Debt as a (Credible) Collusive Device: 'Everybody Happy But the Consumer'*

Giancarlo Spagnolo†

Working Paper in Economics and Finance No. 243, Stockholm School of Economics
May 2000, available at *http://swopec.hhs.se*
This revised version: August 1, 2004

Abstract

The paper proposes a theory of anti-competitive effects of debt finance based on the interaction between capital structure, managerial incentives, and firms' ability to sustain collusive agreements. Shareholders' commitments not to expropriate debtholders through managers with valuable reputations or "conservative" incentives greatly facilitate collusive behavior in product markets. Concentrated/collusive credit markets or large banks in competitive ones can confer credibility to such arrangements, thereby "exporting" collusion through leverage in otherwise competitive downstream industries. Managers are happy with the arrangement since they share in the collusive rent. These "conservative governance structures" imply high prices and underinvestment in R&D. Corruption and bad debtholder protection may restore competition by allowing shareholders to bribe managers and induce them to undercut rivals and expropriate debtholders.

JEL Classification: D21, G32, L13, L41.

Keywords: Financial market - product market interaction, conflicts of interests, credit market competition, collusion, corruption, innovation, governance, conservatism, capital structure, managerial incentives, stakeholders.

---

*This is a heavily revised version of Ch. 4 of my Ph.D. dissertation at the Stockholm School of Economics. I am grateful to Tore Ellingsen and Jörgen W. Weibull for advice, and to Bengt Holmström for the excellent discussion and further suggestions. Thanks also to Franklin Allen, Erik Berglöf, Elena Carletti, Nicola Cetorelli, Gilles Chemla, Gabriella Chiesa, Antoine Faure-Grimaud, Sven-Olof Fridolfsson, Patrick Rey, Paola Sapienza, Jean Tirole, Alberto Zazzaro and participants in Bonn, Mannheim, Munich, Stockholm (SSE and IUI), Toulouse, the SFA98, EEA99, and EARIE99 meetings, the 1999 CEPR-ESSFM in Gerzensee, the 2003 Regulation and Antitrust Workshop in Siena, the 2003 CEPR/CREI Conference on Finance and Innovation in Barcelona, and the (fantastic) FIRS Conference in Capri, May 2004. Nora Hartmann (Bonn) corrected a mistake in the proof of Lemma 4. All remaining errors are mine. Generous financial support was provided by the Swedish Competition Authority, the European Commission (Marie Curie Fellowship), the SFA (Ph.D. Paper Award), and the EARIE (YEEC Award).

†University of Mannheim, Sveriges Riksbank, Consip SpA and C.E.P.R. Address: *L7 3-5, 68131 Mannheim, Germany.* Mobilephone: ++39-320-4312186. e-Mail: *gianca@uni-mannheim.de.*

1 Introduction

Understanding the relation between financial structure and the real economy is crucial to assess the relative efficiency of alternative financial institutions. This paper focuses on the relation between debt finance – in particular bank debt – and borrowers' long-term competitive attitudes interpreted in a broad sense.

The empirical work of Judith Chevalier (1995), Chevalier and David Sharfstein (1996), Dan Kovenock and Gordon Phillips (1995, 1997), and particularly Phillips (1995) showed that in some concentrated industries, high leverage is correlated with low output, high prices and more passive investment behavior: debt finance appears to have anti-competitive effects on at least some product markets. More recently, cross-county studies by Nicola Cetorelli (2001, 2003), Thorsten Beck *et al.* (2003) and Cetorelli and Philip Strahan (2004) showed that credit market concentration induces concentration in downstream industries.

These findings are hardly surprising if one looks a century back at the US experience of 'financial capitalism', when J.P. Morgan's men sat on the boards of railways and shipping companies, coordinating their strategies at the expense of customers.[1] They are even less surprising if one recalls that about at the same time other banks where doing approximately the same in Austria and Germany.[2] But they remain somewhat surprising for economics and finance scholars, as established theories of the interaction between financial and product markets predict that debt should lead borrowing firms to compete *more* aggressively (the next section reviews related literatures).

Inspired by the late experiences of 'financial capitalism', this paper develops a formal theory of the anti-competitive effects of debt finance based on the interaction between capital structure, managerial incentives, and firms' ability to sustain collusive behavior in product markets. The theory explains why and how concentrated/collusive credit markets – or large banks in competitive ones – may "export" collusion in otherwise competitive downstream industries. It shows that borrowers' commitments to prudent strategies aimed at reducing shareholders-debtholders conflicts and the *ex ante* cost of debt finance – like choosing a CEO with a valuable reputation or conservative incentives – also facilitate collusive behavior in product markets. Common, allied or interlocked lenders can make these commitments credible across competitors by introducing simple debt covenants or sitting on borrowers' boards. The combination of bank debt and conservative managers may then have the product market effects of a hidden merger, making full collusion sustainable in industries where unleveraged firms would be unable to collude at all. Among the policy implications of these results, discussed in depth in the last section of the paper, are that:

– since (lack of) competition in the banking sector 'trickles down' to downstream industries, credit markets should be high up on the agenda of competition authorities;

[1] That dominant banks could have significant anticompetitive effects on borrowing industries was very clear to Louis Brandeis and other early 20th century US politicians who fought J.P. Morgans' "money trust" obtaining a substantial strengthening of antitrust laws and banking regulation. Miguel Cantillo Simon (1998) shows that a large part of the additional firm value generated by links with J.P. Morgan came indeed from cartelization. See also Bradford de Long (1991).

[2] See Martin Hellwig (1991) for a general discussion and Ulrich Wegenroth (1997) for an historical account.

– since innovation is positively related to industry competition, enhancing credit market competition fosters R&D investment and innovation;

– the costs of *product* markets' monopolization should also be taken into account when trading off competition and financial stability in banking;

– low contract enforceability, debtholder protection and transparency, and even easy corruption may be beneficial in undermining "conservative governance structures".

