$.

If the equity issue is a success, the firm carries out the second stage of the project and chooses strategy A. If the equity issue fails, the firm cannot immediately start a new attempt to issue equity, but it can still take on a loan. The mechanism is the same as described above, and the cost of obtaining the loan is c. In this case, the firm pursues strategy B. We assume that this alternative is preferred to closing the firm.

The investment bank receives a fixed fee w_0 and a bonus β if the equity issue succeeds. w_0 can be positive or negative. In the latter case the fixed fee is akin to an "entry fee" payable by the investment bank. Equivalently, w_0 can be interpreted as a punishment for failure, with $w_0 + \beta$ as the reward in the case of success. In practice we rarely observe negative transfers from investment banks to their clients. One potential reason may be that this would also attract firms that stand no chance to issue equity, but that try to collect the investment bank's entry fee (punishment). We therefore explicitly take into account that there may be a lower bound $\hat{w}$ on w_0. This is akin to introducing a limited liability constraint (LLC) for the investment bank. In particular, we assume $w_0 \geq 0$ so that no negative payments are possible. However, we are also interested in the implications of relaxing this assumption. As a second case, we therefore also assume that $\hat{w}$ is sufficiently low so that (LLC) is not binding. Considering both cases is interesting for two reasons. First, it allows us to carve out the implications of the assumption that no payments are made from the underwriter to the firm. Second, in our model with zero fixed costs of underwriting, (LLC) is always binding for $w_0 \geq 0$. A reason for why (LLC) may not be binding despite $w_0 \geq 0$, is a high fixed cost of underwriting. This case is qualitatively equivalent to our case, where we assume that $\hat{w}$ is sufficiently low so that (LLC) is not binding.

Without loss of generality, we assume that $w_0 > 0$ is paid through credit to be taken on after a failed equity issue, while $w_0 < 0$ reduces the required level of credit after failure.[6] $w_0 + \beta$ is positive and paid out of the proceeds of the equity issue. Thus, the equity issue covers the expansion stage investment and the required payment to the investment bank, $E = I + w_1$. The equity issue is competitively priced so that the expected payment to equity holders equals E.

The market for underwriting services is competitive. Therefore, w_0 and β maximize the firm's expected payoff subject to the bank's participation constraint. When choosing the optimal contract, w_0 and β, the firm has to take into account the double-sided moral hazard problem. It arises as both the firm's and the underwriter's efforts affect the probability of a successful equity issue and their contributions cannot be disentangled.

Specialized investment bank The investment bank's incentive to exert effort stems from the bonus β. The firm exerts effort because a successful equity issue allows it to pursue strategy A, which increases the expected firm value by V_{AB}. If the firm has risky debt outstanding, part of this increase in value accrues to debt holders, as the value of outstanding debt increases by $\delta \equiv (q_A - q_B)(D_0 - \underline{\pi})$. The increase in current owners' expected payoff is $\Delta_{AB} \equiv V_{AB} - \delta$. Another benefit of a successful equity issue is that it saves the cost of a bank loan, c.

The firm's management maximizes the expected incremental profit to equity holders:

$$\max_{e,i,w_0,\beta} (\alpha_e e + \alpha_i i)[\Delta_{AB} + c - \beta] - w_0 - \frac{1}{2}e^2$$

subject to

$$w_0 + (\alpha_e e + \alpha_i i)\beta \geq \frac{1}{2}i^2 \tag{PCi}$$

$$i = \alpha_i \beta \tag{ICi}$$

$$e = \alpha_e[\Delta_{AB} + c - \beta] \tag{ICe}$$

$$w_0 \geq \hat{w}. \tag{LLC}$$

[6]The expected future cash flow with strategy B and the outstanding debt D_0 place an upper bound on $w_0 > 0$. However, this constraint will never be binding in our model. We continue to assume that even when $w_0 < 0$ reduces the required debt after failure, the total debt repayment exceeds $\hat{D}$ so that it is still optimal for the firm to choose strategy B .

(PCi) is the investment bank's participation constraint. (ICi) and (ICe) are, respectively, the investment bank's and the firm's incentive constraints, which are given by the first order conditions for the optimal choice of i and e. (LLC) puts a lower bound on w_0.

The premium β plays a dual role. While it provides the investment bank with incentives to exert effort, it reduces the firm's incentives. This is the nature of the double-sided moral hazard problem, which makes it impossible to increase the investment bank's incentives without negatively affecting the firm's incentives.[7]

If (LLC) is not binding, w_0 is determined by the investment bank's participation constraint. Substituting the first order conditions in the participation constraint, it is straightforward to check that w_0 is negative for any level of β. Thus, the investment bank earns a quasi rent from the incentive system, which, in the case of a non-binding (LLC), is extracted through w_0.[8] However, if (LLC) is binding, it is not possible to (completely) extract the quasi rent through w_0. It is then optimal to choose $w_0 = 0$ and reduce β. Since the investment bank is more productive than the firm's management, $\alpha_i > \alpha_e$, it is optimal for the firm to provide positive incentives for the investment bank despite the rent that the investment bank extracts. For $\alpha_i = \alpha_e$, zero effort by the investment bank would be optimal, as it would in this case be cheaper for the firm to bear the higher marginal costs of its own effort than the expected wage costs to induce the investment bank to spend positive effort.