Our work starts from the observation by James Brander and Michel Poitevin (1992), David Hirshleifer and Anjan Thakor (1992), and Daron Acemoglu (1998) that by committing to a prudent behavior through "conservative managers" shareholders can moderate the ex ante agency cost of debt finance. We introduce this commitment opportunity in a dynamic leveraged oligopoly model à la Vojislav Maksimovic's (1988, 1995) to reconsider the effects of capital structure on firms' long-term competitive attitudes and incentives to innovate.

We find that when shareholders can credibly commit against strategic default by hiring a manager with an established reputation, debt needs not hinder product market collusion, as originally found by Maksimovic, and may actually facilitate it. Commitments to debtholder-friendly behavior through conservative managerial incentive schemes has an even stronger pro-collusive effects that reinforce those of managers' reputational concerns.

Delegation of control is a contractual device, and its commitment value towards competitors is greatly reduced when secret renegotiation is feasible at low cost (Mathias Dewatripont, 1988; Michael Katz, 1991). We find that when credit markets are concentrated/collusive, 'allied' lenders can make the choice of conservative managers *renegotiation-proof* – hence commitments to 'prudent' product market strategies credible – even when secret contract renegotiation is feasible and costless.[3] Even when credit markets are competitive and firms have multiple lenders, we show that by choosing at least one common lender – or a common set of "allied" lenders – oligopolistic firms can credibly commit to "prudent behavior", coordinate and enforce tacit collusive agreements that could not be sustained otherwise, as conjectured by Brander and Tracy Lewis (1986). When no lender is in common, independent lenders are shown able to monopolize otherwise competitive downstream product markets by having "a man of theirs" on the board of the firms they are *not* financing; i.e. through information networks composed of *indirectly interlocking directors*, each monitoring the borrowers of the competing banks.[4] Bad law enforcement and low debtholder protection are shown to hinder these conservative governance structures: they undermine the credibility of commitments by allowing shareholders to bribe managers, undo the conflict of interest introduced by debtholder-friendly incentives and induce them to maximize profits expropriating debtholders.

To our knowledge, this is the first formal-theoretical account of how in the early 1900s J.P. Morgan and its counterparts in Europe facilitated collusion among borrowers to

> *"[create] value for shareholders by the extraction of monopoly rents from consumers..."* (De Long, 1991).

[3] The result is independent of whether the credit market is contestable, and solves both the downstream firms' enforcement and coordination problems: it makes the joint monopoly agreement sustainable as the unique collusive equilibrium in otherwise competitive product markets, independent of the discount rate.

[4] The two mechanisms that make managerial contracts renegotiation-proof in this model – third parties and information networks – are quite general. They can confer commitment value to contracts other than those we are focussing on.

The results offer a theoretical rationale for the evidence mentioned earlier, and for the strictly related observation that in continental economies and Japan product markets tend to be less competitive in than in Anglo-Saxon economies.[5] They also offer an explanation to Wendy Carlin and Colin Mayer's (2003) finding that in OECD countries the presence of large banks is associated with lower growth in innovative industries and higher growth in mature ones.[6]

While testable predictions are detailed at the end of the paper, we note here that the results are consistent with a number of other empirical regularities, among which that debt issues are perceived as good news by the stock market (Christopher James, 1987; Milton Harris and Arthur Raviv, 1991); that the probability of a firm undertaking an LBO is positively related to competitors' leverage (Paul Marsh, 1982; Chevalier, 1995); and that managerial incentives are often low-powered (Jensen and Kevin Murphy, 1990; Murphy, 1999), particularly in bank-dominated economies (Steven Kaplan, 1994a,b).[7]

Finally, Jeffrey Zwiebel (1996) has convincingly argued that an important weakness of many models of the disciplinary role of debt is that financial decisions must be made *ex ante* and must be out of managers' control, since debt leaves managers worse off.[8] One appealing feature of our model is that it provides a clear explanation for why managers may be willing to choose high leverage, putting themselves under the threat of bankruptcy: a combination of debt and conservative incentives may be a commitment to profitable, collusive behavior and – for the commitment to be credible – managers must receive a stake of the collusive rent.

The reminder of the paper is organized as follows. Section 2 sets up the model and shows how managers' reputation and debtholder-friendly incentives affect the relation between debt finance and dynamic product-market competition. Section 3 shows how common/allied lenders can monopolize competitive product markets by conferring credibility to commitments to "prudent management." Section 4 considers multiple, asymmetric, independent lenders and "bankers on boards". Section 5 discusses extensions, policy implications and related literature. Section 6 concludes with some testable predictions. All proofs are in the Appendix.

2 Debtholder-friendly managers and collusive behavior

Maksimovic (1988, 1995) studies a dynamic leveraged oligopoly model in which firms repay their debt by periodic installments (coupons), which can alternatively be thought of as repayments of several debt contracts with different maturities, and finds a monotone negative relation between a firm leverage and its ability to sustain tacit collusion.[9] We begin by sketching a dynamic

[5] See e.g. Marcus Noland (1995), Yoshiro Miwa (1996), or Maki Atsushi (1998).

[6] Protecting mature industries from competition ensures high returns (collusive margins) in these safe sectors; this may have been one way banks have steered investment away from risky, innovative sectors. This also suggests that the more competitive and fragmented financial market may have been an important factor behind the recent increase in US' technological lead.

[7] Brian Hall and Jeffrey Liebmann (1998) document how stock-related incentives increased US managers' pay-performance sensitivity in recent years. Consistent with the results of the present paper, a comparable stock-options never took place in more bank-oriented countries, while Giancarlo Spagnolo (2000) shows that US managers' stock-options are also typically designed so that product-market competition is softened.

[8] In Zwiebel's words: "[...] this contrasts with common perception of leveraged choices being in the domain of standard managerial decisions. Managers commonly undertake capital decisions without any apparent extraordinary external threat." For example, in the leveraged buyout wave of the '80s it was managers who usually took the initiative, and increases in leverage were accompanied by simultaneous changes in managerial incentives.

[9] An analogous result is found by Rune Stenbacka (1994), who extends Maksimovic's model to the case of demand uncertainty, and by Ulrich Hege (1998), who characterizes the relative pro-competitiveness of bank vs.

leveraged oligopoly model à la Maksimovic, that can be also be interpreted in terms of R&D competition, and by describing his main result; we then use the model as a workhorse for our analysis of "conservative governance structures".

2.1 Set up and benchmark results

Let there be N identical firms competing in an infinitely repeated product market oligopoly. Time is discrete, firms discount future profits through a common discount rate r and repeatedly play an oligopoly stage game with a unique non-cooperative pure-strategy Cournot-Nash equilibrium (standard specifications of Cournot and homogeneous or differentiated Bertrand oligopolies satisfy this requirement). Let π_i^A denote the profit realized by a firm i in a period when all firms stick to the prescriptions of a stationary collusive agreement A that coordinates all relevant market variables, and π_i^{NC} denote the same firm's profit at the unique Cournot-Nash equilibrium of the stage game. Abusing notation, we let $\widehat{\pi}_i^A$ denote one-period profits from unilaterally deviating from A and choosing the static best response strategy while other firms stick to A; and $\underline{\pi}_i^A$ the one-period profits from sticking to A when another firm deviates unilaterally. Under standard specifications the underlying oligopoly stage-game has the strategic structure of a Prisoner's Dilemma with $\widehat{\pi}_i^A > \pi_i^A > \pi_i^{NC} > \underline{\pi}_i^A$.[10] For the interpretation of firms competing in R&D, we assume that R&D spillovers are not too strong (so that non cooperative R&D investments are higher than collusive ones) and that the advantage induced by a period's R&D investment expires at the end of that period.[11]

The collusive agreement A can then be sustained in subgame perfect equilibrium in the dynamic game by grim-trigger strategies ("respect A as long as everybody does it, if a defection is observed play the static Nash equilibrium forever," James Friedman, 1971) if short-run gains from deviating are smaller than discounted losses from the punishment phase, that is, if

$$\widehat{\pi}_i^A - \pi_i^A \leq \frac{\pi_i^A - \pi_i^{NC}}{r},\ \forall i, \ \Leftrightarrow\ r \leq r^* = \frac{\pi_i^A - \pi_i^{NC}}{\widehat{\pi}_i^A - \pi_i^A},\ \forall i. \tag{1}$$

Suppose firms simultaneously increase leverage by issuing long-term debt or, as in Maksimovic, that when the industry was founded all firms simultaneously issued debt in the form of bonds sold for a lump-sum amount D_i against the obligation to pay bondholders an amount b_i in every following period, with $D_i = \frac{b_i}{r}$. In each period firms are free to distribute dividends after having paid the coupon b_i. If in one period a firm cannot meet its debt-service obligation, bankruptcy occurs. Bankrupt firms are sold to new profit-maximizing owners.[12] The period after a firm

publicly traded debt.

[10] This is always the case for Cournot and (omogeneous or differentiated) Bertrand competition, and it the case with R&D competition as long as spillovers are not too strong (see e.g. Xavier Vives, 2003).

[11] This ensures that the product market game is stationary, as in Maksimovic. All the results we derive apply also if firms compete simply on output or price. Also, the results do not depend on the stationarity of the product market game. It will become clear that – at the cost of substantial complication and lengthening of the model – fully analogous results could be obtained with a non-stationary dynamic product market game such as that studied by Volker Nocke (2000).

[12] The alternative assumption, that after bankruptcy firms exit from the product market, readily transforms the model into a "predation" one. It can easily be shown that in this case debt makes collusion impossible: it greatly increases firms' incentives to deviate, drive competitors bankrupt, and monopolize the market, while no credible punishment is available to firms as a deterrent.

becomes bankrupt old shareholders – or whoever else is in charge of running the firm before it is sold to new owners – have a short horizon and therefore maximize short-run profits.[13] The condition for the collusive agreement to be respected by each firm i under the threat of grim-trigger strategies becomes

$$\pi_i^A - b_i + \frac{\pi_i^A - b_i}{r} \geq \widehat{\pi}_i^A - b_i + \max\left\{\frac{\pi_i^{NC} - b_i}{r}, 0\right\},$$

or, equivalently,

$$\widehat{\pi}_i^A - \pi_i^A \leq \frac{\pi_i^A - b_i}{r} - \max\left\{\frac{\pi_i^{NC} - b_i}{r}, 0\right\}. \tag{2}$$

As long as $b_i \leq \pi_i^{NC}$, the right hand side (RHS) of the inequality can be simplified to $\frac{\pi_i^A - \pi_i^{NC}}{r}$, and condition (2) reduces to (1). Instead, at higher levels of leverage, with $\pi_i^{NC} < b_i < \pi_i^A$, condition (2) becomes

$$\widehat{\pi}_i^A - \pi_i^A \leq \frac{\pi_i^A - b_i}{r} \;\Leftrightarrow\; r \leq r^{**} = \frac{\pi_i^A - b_i}{\widehat{\pi}_i^A - \pi_i^A}.$$

By inspection, at this level of debt condition (2) becomes more stringent and collusion more difficult to sustain (r^{**} decreases) when firm leverage increases, pushing the coupon b_i up towards π_i^A. This is Maksimovic's (1988, 1995) main result.