We first assume that (LLC) is not binding. Inserting $w_0 = \frac{1}{2}i^2 - (\alpha_e e + \alpha_i i)\beta$, (ICe), and (ICi) in the firm's objective function gives us

$$\max_{\beta} \ (\alpha_e^2[\Delta_{AB} + c - \beta] + \alpha_i^2\beta)(\Delta_{AB} + c) - \frac{1}{2}\alpha_e^2[\Delta_{AB} + c - \beta]^2 - \frac{1}{2}\alpha_i^2\beta^2.$$

[7] We note that we implicitly assume a balanced budget. It is therefore not possible to punish both parties for a failed equity issue above and beyond the transfers between the two parties. In particular it is not possible to commit to destroying the project if the equity issue fails or to use payments to third parties in case of failure. Therefore, one party's punishment is the other party's gain and vice versa. For that reason, first best cannot be implemented despite risk neutrality even if (LLC) is not binding.

[8] In the presence of a high fixed cost, the quasi rent is part of the underwriter's reimbursement for the fixed cost.

The first-order condition for the optimal β is $\alpha_i^2(\Delta_{AB}+c)-(\alpha_e^2+\alpha_i^2)\beta=0$ and

$$\beta^* = \frac{\alpha_i^2}{\alpha_e^2+\alpha_i^2}(\Delta_{AB}+c). \tag{2}$$

Inserting β^* in the objective function gives the expected profit when a specialized investment bank acts as underwriter and (LLC) is not binding:

$$\pi_i^{nb} \equiv \nu(\Delta_{AB}+c)^2,$$

with $\nu \equiv 0.5(\alpha_e^4+\alpha_e^2\alpha_i^2+\alpha_i^4)/(\alpha_e^2+\alpha_i^2)$. From $\Delta_{AB}>0$, it follows that $\pi_i^{nb}>0$ and it is optimal for the firm to first try to issue equity instead of using outright debt.

If (LLC) is binding, substituting $w_0 = 0$ and the incentive constraints in the objective function gives us

$$\max_{\beta} \ \frac{1}{2}\alpha_e^2[\Delta_{AB}+c-\beta]^2+\alpha_i^2\beta[\Delta_{AB}+c-\beta].$$

The first-order condition for the optimal β is now $(\alpha_i^2-\alpha_e^2)(\Delta_{AB}+c-\beta)-\alpha_i^2\beta=0$ and

$$\beta^* = \frac{\alpha_i^2-\alpha_e^2}{2\alpha_i^2-\alpha_e^2}(\Delta_{AB}+c).$$

Inserting β^* in the objective function gives

$$\pi_i^b \equiv \frac{\alpha_i^4}{2(2\alpha_i^2-\alpha_e^2)}(\Delta_{AB}+c)^2$$

when a specialized investment bank is used and (LLC) is binding. Again, $\pi_i^b>0$.

Universal bank Instead of using a specialized investment bank, the firm can resort to the investment bank branch of a universal bank. A main difference is often seen in that the universal bank can provide credit after failure of the equity issue. We follow Kanatas and Qi (2003) in assuming that a universal bank that had been used as underwriter has a cost advantage when providing the credit after a failed underwriting. The cost advantage stems from information spillover, as a universal bank can economize on monitoring costs and/or relationship-building costs. The cost savings is given by γc, with $\gamma \in (0,1)$, and allows the universal bank to earn a (quasi) rent of γc when the equity issue fails. Because of this rent, the universal bank's participation and incentive constraints differ from those of a specialized investment bank. They are

$$w_0 + (\alpha_e e + \alpha_i i)\beta + (1 - (\alpha_e e + \alpha_i i))\gamma c \geq \frac{1}{2}i^2 \tag{PCu}$$

$$i = \alpha_i[\beta - \gamma c]. \tag{ICu}$$

The cost savings γc relaxes the investment bank's participation constraint. Therefore, if (LLC) is not binding, e.g., if $\hat{w}$ is sufficiently low or in a model with fixed costs of underwriting, a universal bank ceteris paribus provides investment banking services at a lower cost than a specialized investment bank. This is a potential positive effect of information spillover. However, at the same time, it reduces the universal bank's incentive to exert effort, as the investment bank only earns the rent if the equity offer fails. Compensating for the negative incentive effect through increasing β is costly for two reasons. First, it reduces the firm's incentives and, second, it increases the investment bank's rent if (LLC) is binding. This is a negative effect of information spillover. Depending on which effect is stronger, the firm's expected profit may be higher or lower when using a universal bank than when using a specialized investment bank.

The firm's expected profit levels when using a universal bank are derived in the appendix. If (LLC) is not binding, we obtain

$$\pi_u^{nb} \equiv \gamma c + \nu(\Delta_{AB} + c - \gamma c)^2. \tag{3}$$

The universal bank is preferred if $\pi_u^{nb} > \pi_i^{nb}$, or $\gamma c + \nu(\Delta_{AB} + c - \gamma c)^2 > \nu(\Delta_{AB} + c)^2$. Rearranging terms, we obtain that the universal bank is chosen by the firm when $2\nu[\Delta_{AB} + c - 0.5\gamma c] < 1$.

If (LLC) is binding, the firm's expected profit is

$$\pi_u^b \equiv \frac{\alpha_i^4}{2(2\alpha_i^2 - \alpha_e^2)}(\Delta_{AB} + c - \gamma c)^2. \tag{4}$$

It directly follows that $\pi_u^b < \pi_i^b$.

We can summarize our findings in the following proposition:

Proposition 1 *i) The firm will never choose the underwriting service of a universal bank if (LLC) is binding and $w_0 = 0$.*
ii) If (LLC) is not binding, the firm will choose a universal bank if

$$2\nu[\Delta_{AB} + c - 0.5\gamma c] < 1. \tag{5}$$

A universal bank is chosen if the positive information effect exceeds the negative incentive effect of information spillover. For $w_0 = 0$, the underwriter earns a rent, and the efficiency gain cannot be transferred to the firm, leaving the negative incentive effect. Thus, the universal bank will never be chosen in this case.[9] If (LLC) is not binding, the bank's participation constraint is binding. In this case, condition (5) is satisfied when the positive effect dominates the negative effect. This is the case if the informational economies of scope are rather pronounced.