2.2 Managers' reputation, bankruptcy and collusion

Maksimovic's result is derived under the standard assumption of profit maximizing firms. However, large firms are led by managers whose incentives may not perfectly coincide with shareholders' objectives.[14] Even when incentive contracts are so well designed as to lead managers to maximize shareholders' discounted profits under normal conditions, top managers face extra costs when their firm goes bankrupt. For professional managers bankruptcy implies a substantial loss of reputation, together with either the loss of the job, or a drastic wage cut.[15] Moreover, lenders often explicitly ask shareholders to hire top managers with a particularly solid reputation for "prudent behavior," who have much to lose from driving the firm into bankruptcy.[16]

Managers' reputational costs of bankruptcy have already been taken into account in classical models addressing firms' financial policy (Stephen Ross, 1977; Hirshleifer and Thakor, 1992) or business cycles (Bruce Greenwald and Joseph Stiglitz, 1990, 1993), it is therefore time to analyze their effects on product markets. Herer we modify firms' objective function to incorporate such costs as in Ross (1977). Managers' direct costs from financial distress may be fixed, or may vary depending on "how bad" financial problems are. To consider both cases we let $C_i \geq 0$ denote the fixed loss that a manager incurs when his firm can't meet debt service obligations, and let

[13] Maksimovic notes that after bankruptcy is declared shareholders are indifferent about profits, so that many static equilibria exist, but that the most reasonable assumption is that the Cournot-Nash one is played.

[14] Classical references include Herbert Simon (1957), William Baumol (1958), Oliver Williamson (1964), and Jensen and Meckling (1976).

[15] Stuart Gilson (1989) and Gilson and Michael Vetsuypens (1993) find that about half of the managers of firms facing financial distress are replaced and are not re-hired by comparable (exchanged-listed) firms for the following three years; and that those who are retained experience very large reductions in salary and bonuses.

[16] Gilson (1989) finds that a significant number of changes of management are initiated by creditors, e.g. during debt restructuring.

$c_i(b_i - \pi_i)$, with $c_i \geq 0$, be a variable managerial cost increasing with the amount of debt the firm cannot honor. To simplify exposition it is also useful to define $\mathbf{C}_i = C_i + c_i(b_i - \pi_i^{NC})$.

To isolate the effects of debt and bankruptcy on managerial behavior and tacit collusion we focus on managers under a long-term profit-sharing compensation plan, which leads them to maximize an objective function equivalent in all aspects to that of shareholders except in the evaluation of bankruptcy.

Definition 1 ***Net profit sharing long-term contract (NPS):*** *In every period managers are paid a fixed wage (normalized to zero, together with the reservation wage) plus a share of the period's net profits, $\alpha(\pi_i^t - b_i)^+$, with $0 < \alpha < 1$.*[17]

The following lemma will be useful below.

Lemma 1 *When firms are led by managers under NPS contracts, debt and managerial bankruptcy costs do not affect the Nash equilibrium of the static market game.*

The long-term incentive contract between a manager and an owner ends when a change of control occurs. Therefore, after bankruptcy, debtholders can choose whether to replace old managers, or to retain them at a wage reduced by the negative effects of bankruptcy on their reservation wage. Suppose first that debtholders replace managers when the firm goes bankrupt. With managers under NPS contracts and positive managerial bankruptcy costs, the necessary and sufficient condition for the manager being willing to respect a stationary, collusive agreement delivering per-period profits π_i^A is

$$\alpha\left[(\widehat{\pi}_i^A - b_i) - (\pi_i^A - b_i)\right] \leq \alpha\frac{(\pi_i^A - b_i) - (\pi_i^{NC} - b_i)}{r} \tag{3}$$

for $b_i \leq \pi_i^{NC}$, which also reduces to (1), and

$$\alpha\left[(\widehat{\pi}_i^A - b_i) - (\pi_i^A - b_i)\right] \leq \alpha\frac{\pi_i^A - b_i}{r} + \mathbf{C}_i, \;\; \Leftrightarrow \;\; r \leq r' = \frac{\pi_i^A - b_i}{\widehat{\pi}_i^A - \pi_i^A - \frac{\mathbf{C}_i}{\alpha}} \tag{3a}$$

for $b_i > \pi_i^{NC}$. Suppose instead that managers are retained after bankruptcy. Condition (3) remains unchanged, while condition (3a) becomes

$$\alpha\left[(\widehat{\pi}_i^A - b_i) - (\pi_i^A - b_i)\right] \leq \alpha\frac{\pi_i^A - b_i - \pi_i^{NC}}{r} + \mathbf{C}_i \Leftrightarrow r \leq r'' = \frac{\pi_i^A - \pi_i^{NC} - b_i}{\widehat{\pi}_i^A - \pi_i^A - \frac{\mathbf{C}_i}{\alpha}}. \tag{3b}$$

Comparing these conditions with (2) one obtains the following.

Lemma 2 *Suppose managers are under long-term NPS contracts. Then:*

(i) If leverage is "low" ($0 \leq b_i \leq \pi_i^{NC}$), managerial bankruptcy costs do not affect firms' ability to collude.

(ii) If leverage is "high" ($b_i > \pi_i^{NC}$) and managers are replaced when bankruptcy occurs, positive managerial bankruptcy costs ($\mathbf{C}_i > 0$) increase the maximum discount rate (decrease

[17] Gross profit sharing contracts have even stronger effects, since then the manager's wage is not affected by financial transactions and the negative effect of debt on collusion found by Maksimovic disappears by assumption.

the minimum discount factor) at which firms can support any collusive agreement in subgame perfect equilibrium.

(iii) If leverage is "high" ($b_i > \pi_i^{NC}$) and managers are not replaced when bankruptcy occurs, managerial bankruptcy costs increase the maximum discount rate at which firms can support any collusive agreement as long as $\mathbf{C}_i > \alpha(\widehat{\pi}_i^A - \pi_i^A)\frac{\pi_i^{NC}}{\pi_i^A - b_i}$.

For positive levels of bankruptcy costs there is a range of "high" debt levels – increasing in such costs – at which (3a) and (3b) are both strictly less stringent than (1). However, (3a) and (3b) are the relevant conditions only if bankruptcy does eventually occur. When (1) is not satisfied – provided managers are unconstrained regarding dividend policy – a manager that defects from collusive strategies has enough cash to avoid bankruptcy. He can either use short-run gains from deviation to buy back all debt, or retain and invest them at the market rate r to pay future coupons. Then the incentive compatibility condition for collusion to be supported by managers under NPS contracts is not affected by bankruptcy costs, it is precisely condition (1). If, instead, managers are restricted to pay out part of the realized profits as dividends, then even when (1) is not satisfied it can be impossible for a deviating manager to avoid bankruptcy. Then, sufficiently high managerial bankruptcy costs can indeed revert Maksimovic's result making collusion easier for highly leveraged firms than for unleveraged ones. The following proposition formalizes this intuition.

Proposition 1 *Suppose managers are under NPS contracts. Then:*

(i) When managers are unconstrained regarding dividend policy and their bankruptcy costs are large, high leverage (with $b_i > \pi_i^{NC}$) does not limit firms' ability to collude.

(ii) When managers are constrained to pay out (part or all) realized profits as dividends and managerial bankruptcy costs are large, high leverage (with $b_i > \pi_i^{NC}$) enhances firms' ability to collude (highly leveraged firms can sustain any given collusive agreement at strictly higher discount rates than unleveraged firms).

2.3 Debtholder-friendly managerial incentive schemes

Suppose now that there are no reputational costs of bankruptcy. Shouldn't informed lenders be expected to anticipate the strategic default problem identified by Maksimovic, and ask for some alternative form of commitment before lending money to limitedly liable borrowers? Hirshlifer and Thakor (1992), Brander and Poitevin (1992) and Acemoglu (1998) showed that low-powered managerial incentive schemes can do at least as well in inducing managers to take into account debtholders' interests. Brander and Poitevin (1992), in particular, consider two kinds of managerial incentive schemes: a **penalty contract**, which gives managers a fixed salary W when the firm is solvent, and the same salary minus a penalty T when the firm goes bankrupt (where T may consist simply of the managers' bankruptcy costs discussed in the previous section); and the widely used **bonus contract**, which implies a per-period wage composed of a salary W plus a fixed monetary bonus B paid only in periods in which the firm's accounting profits are above a target level π^B. They show that in their model the bonus contract is an "optimal contract," since through a suitable choice of the target π^B it leads to the ex ante first best outcome, maximizing firm value.

For the sake of simplicity, in evaluating the product-market effects of these contracts we focus on the case where managers are replaced after bankruptcy, and assume that when a manager

is indifferent among two or more available strategies he chooses the one that maximizes firm's profits.[18] Also – to abstract from the reputational issues considered in the previous section – we assume that managers' reservation wage is not affected by bankruptcy, and we maintain its normalization to zero (without loss of generality). We have the following.

Proposition 2 *A) Suppose shareholders hire managers under "penalty contracts" to reduce the agency costs of debt finance. Then:*

(i) When managers are unconstrained regarding dividend policy, leverage does not affect firms' ability to collude.

(ii) When managers are committed to distribute net profits as dividends, highly leveraged firms ($b_i > \pi_i^{NC}$) *can support any feasible stationary profit stream that leaves firms solvent in subgame perfect equilibrium in the market supergame at any level of the discount rate.*

B) Suppose shareholders hire managers under "bonus contracts" to reduce the agency costs of debt finance. Then any stationary collusive agreement that allows managers to receive their bonuses can be supported in subgame-perfect equilibrium in the market supergame at any level of the discount rate.

The intuition for part A) is that the penalty T has the same pro-collusive effect as the reputational costs of bankruptcy analyzed in the previous section, while the flat wage removes any incentive for managers to deviate from a collusive agreement. One might have expected that the apparently more aggressive bonus contracts would not have so striking pro-collusive effects, but part B) shows that quite the opposite is true. The reason is that the bonus incentive scheme, as the penalty one, is "capped."[19] If managers can sustain a stationary collusive agreement delivering per-period profits higher than, or equal to the trigger level π^B, they will have no incentive whatsoever to deviate. They cannot capture any further gain from a deviation, while the following punishment phase makes them lose future bonuses independent of whether their firm goes bankrupt. And this holds whatever the discount rate is.

These results reinforce Brander and Poitevin's argument that the relatively low power of managers' incentive schemes found by Jensen and Murphy (1990) and others could be attributed to the role of "conservative" managerial contracts as commitments towards borrowers: in oligopolies, conservative incentives introduce a *conflict of interest* between shareholders and managers that however reduces the agency costs of debt finance and softens competition in the product market, thereby increasing profits.[20] It is also worth noting the following.

Remark The pro-collusive effects of manager's reputational costs of bankruptcy (identified in the previous section) and of conservative incentive schemes are independent and reinforce each other: the overall pro-collusive effect of conservative "managers" is given by the *sum* of the collusive effects of managers' reputational costs of bankruptcy and of conservative managerial incentive schemes.

[18] This eliminates a multiplicity of weak stage-game equilibria in subgames where managers run firms but and are indifferent about the oucome. Alternatively, one could assume that managers' compensation contains a small profit-sharing component, or that managers own a small amount of the firm's shares.

[19] Bonus schemes used in the real world are almost always capped (Murphy, 1999).

[20] Spagnolo (2000) shows that the typical design of stock-option plans also facilitates product market collusion.