Before we introduce tying, it is interesting to compare our result with the one obtained by Kanatas and Qi (2003) in a related setting. Kanatas and Qi assume that $w_0 = 0$. However, in their model, the bank's participation constraint can nevertheless be binding because of fixed monitoring costs. As in our model, an investment bank or a universal bank may be preferred if the underwriter's participation constraint is binding, depending on whether the negative incentive or the positive information effect dominates. If one introduces a punishment for failure, or an entry fee, i.e., $w_0 < 0$, in their model, which only requires effort by the underwriter, the universal bank always dominates the investment bank. The reason is that the negative incentive effect of information spillover can then be overcome at no cost by increasing β, leaving the positive effect of information spillover. In contrast, in our paper, increasing β reduces the firm's effort incentives.

3 Tying Lending and Underwriting

We turn to the role of tied deals where one bank provides both underwriting services and a loan to the same firm. In this situation, the underwriter also provides the debt with a repayment obligation D_0.[10] For example, the universal bank already provided the initial debt or new debt is raised from the universal bank that is used to repay initial debt holders. The value of the debt claim depends on the success of the equity issue and is given by $P_0 \equiv$

[9] This does not hold if incentives stem from reputation as discussed below. There, the additional possibility to earn a rent from future business can increase incentives to exert effort.

[10] The assumption that the universal bank takes the total debt is without loss of generality. What is important is that it assumes the risky portion of the debt. That is, the bank could alternatively assume a repayment obligation $D_0 - \underline{\pi}$ that is subordinate to the other claims.

$\underline{\pi} + q_B(D_0 - \underline{\pi}) + p(e,i)[(q_A - q_B)(D_0 - \underline{\pi})]$. Let P be the amount that the firm can raise when issuing the debt claim. In a competitive market, where loans are priced on an individual basis, $P = P_0$. This, however, is not necessary in a tied deal where the bank has to break even in total. The universal bank's participation and incentive constraints are given by

$$w_0 + (\alpha_e e + \alpha_i i)\beta + (1 - (\alpha_e e + \alpha_i i))\gamma c - (P - P_0) \geq \frac{1}{2}i^2 \tag{PCut}$$

$$i = \alpha_i[\beta - \gamma c + \delta]. \tag{ICut}$$

There are two important insights on the benefit of tying. First, w_0 and $(P - P_0)$ are substitutes in transferring funds from the bank to the firm. Thus, in the case where $w_0 \geq 0$, P can serve as a means to reduce the underwriter's rent. Second, through tying, the positive effect of a successful equity issue on the value of the outstanding debt increases incentives. This second benefit of tying depends on the outstanding debt's risk, $(q_A - q_B)(D_0 - \underline{\pi})$. The higher the risk, the higher is the positive effect on incentives. Thus, it is particularly risky debt that should be observed in tied deals. It is interesting to note that the first benefit of tying is present even if the outstanding debt is risk free, while the second benefit is present even if $P = P_0$. In the following, we assume that competition between universal banks reduces P so that the universal bank's participation constraint will always be binding in a tied deal.

The firm's expected profit when using a universal bank as underwriter in a tied deal is derived in the appendix and given by

$$\pi_{ut} = \gamma c + \nu(\Delta_{AB} + c - \gamma c + \delta)^2. \tag{6}$$

The following proposition, which is proven in the appendix, compares the firm's expected profit when a universal bank is used as underwriter in a tied deal to the expected profit when the firm uses a specialized investment bank.

Proposition 2 *A specialized investment bank versus a universal bank with tying:*

1. *If $\gamma c < \delta$, the firm will always choose a universal bank.*

2. *If $\gamma c > \delta$ and the investment bank's (LLC) is not binding, the firm will choose a universal bank if*

$$2\nu[\Delta_{AB} + c - 0.5(\gamma c - \delta)] < \frac{\gamma c}{\gamma c - \delta} \tag{7}$$

3. *If $\gamma c > \delta$ and the investment bank's (LLC) is binding, the firm chooses a universal bank if*

$$2\nu[\Delta_{AB} + c - 0.5(\gamma c - \delta)] - \tau \frac{(\Delta_{AB} + c)^2}{\gamma c - \delta} < \frac{\gamma c}{\gamma c - \delta}, \tag{8}$$

where $\tau \equiv 0.5\left(\alpha_i^2 \alpha_e^4 + \alpha_i^6 - \alpha_e^6\right) / (\alpha_i^2 \alpha_e^2 + 2\alpha_i^4 - \alpha_e^4)$.

If the positive incentive effect from tying exceeds the negative incentive effect from the information advantage, i.e., $\delta > \gamma c$, then a universal bank always dominates a specialized investment bank: the universal bank has higher total incentives and lower financing costs after failure (Proposition 2.1). In this case, whether or not (LLC) is binding is irrelevant for the choice of underwriter.

For $\gamma c > \delta$, tying reduces the negative incentives, but they are still present. Comparing (7) and (8) shows that the universal bank dominates a specialized investment bank for a larger set of parameters if (LLC) is binding for a specialized investment bank. In this case, providing incentives involves a rent when the firm uses a specialized investment bank, while the firm can eliminate the rent through tying with a universal bank.

Let Π be the expected advantage of a universal bank (with tying) over a specialized investment bank. In the following proposition we analyze the effect of δ, γ, and V_{AB} on Π to gain an intuition for conditions (7) and (8).