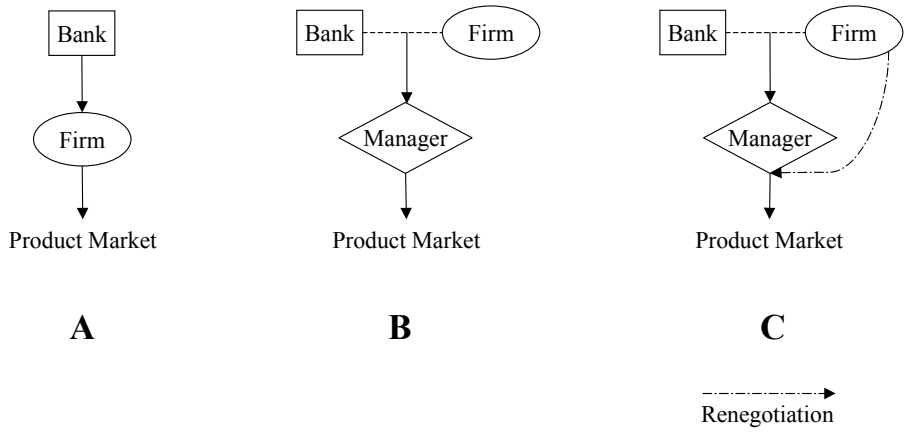

Figure 1: Commitment and renegotiation in a vertical structure

3 The role of banks

We have been working under the implicit assumption that shareholders' choice of a top manager and of his incentive contract is an effective commitment device towards both, lenders and competitors. However, under a collusive product market agreement shareholders (and debtholders) would have incentives to secretly renegotiate their managers' contract and undo the initial commitment.

3.1 Bank relations and secret renegotiation

As pointed out by Dewatripont (1988) and Katz (1991), the commitment value of contracts with third parties can be greatly reduced by agents' ability to *secretly renegotiate* the contract. This problem is sketched in Figure 1, where example A represents the situation before delegation, B the situation after delegation (a manager moderates debtholders/shareholders conflicts on product market strategies), and C the possibility that shareholders secretly renegotiate their manager's contract.

Acemoglu (1998) considers this possibility and shows that leaving sufficient rents to managers could block secret renegotiation within one vertical structure by making it too expensive for owners.[21] Though, when competing vertical structures seek commitment towards each other – commitment *between* structures – under perfect information neither a covenant, nor rents, nor other contractual arrangements within one structure can prevent renegotiation.[22] In our

[21] This solution, however, requires that in equilibrium part of the manager's rents are paid by the lender, i.e. that the manager is simultaneously on the payroll of both bank and firm, a seldom observed arrangement.

[22] When one structure use contracts to commit and affect the strategy of competing structures, secretly undoing the commitment it can secure itself additional gains that can be redistributed internally to achieve the Pareto improvement necessary for renegotiation.

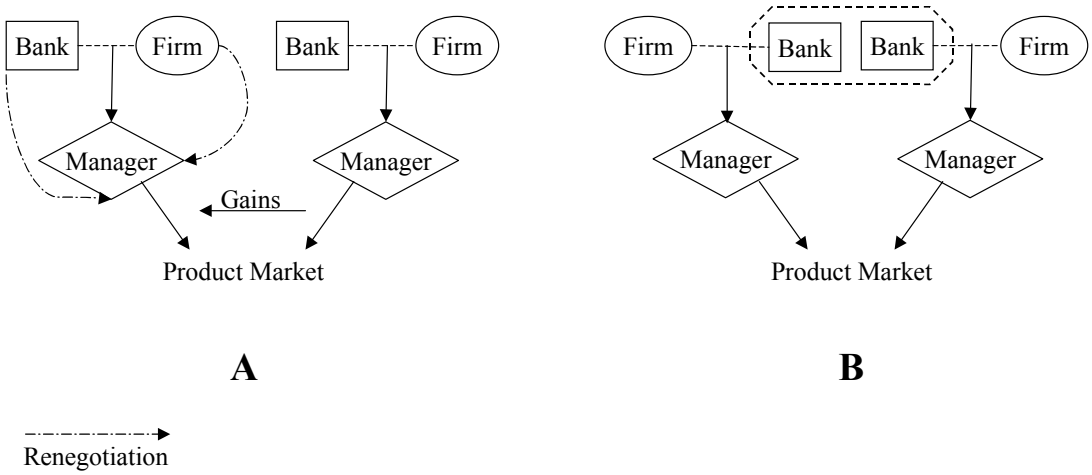

Figure 2: Renegotiation and commitment between vertical structures

example, suppose two competing bank-firm-manager structures commit through internal managerial contracts to prudent, collusive product market strategies not sustainable otherwise. Each vertical structure would then strictly gain by secretly renegotiating the internal contract and unilaterally defecting from the product market agreement. This case is described in Figure 2-A, where debtholders and shareholders agree to renegotiate their manager's conservative contract to obtain and share gains from a unilateral defection in the product market.

We show now that a "relation" between lenders – as described in Figure 2-B – may lead these to internalize the externalities they impose on each other through borrowers, block renegotiation and confer commitment value to "conservative governance structures."

3.1.1 Related lenders

There are several conceivable "relations" that may lead lenders to internalize the externalities they impose on each other through borrowers.

Common lender. The more obvious case is that in which the two lenders are in fact the same one, where firms borrow from the same bank, an extreme but common form of "relation between lenders" described in Figure 3-A.

Cooperative relations. When the banking industry is highly concentrated, lenders may collude. But even in fragmented and competitive credit markets, independent banks are often involved in long-term (explicit or implicit) cooperative agreements, e.g. in information sharing, interbank lending, syndacated financing etc. Allied banks could then internalize externalities and behave as one bank towards borrowers. Figure 3-B refers to this situation.

Ownership relations. Distinct banks may belong to the same group, they can be directly or indirectly controlled by the same holding, as described in Figure 3-C. Again, banks controlled by the same entity would internalize externalities, behaving as a common lender towards borrowers.