Proposition 3 1. *Π is increasing in δ.*

2. *For $\delta < \gamma c$, there exists a critical $\widehat{\gamma} \in [0,1]$ such that Π is decreasing in γ for $\gamma < \widehat{\gamma}$ and increasing in γ for $\gamma > \widehat{\gamma}$. $\widehat{\gamma}$ is increasing in V_{AB}, with $\widehat{\gamma} = 0$ if $V_{AB} \leq V_{AB}^L \equiv 1/(2\nu) - c$ and $\widehat{\gamma} = 1$ if $V_{AB} \geq V_{AB}^H \equiv 1/(2\nu)$.*

3. *For $V_{AB} < V_{AB}^L$, Π is positive for all γ.*

4. *For increasing V_{AB}, Π becomes eventually negative if $\delta < \gamma c$. However, Π is always positive if $\gamma c < \delta$.*

Increasing δ has an unambiguously positive effect as it reduces the negative net incentives of a universal bank, $\gamma c - \delta$.

Increasing γ has two effects. First, it reduces the financing costs after a failed equity issue (positive efficiency effect) and, second, it reduces incentives (negative effect). The relative importance of the incentive effect depends on the value increase associated with a successful issue, V_{AB}. The higher V_{AB}, the more important are incentives. With a large V_{AB} the negative incentive effect dominates and Π is decreasing in γ and eventually becomes negative. If incentives are not important (low V_{AB}), then the efficiency effect dominates and Π is increasing in γ.

For small enough economies of scope ($\gamma c < \delta$) tying eliminates all the negative incentive effects of the universal bank compared to a specialized investment bank (see Proposition 2). For small V_{AB} the efficiency effect dominates the incentive effect even for larger informational economies of scope ($\gamma c > \delta$). Therefore, a universal bank will be chosen even for high γ if V_{AB} is low. However, if V_{AB} is large, the negative incentive effect becomes more and more dominant with a larger γ and universal banks are only chosen if γ is sufficiently small. Put differently, if incentives are very important, then the information spillover is a competitive disadvantage, and the universal bank can only potentially compete against a specialized investment bank if the information spillover is sufficiently low. If incentives are not so important, then the information spillover turns into an advantage, and the universal bank indeed does better relative to the investment bank for all realizations of the informational spillover parameter γ.

Loan pricing in tied deals For a given level of D_0, how does the interest rate on debt in tied deals compare to the debt's interest rate when the firm uses a specialized investment bank as underwriter? The value of the outstanding debt is $P_0 \equiv \underline{\pi}+q_B(D_0-\underline{\pi})+p(e,i)[(q_A-q_B)(D_0-\underline{\pi})]$. Tying affects the interest rate on debt in two ways. First, tied deals with universal banks may lead to increased incentives compared to the incentives if underwriting is provided by specialized investment banks. Increased incentives results in a higher probability of success, $p(e,i)$, and therefore in lower risk. Thus, whenever incentives increase in tied deals, the debt's interest rate decreases. However, the debt's risk-adjusted (or expected) rate of return is not affected by the higher incentives in tied deals when the loan is competitively priced. Second, with a binding (LLC), the loan pricing can be used to reduce the rent in the underwriting business. Whenever $P > P_0$, the debt's risk-adjusted interest rate is lower in tied deals.

Proposition 4 *Tying reduces the risk-adjusted (expected) rate of return on the debt if (LLC) is binding without tying.*

This proposition displays a crucial part of our analysis: universal banks may penetrate the business of specialized investment banks (which formerly have earned rents in underwriting) by providing tied deals and by competing with lower interest rates. Hence, we should expect that when universal banks enter the market, the interest rate demanded for debt in tied deals is below the market rate for debt of the same risk class.

4 Reputation in Investment Banking

A large fraction of the total compensation for investment banking services do not directly depend on the quality or outcome of the service provided. Instead, a fixed fee is paid, especially in so called firm commitment issues (see e.g. Chen and Ritter (2000) and Ritter (1998) for empirical evidence). This does not imply that the investment bank has no incentive to provide high quality. Often the market understands the quality provided, even if this quality is not verifiable in a court. Reputation in the market for investment banking services can therefore be an important determinant of incentives. To focus on reputation incentives and their implications for competition between investment banks and universal banks, we assume now that no variable pay is possible, i.e., $\beta = 0$. Instead, clients pay a fixed fee w for the investment banking service. Market participants can observe the quality of investment banking services and choose a bank based on its history of quality. This assumption is stronger than necessary; it is only required that low-quality service is detected with a positive probability. To model reputation, we introduce an infinite number of periods. In each period, firms want to issue equity as discussed above with two simplifying assumptions on the probability of a successful equity issue, $p(e, i)$. First, no effort by the firm is required when issuing the equity. Second, the investment bank can choose between only two effort levels, $i \in \{h, l\}$, resulting in probabilities $p_h > p_l$ and effort costs $c_l = 0$ and $c_h = k$. We assume that high effort is efficient.

The sequence of events in each period t is as follows. In the first step, investment banks simultaneously quote prices w_t at which they are willing to provide underwriting services. In the second step, each firm chooses the underwriter. Mandates are equally distributed if the firms are indifferent. In the third step, investment banks choose whether to provide high- or low-quality underwriting services for the individual projects, and market participants observe the choice. Finally, if the equity issue succeeds, a firm choose strategy A. If the issue fails, a firm raises additional debt and chooses strategy B.

The risk-free rate of return used to discount periods is r. There is no discounting within periods.

Specialized investment bank All investment banks are symmetric and therefore pursue the same strategy. Let m be the number of customers that each investment bank obtains in equilibrium if it did not shirk in previous periods. When deciding on the optimal level of service, each investment bank compares the expected payoffs with low and high effort. Low effort on one project results in zero future demand. Therefore, it always pays to either shirk on all mandates or not at all.[11] With low effort, the investment bank saves mk, but will have zero demand in the future. With high effort, the investment bank has to incur cost mk, but earns a rent of $m\sum_{t=1}^{\infty}(w_t - k)(1+r)^{-t}$ from future business. Since the price setting problem of investment banks is constant over time, in equilibrium, $w_t \equiv w$ holds for all $t = 1, .., \infty$. Thus, the rent from future business equals $m(w-k)/r$.

High effort is optimal for the investment bank if $k \leq (w-k)/r$. Rearranging terms yields

$$w \geq (1+r)k. \tag{9}$$

Firms seek to obtain the underwriting services from the investment bank that offers advice at the lowest price and that has an incentive to choose high effort. For $w^* = (1+r)k$, (9) holds with equality. Any deviation from w^* by individual investment banks results in zero demand. This is immediately clear for an investment bank that offers advice at a price exceeding w^*. The only reason for undercutting w^* in the current period is to increase demand above m. While the current price does not directly affect the incentives of the investment bank, the increased demand does. Obtaining a higher demand only once and returning to the equilibrium price w^*

[11] If we assume that the market observes shirking with a positive probability that is increasing in the number of projects on which the investment bank shirked, then the investment bank might consider shirking on less than all projects for which it provides advice.

after one period jeopardizes incentives because the savings from shirking on more than m deals exceeds the future equilibrium rent. Continuing to provide services at a lower price to increase future demand also jeopardizes incentives because (9) would be violated. The equilibrium is summarized in the following Lemma.

Lemma 2 *The following constitutes a subgame-perfect Nash equilibrium:*

- *All investment banks offer high-quality service at price $w^* = (1+r)k$ and provide high-quality.*
- *If $(p_h - p_l)(V_A - V_B + c) \geq (1+r)k$, then firms seek high-quality service at price w^* from an investment bank that has a history of consistently providing high-quality service. If $(p_h - p_l)(V_A - V_B + c) < (1+r)k$, then firms do not demand the service of an investment bank.*

Universal bank Again, the universal bank has a cost advantage γc of providing the credit after a failed equity issue. Therefore, in addition to saving k, the universal bank also expects to gain $(p_h - p_l)\gamma c$ from shirking. However, the expected efficiency gain of $(1-p_h)\gamma c$ also increases the rent from future business when choosing high effort. A universal bank chooses high effort if

$$k + (p_h - p_l)\gamma c \leq \frac{w - k + (1-p_h)\gamma c}{r}.$$

Thus, the equilibrium price at which a universal bank offers high quality advice has to satisfy

$$w \geq (1+r)k - (1-p_h)\gamma c + (p_h - p_l)\gamma c r.$$

The minimum price is lower than for a specialized investment bank if $(1-p_h)\gamma c \geq (p_h - p_l)\gamma c r$. That is, the minimum price is lower if the efficiency gain (the expected rent) from providing credit after failed equity issues exceeds the annualized short-term gain of increasing the expected rent (the negative incentive effect). In the one-period model with no limited liability, we used β to deal with the incentive effect and w_0 to deal with the efficiency gain. In the fixed-price reputation model, both effects enter the fixed price w. If $(1-p_h)\gamma c \geq (p_h - p_l)\gamma c r$, universal banks can offer high quality service at a lower price than specialized investment banks. Despite the lower price, universal banks earn a higher expected rent. The reason is that the efficiency gain is not completely transferred to the firm. In order to maintain incentives, prices can only be reduced by $(1-p_h)\gamma c - (p_h - p_l)\gamma c r$. A price reduction of $(1-p_h)$, i.e., the entire efficiency gain, would give an incentive to universal banks to shirk, implying that they will not receive any mandates at such a low price.

In the absence of reputation concerns, a universal bank is unable to compete with an investment bank when $w_0 \geq 0$ (see Proposition 1). Here, we also have $w_0 \geq 0$ (indeed, $w = w_0$). Nevertheless, the universal bank may be chosen. The rent from the efficiency gain not only affects incentives to defect today but also has the potential to make future business more profitable for the universal bank, thereby providing a counterbalance to the negative incentive effect.

Universal bank with tying When we discussed tying in the previous section, we stressed the possibility of using the pricing of debt to reduce the rent extracted by the universal bank in the presence of limits on w_0. In the current setting, increasing P is akin to reducing the fee for current business. For modelling purposes we assume that the debt is correctly priced, i.e., $P = P_0$, and that any changes in incentives through tying are captured by w. However, for the empirical predictions of the analysis, it is important to note that, in equilibrium, potential benefits of tying can result in both a lower investment banking fee and a below market rate of return on the credit ($P > P_0$). A universal bank chooses high effort in a tied deal if

$$k + (p_h - p_l)\gamma c \leq \frac{w - k + (1-p_h)\gamma c}{r} + (p_h - p_l)\delta.$$

Thus, tying again increases a universal bank's incentives to issue the equity. Incentives stemming from debt substitute for incentives from high fees in the investment banking business. To increase incentives, the debt in the tied deal should be as risky as possible. The maximum debt that can be used without resulting in risk shifting is $\hat{D}$, and therefore $\hat{\delta} \equiv (q_A - q_B)(\hat{D} - \underline{\pi})$ provides maximum incentives from tying. Given $\hat{\delta}$, the price has to satisfy

$$w \geq (1+r)k - (1-p_h)\gamma c + (p_h - p_l)(\gamma c - \hat{\delta})r.$$

Tying has an effect on the universal bank's incentives similar to that in the model with variable pay. Again, it not only provides incentives in the underwriting business, but also reduces the rent of the universal bank when (LLC) is binding.