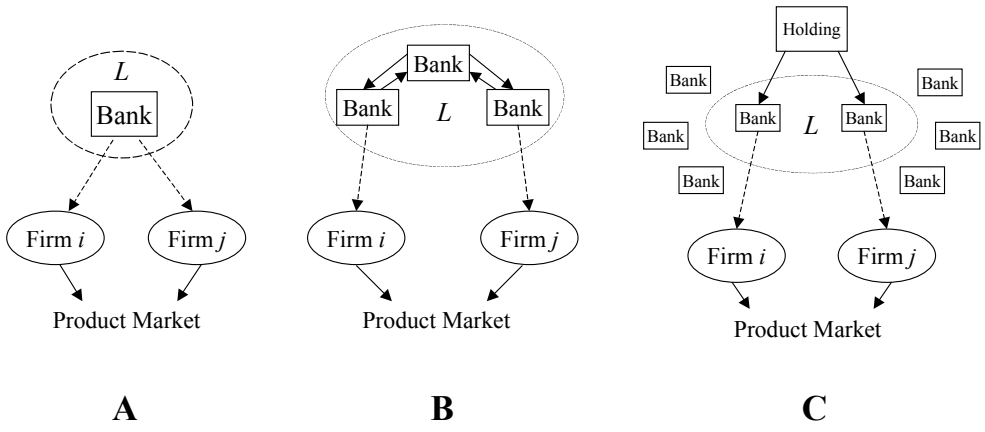

Figure 3:

3.1.2 Additional assumptions

For the sake of crispness, in the remainder of the paper we will refer to a "common lender" L with the understanding that this can be one bank or several banks acting cooperatively. Also, we now restrict attention to a product market *duopoly* (the N-firm case being fully analogous and more cumbersome), where managers that drive their firm bankrupt are replaced; and we retain the normalization of managers' reservation wage to zero. In addition, to sharpen our results and emphasize the power of bank debt as a collusive device we adopt the following extreme (pro-competitive) assumptions:

Assumption 1 *Secret contract renegotiation is feasible and costless.*[23]

Assumption 2 *Condition (1) is not satisfied by any collusive agreement.*

Assumption 3 *Lenders own no shares in borrowing firms, nor control proxy votes in their shareholders meetings.*

3.2 Common lenders, covenants and collusion

Suppose at the foundation of the industry, or in any other period τ, firms raise debt finance from a common lender L under the covenant that the firm is run by a given manager under lender-friendly incentive compensation as long as there is outstanding debt. For example, the debt contract could be as follows.

[23] It should be clear at this point that allowing for positive costs of renegotiation can only reinforce our results. Frictions in renegotiation, such as asymmetic information at the contracting stage, would give direct commitment power to observable contracts (see Mathias Dewatripont, 1988; Paolo Fulghieri and S Nagarajan 1992; and Bernard Caillaud et al. 1995).

Definition 2 ***The Debt Contract:*** *"Shareholders receive today the amount of cash D_i against the promise of the coupon payment b_i in each future period, where $D_i = \frac{b_i}{r} - g_i$,* if an external manager is hired as CEO under a long-term bonus contract – *as defined in the previous section, with W_i normalized to 0, and $B_i > 0$ – with target profits $\pi_i^B \geq \pi_i^{NC}$; the managers' contract cannot be modified without the agreement of the lender (as long as debt is in place).* "

Here g_i denotes the amount of future collusive profits that the lender extracts in advance from each firm by selling overpriced debt.

Since the lender is aware of shareholders' incentives to secretly renegotiate the manager's contract, we assume he will make sure that the contract forbids the manager from accepting additional/parallel forms of compensation (in particular from the owner), and that penalties for contract/covenant infringement are sufficiently high for both owner and manager.

Consider first a "low" debt contract ($b_i \leq \pi_i^{NC}$). When leverage is low the common lender loses little from a deviation in the product market, since firms are able to repay debt even when they are stuck at the static Nash equilibrium. Moreover, L may gain from a deviation by obtaining control of the non-deviating firm if this can't meet the coupon the period of the deviation. Because shareholders' gains from deviating from a collusive agreement are sufficient to compensate the manager for the loss of future bonuses and to induce him to deviate, all required parties may eventually agree to a joint secret renegotiation of debt and managerial contracts, leading to a deviation from the collusive agreement. Still, we can state what follows.

Lemma 3 *(i) At very low levels of debt, such that $b_i \leq \underline{\pi}_i^A < \pi_i^{NC}$ $\forall i$, managerial bonus contracts are not renegotiation-proof and leverage does not affect firms' ability to collude.*

(ii) At low levels of debt, such that $\underline{\pi}_i^A < b_i < \pi_i^{NC}$ $\forall i$, when

$$\frac{\pi_i^{NC} - b_i}{r} < b_i - \underline{\pi}_i^A, \text{ and } b_i - \underline{\pi}_i^A - \frac{\pi_i^{NC} - b_i}{r} > \widehat{\pi}_i^A - \pi_i^A - \frac{\pi_i^A - \pi_i^{NC}}{r},$$

debt makes managers' contracts renegotiation-proof and collusion sustainable; it does not affect firms' ability to collude otherwise.

That is, even low levels of debt, with b_i smaller but close to π_i^{NC}, can facilitate collusion by making sure that if a firm deviates, the lender loses from the side of the other firm it financed. When shareholders' net gains from deviation are small, compensating the lender for this loss is not possible and renegotiation cannot occur. This effect becomes much stronger with "high" debt levels ($b_i > \pi_i^{NC}$). Then we can state the following.

Lemma 4 *Suppose a "high" debt contract ($b_i > \pi_i^{NC}$) is accepted by both owners. Then:*

(i) As long as

$$b_j < \widehat{\pi}_i^A - \pi_i^A + \underline{\pi}_j^A, \ \forall i, j,$$

for given managerial bonuses B_i, target profit levels π_i^B, and collusive profits π_i^A ($\pi_i^A \geq \pi_i^B$), the maximum discount rate at which the managerial contracts are renegotiation-proof is higher than that at which owners can collude, and is monotonically increasing in firms' leverage.

(ii) As long as

$$b_i \geq \widehat{\pi}_j^A + \underline{\pi}_i^A - \pi_j^A, \ \forall i, j,$$

for given managerial bonuses B_i, target profit levels π_i^B, and collusive profits π_i^A ($\pi_i^A \geq \pi_i^B$), contracts are renegotiation-proof and collusion supportable at any level of the discount rate.

That is, for higher levels of debt there is a smooth positive relation between firms' leverage and the ability of the debt contract to confer credibility to conservative managerial contracts.[24] The debt contract makes collusion supportable at discount rates at which unleveraged owners cannot collude, and for high enough leverage full collusion becomes supportable at any level of the discount rate. We can now state this section's main result.