While the incentive constraint was implied by the bank's participation constraint in the fixed-price model without tying, this is no longer the case with tying. w is now given by $\max\{(1+r)k, (1+r)k-(1-p_h)\gamma c+(p_h-p_l)(\gamma c-\hat{\delta})r\}$. The universal bank is able to charge a lower price, which is consistent with incentives not to shirk if $(1-p_h)-(p_h-p_l)(1-\hat{\delta}/\gamma c)r > 0$. The partial derivatives of the LHS of this inequality are straightforward. The inequality is always fulfilled if $\gamma c < \hat{\delta}$.

We can summarize in:

Proposition 5 *i) A specialized investment bank versus a universal bank with tying:*

1. *If $\gamma c < \hat{\delta}$, the firm will always choose a universal bank.*

2. *If $\gamma c > \hat{\delta}$, the firm chooses a universal bank if*

$$(1-p_h) > (p_h-p_l)(1-\hat{\delta}/\gamma c)r.$$

ii) When competing with specialized investment banks universal banks (with tied deals) are more likely to be chosen if:
(1) the debt capacity ($\hat{\delta}$) is more pronounced;
(2) the marginal impact of higher effort ($p_h - p_l$) is small;
(3) informational spillovers (γ) are small;
(4) the interest rate (r) is small or, equivalently, the time period between subsequent issues is small.

In all these cases, the negative incentive effect is small enough and the positive incentive effect of tying is large enough to make a universal bank with tying the preferred underwriter.

5 Empirical Implications

We summarize in the following what we consider to be the main empirically testable hypotheses stemming from our theoretical analysis. Before doing this, we briefly interpret our main parameters.

The risk of the firm's outstanding debt is higher the higher $(D_0 - \underline{\pi})$. Firms with a higher degree of risk of outstanding debt should have lower credit ratings. Hence, higher levels of $(D_0 - \underline{\pi})$ translate into lower credit ratings. The difference $(p_h - p_l)$ stands for the marginal effect of high underwriter efforts on the success of the issue compared to a situation with low underwriter effort. A large marginal impact of the efforts of the underwriter on the probability of success can especially be expected for firms that have a transparent business plan that can be sold rather easily to the equity market if the underwriter provides sufficient effort.

Pronounced informational economies of scope prevail if the universal bank, which has acted as an underwriter to the firm, saves a high fraction of costs c when providing debt to this firm after a failed equity issue. When providing debt, an intermediary incurs the cost of (i) establishing a customer relation, (ii) evaluating the existing operations, and (iii) evaluating the new investment opportunity. The underwriter does not have to incur the costs (i) and (ii) again. The level of cost savings on (iii) depends on how different the strategies are. Equity financing and debt financing might result in quite different investments, potentially in different business fields. The further apart the strategies A and B (and the respective business fields in which they are undertaken), the lower are the cost savings for the universal bank. We therefore argue that γ is lower for listed conglomerates that want to raise equity in a seasoned equity offering than for privately owned focused firms that want to raise equity in an IPO. First, for a listed firm public information is available that reduces the cost of establishing a customer relation and evaluating the existing operations. The ratio of these costs, which an underwriter saves when providing debt, to total costs is therefore lower for listed firms than for privately owned firms. Thus, ceteris paribus, γ will be lower for listed firms. Second, conglomerates can invest in quite distinct business areas. Therefore, the cost savings on evaluation the new investment opportunity is likely to be lower than for a focused firm. Ceteris paribus, γ will therefore be lower for conglomerates.

The parameter V_{AB} reflects the the risk shifting problem. The more pronounced the risk shifting problem, the larger is V_{AB} reflecting the notion that in this case debt financing is only feasible for strategies which lead to significantly lower net present values of investment than projects which are equity financed. We expect V_{AB} to be higher for firms with high growth options, little collateral, and high benefits of starting at a large scale. These firms can exploit a first-mover advantage by using their superior technological knowledge. Therefore, V_{AB} should be high for innovative firms with superior technological knowledge leading to high growth potentials and with few tangible assets. In contrast, V_{AB} is low for firms operating in mature industries with little growth potentials and pronounced tangible assets.

Finally, we interpret small rates of interest r (in our model with reputation) to occur if the time length between two periods is small as well. This is most likely if hot issue markets prevail.

We can now summarize our main empirical predictions as follows. First, we address the choice of underwriters (in the presence of tying) and second, we turn to the expected implications of tying.

Universal banks (which provide tied deals) are more likely to be chosen:

- By firms with lower credit ratings (see Proposition 3.1). This hypothesis is addressed and confirmed by Drucker and Puri (2005).
- By firms with transparent business plans (see Proposition 5.2).
- By firms which are little focused, e.g., conglomerates (see Propositions 3.4 and 5.3).
- By less innovative firms with few growth options (see Proposition 3.3).
- In hot issue markets (see Proposition 5.4).

Implications of tying:

- Tying may lead to fiercer price competition and below-market rates of interest (see Proposition 4). Alternatively we expect to observe price competition in investment banking fees (see especially Section 4).
- Firms that have been financed with a tied deal should be more leveraged than corresponding firms (see our discussion in the two preceding sections).

6 Conclusion

This paper examines a particular aspect of the expansion of commercial banks' activities into investment banking: the ability of universal banks to tie lending and underwriting. This phenomenon has increasingly been observed in the last decade. Our theoretical framework allows us to investigate different aspects of this phenomenon and to shed light on the underlying mechanisms and reasons for tying as well as on the consequences of tying for the parties involved. We show that commercial banks face a dilemma when entering the underwriting business. While informational economies of scope between underwriting and lending can reduce the cost of raising capital, they also reduce incentives in the underwriting business. Tying concurrent lending and underwriting can help to resolve this incentive problem and enable universal banks to compete against specialized investment banks. However, risky debt in tied deals does not only increase incentives in underwriting, it also enables universal banks to provide its services at lower prices compared to specialized investment banks. Hence, tying turns out to be a mixed blessing since it allows commercial banks to enter the underwriting markets only at the costs of fiercer price competition and lower overall profitability of this market. On the basis of our model we expect that universal banks are chosen as underwriters by firms with specific characteristics, e.g., by companies with a low credit rating, less innovative firms, and firms with a conglomerate structure. Our model thereby predicts a segmentation of the underwriting market which would potentially be even more pronounced if the costs to provide underwriting services differ among the types of underwriters.

7 Appendix

7.1 Expected profits with a universal bank and no tying, (3) and (4)

We first derive Equation (3), where (LLC) is not binding. In this case, the universal bank's participation constraint is binding and $w_0 = \frac{1}{2}i^2 - (\alpha_e e + \alpha_i i)\beta - (1 - (\alpha_e e + \alpha_i i))\gamma c$. Inserting w_0 and the incentive constraints in the firm's optimization problem gives us

$$\max_\beta \gamma c + (\alpha_e^2[\Delta_{AB} + c - \beta] + \alpha_i^2[\beta - \gamma c])(\Delta_{AB} + c - \gamma c) - \frac{1}{2}\alpha_e^2[\Delta_{AB} + c - \beta]^2 - \frac{1}{2}\alpha_i^2[\beta - \gamma c]^2$$

and the first-order condition for the optimal β is $\alpha_i^2(\Delta_{AB} + c) + \alpha_e^2\gamma c - (\alpha_e^2 + \alpha_i^2)\beta = 0$, which yields

$$\beta^* = \frac{\alpha_i^2}{\alpha_e^2 + \alpha_i^2}(\Delta_{AB} + c) + \frac{\alpha_e^2}{\alpha_e^2 + \alpha_i^2}\gamma c. \tag{10}$$

Inserting the optimal values in the firm's objective function gives us Equation (3):

$$\pi_u^{nb} = \gamma c + \nu(\Delta_{AB} + c - \gamma c)^2,$$

with $\nu \equiv 0.5(\alpha_e^4 + \alpha_e^2\alpha_i^2 + \alpha_i^4)/(\alpha_e^2 + \alpha_i^2)$.

We next derive Equation (4), where (LLC) is binding. Now, $w_0 = 0$ and the firm's optimization problem is given by

$$\max_\beta \quad \frac{1}{2}\alpha_e^2[\Delta_{AB} + c - \beta]^2 + \alpha_i^2[\beta - \gamma c][\Delta_{AB} + c - \beta].$$

The first-order condition for the optimal β is $(\alpha_i^2 - \alpha_e^2)(\Delta_{AB} + c - \beta) + \alpha_i^2(\gamma c - \beta) = 0$ and

$$\beta^* = \frac{\alpha_i^2 - \alpha_e^2}{2\alpha_i^2 - \alpha_e^2}(\Delta_{AB} + c) + \frac{\alpha_i^2}{2\alpha_i^2 - \alpha_e^2}\gamma c.$$

Inserting the optimal β in the entrepreneurs objective function gives Equation (4):

$$\pi_u^b = \frac{\alpha_i^4}{2(2\alpha_i^2 - \alpha_e^2)}(\Delta_{AB} + c - \gamma c)^2.$$

7.2 Expected profits with a universal bank and no tying, (6) and proof of Proposition 2

With tying, (LLC) is never binding, as the universal bank can adjust P. As adjusting P is a perfect substitute for adjusting w_0, we can assume that (LLC) is not binding and set $P = P_0$.

Inserting $w_0 = \frac{1}{2}i^2 - (\alpha_e e + \alpha_i i)\beta - (1 - (\alpha_e e + \alpha_i i))\gamma c$ and the incentive constraints in the firm's optimization problem gives us

$$\max_{\beta} \gamma c + (\alpha_e^2[\Delta_{AB} + c - \beta] + \alpha_i^2[\beta - \gamma c + \delta])(\Delta_{AB} + c - \gamma c + \delta) - \frac{1}{2}\alpha_e^2[\Delta_{AB} + c - \beta]^2 - \frac{1}{2}\alpha_i^2[\beta - \gamma c + \delta]^2$$

and the first-order condition for the optimal β is

$$(-\alpha_e^2 + \alpha_i^2)(\Delta_{AB} + c - \gamma c + \delta) + \alpha_e^2[\Delta_{AB} + c - \beta] - \alpha_i^2[\beta - \gamma c + \delta] = 0.$$

Rearranging terms yields

$$\beta^* = \frac{\alpha_e^2}{\alpha_e^2 + \alpha_i^2}(\gamma c - \delta) + \frac{\alpha_i^2}{\alpha_e^2 + \alpha_i^2}(\Delta_{AB} + c).$$

Inserting the optimal values in the firm's objective function gives Equation (6),

$$\pi_{ut} = \gamma c + \nu(\Delta_{AB} + c - \gamma c + \delta)^2.$$

We first compare π_{ut} with π_i^{nb} where (LLC) is not binding for the investment bank. $\pi_{ut} > \pi_i^{nb}$ if $\nu[(\Delta_{AB} + c)^2 - (\Delta_{AB} + c - \gamma c + \delta)^2] < \gamma c$. Rearranging terms yields $2\nu\,(\gamma c - \delta)\,[(\Delta_{AB} + c) - 0.5(\gamma c - \delta)] < \gamma c$.This condition is always fulfilled if $\gamma c < \delta$. For $\gamma c > \delta$ the condition can be written as

$$\nu[2(\Delta_{AB} + c) - (\gamma c + \delta)] < \frac{\gamma c}{(\gamma c + \delta)}$$

When (LLC) is binding for the investment bank, we have to compare π_{ut} with π_i^b. $\pi_{ut} > \pi_i^b$ if

$$\frac{\alpha_i^4}{2(2\alpha_i^2 - \alpha_e^2)}(\Delta_{AB} + c)^2 - \nu(\Delta_{AB} + c - \gamma c + \delta)^2 < \gamma c.$$

Rearranging terms yields

$$2\nu[(\Delta_{AB} + c) - 0.5(\gamma c - \delta)](\gamma c - \delta) - \tau(\Delta_{AB} + c)^2 < \gamma c.$$

$\tau = 0.5\,(\alpha_i^2\alpha_e^4 + \alpha_i^6 - \alpha_e^6)\,/(\alpha_i^2\alpha_e^2 + 2\alpha_i^4 - \alpha_e^4)$. This condition is always satisfied for $\gamma c \leq \delta$, as $\alpha_i > \alpha_e$ implies $\tau > 0$. Hence, $\gamma c < \delta$ is a sufficient condition for a universal bank to be optimal. For $\gamma c > \delta$, the condition can be written as

$$2\nu[(\Delta_{AB} + c) - 0.5(\gamma c - \delta)] - \tau\frac{(\Delta_{AB} + c)^2}{\gamma c - \delta} < \frac{\gamma c}{\gamma c - \delta}.$$

7.3 Proof of Proposition 3

A) (LLC) of the specialized investment bank is not binding The universal bank is preferred if $\Pi_{uti} \equiv \pi_{ut} - \pi_i^{nb} = \gamma c - \nu[2V_{AB}\gamma c - 2V_{AB}\delta + \delta^2 + 2c\gamma c - 2c\delta - (\gamma c)^2] > 0$

1) $\partial\Pi_{uti}/\partial\delta = 2\nu[V_{AB} - \delta + c] = 2\nu[\Delta_{AB} + c] > 0$

2) $\partial\Pi_{uti}/\partial\gamma = [1 - 2\nu[V_{AB} + c - \gamma c]]c$ and $\partial^2\Pi_{uti}/\partial\gamma^2 = \nu > 0$ with $\gamma \in [0,1]$. Thus, Π_{uti} is a convex function of γ. Ignoring for a moment the bounds, 0 and 1, there exists a critical $\widehat{\gamma}$ such that Π_{uti} is decreasing in $\gamma < \widehat{\gamma}$ and increasing in $\gamma > \widehat{\gamma}$. $\widehat{\gamma}$ is defined by $1 - 2\nu[V_{AB} + c - \widehat{\gamma}c] = 0$ and $\widehat{\gamma}c = V_{AB} + c - 1/\nu$.

We can distinguish three cases

(i) $\widehat{\gamma} \geq 1$ or $\frac{\partial\Pi_{uti}}{\partial\gamma}|_{\gamma=1} = 1 - 2\nu[V_{AB}] \leq 0$, i.e., $1 < 2\nu[V_{AB}]$ –> $\frac{\partial\Pi_{uti}}{\partial\gamma} < 0$ for $\gamma \in [0,1]$

(ii) $\widehat{\gamma} \leq 0$ or $\frac{\partial\Pi_{uti}}{\partial\gamma}|_{\gamma=0} = 1 - 2\nu[V_{AB} + c] \geq 0$, i.e., $1 > 2\nu[V_{AB} + c]$. –> $\frac{\partial\Pi_{uti}}{\partial\gamma} > 0$ for $\gamma \in [0,1]$

(iii) $\widehat{\gamma} \in (0,1)$ or $\frac{\partial\Pi_{uti}}{\partial\gamma}|_{\gamma=0} = 1 - 2\nu[V_{AB} + c] < 0$ and $\frac{\partial\Pi_{uti}}{\partial\gamma}|_{\gamma=1} = 1 - 2\nu[V_{AB}] > 0$ i.e., $2\nu[V_{AB}] < 1 < 2\nu[V_{AB} + c]$

3) From Proposition 2.1 we know that $\Pi_{uti} > 0$ for $\gamma c < \delta$. For $V_{AB} < V_{AB}^L$ we know from i) that $\partial\Pi_{uti}/\partial\gamma > 0$. Since Π is continuous in γ, $\Pi > 0$ for all γ if $V_{AB}^L < V_{AB}$.

4) Since $\partial\Pi_{uti}/\partial V_{AB} = -\nu(\gamma c - \delta) < 0$, for $\gamma c > \delta$. Hence for V_{AB} being sufficiently large, Π_{uti} becomes negative.

B) (LLC) of the specialized investment bank is binding The universal bank preferred if $\Pi_{utib} \equiv \pi_{ut}^{nb} - \pi_i^b = \gamma c - \nu[2(\Delta_{AB} + c)(\gamma c - \delta) - (\gamma c - \delta)^2] + \frac{\alpha_i^2\alpha_e^4 + \alpha_i^6 - \alpha_e^6}{2(\alpha_i^2\alpha_e^2 + 2\alpha_i^4 - \alpha_e^4)}(\Delta_{AB} + c)^2 > 0$. We are interested in the comparative statics for $\gamma c - \delta > 0$.

1) $\partial\Pi_{uti}/\partial\delta = [\alpha_i^4/(2\alpha_i^2 - \alpha_e^2)]\,(\Delta_{AB} + c) > 0$.

2) $\partial\Pi_{uti}/\partial\gamma$ is identical to the case discussed in part A.

3) The same argument as in part A applies.

4) The same argument as in part A applies since $\nu > \frac{\alpha_i^2\alpha_e^4 + \alpha_i^6 - \alpha_e^6}{2(\alpha_i^2\alpha_e^2 + 2\alpha_i^4 - \alpha_e^4)}$.

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