Proposition 3 *A debt contract with $b_i = \pi_i^B = \pi_i^M - B_i$ with each firm i makes managerial contracts renegotiation-proof and implements the joint monopoly agreement as the unique subgame perfect stationary collusive equilibrium in the product market, independent of the discount rate.*

Moreover, as long as the lender leaves a stake of the collusive rent to owners (as long as $g_i < \frac{\pi_i^M - B_i - \pi_j^{NC}}{r}$), accepting the debt contract is owners' strictly dominant strategy.

In other words, everybody happy – shareholders, debtholders, and managers – but consumers. We will refer to these collusive equilibria as "conservative governance structures". The discounted flow of bonuses is the stake of the collusive rent appropriated by managers, and can be interpreted as the intrinsic cost of the commitment technology.

3.3 Discussion

3.3.1 Credit market competition

Proposition 3 applies independently of how competitive or contestable is the loan market. In the equilibria we characterized, lender(s), managers and shareholders share the collusive rent from the product market. With little credit market competition the lender has most bargaining power, and extracts most of the collusive rent, leaving shareholders with the minimum "fair" share ($\frac{\pi_i^M - B_i - \pi_j^{NC}}{r} - g_i$) that guarantees acceptance (analogous reasoning applies to managers). Increased credit market competition reduces the bargaining power of the lender, redistributing collusive rent (the size of g_i) towards shareholders (and managers), but leaves all else unchanged. Even with a perfectly competitive loan market, as long as firms borrow from the same (coalition of) lender(s), this could internalize product market externalities and guarantee the credibility of commitments to conservative product market strategies, although it won't capture much of the rent.[25] By shifting the distribution of the collusive rent from the common/allied lender(s) to the many downstream borrowers, credit market competition reduces the lender's incentive to set up such "conservative governance structures". It does increase the firms' incentives to take the initiative, but to a much lesser extent: insofar as borrowers are many, independent and subject to antitrust laws, they will face additional coordination costs, free riding, and the risk of being fined by the competition authorities that the common lender does not facer. This observation leads to the following.

Corollary 1 *Suppose that borrowing firms face positive coordination costs (e.g. are many, and/or subject to antitrust laws), and that for each agent the incentive to form "conservative*

[24] Whether managerial contracts are renegotiation-proof may depend on the discount rate because the lender's losses from a deviation are in terms of expected future repayments.

[25] One difference with competing lenders is that firm owners could secretly borrow from an other lender to "buy back debt" towards L and then induce the manager to defect from the collusive agreement. This, however, would not be profitable: L could refuse to sell back the debt, and even if it could not, it would find convenient to alert the other firm, so that it would also simultaneously defect leaving no profits to the firstr firm.

governance structures" increases with the net expected share of the collusive rent. Then the stronger credit market competition, the smaller are agents' incentives to establish conservative governance structures.

3.3.2 Corruption

Although ex-ante shareholders find in their interest to enter "conservative governance structures", ex-post they have incentives to secretly bribe the manager to induce him to defect from the cartel and distribute profits, thereby diving the firm bankrupt and avoiding penalties for covenant infringement. Enforcing such a one-shot illegal transaction is of course problematic. If shareholders pay the bribe first, the manager could keep the bribe without defecting, thereby also earning the stream of future bonuses; if the manager defects first, then why should the owner ever pay the promised bribe; and such an exchange could hardly be simultaneous. When enforcing the bribe/defection exchange is possible (e.g. because there is a Mafia providing enforcement servicies for illegal transactions), it will be costly. The bribe should also be kept very well hidden, as observing the manager's defection the lender (and courts) would suspect and carefully look for signs of the illegal transactions.[26] Let β denote the bribe owners may offer the manager, e the direct cost of enforcing the illegal exchange, s the cost of keeping the bribe-against-defection deal secret, and $f^m(s)$ and $f^s(s)$ the expected cost of being detected and sanctioned by law enforcers respectively for the manager and the shareholders (where $f^{m\prime}, f^{s\prime} < 0$). Given that shareholders and managers choose optimally $s^* = \min\{s + f^m(s) + f^s(s)\}$, to accept the illegal deal and defect the manager requires a compensation at least as large as his expected future rents from not defecting plus his expected fine, $\beta \geq \frac{B}{r} + f^m(s^*)$. Proposition 3 can then easily be modified to encompass corruption by stating that the debt contract implements any agreement A such that $e + s^* + f^s(s^*) + \frac{B}{r} + f^m(s^*) \geq \widehat{\pi}_i^A - \pi_i^A - \delta\frac{\pi_i^A - \pi_i^N}{1-\delta}$, while leaving the current statement for the case $e + s^* + f^s(s^*) + \frac{B}{r} + f^m(s^*) \geq \widehat{\pi}_i^M - \pi_i^M - \delta\frac{\pi_i^M - \pi_i^N}{1-\delta}$. The left hand side of these inequalities is increasing in the effectiveness of the law enforcement system and grow further when shareholders are dispersed (as shareholders' coordination costs would add to enforcement and legal costs). Therefore, we can state the following cross-country implication.

Corollary 2 *.Suppose that shareholders face positive coordination costs and that corrupt deals are mre costly (risky) with a good law enforcement system. Then* caeteris paribus *collusive schemes sustained by "conservative governance structures" should be more frequent where shareholders are more dispersed and law enforcement is better.*

For the sake of crispness, in the remainder of the paper we disregard owner-manager corrupt deals, which can always be handled along the lines sketched here, but the reader should keep in mind that in this framework bad law enforcement and corruption can have the positive side-effects to undo/prevent conservative governance structures.

[26] This is why it is a standard assumption in models of supervisor-agent collusion that hidden transfers imply deadweight losses, and that the enforcement of illegal transactions, when feasible, is costly (see Tirole, 1992).

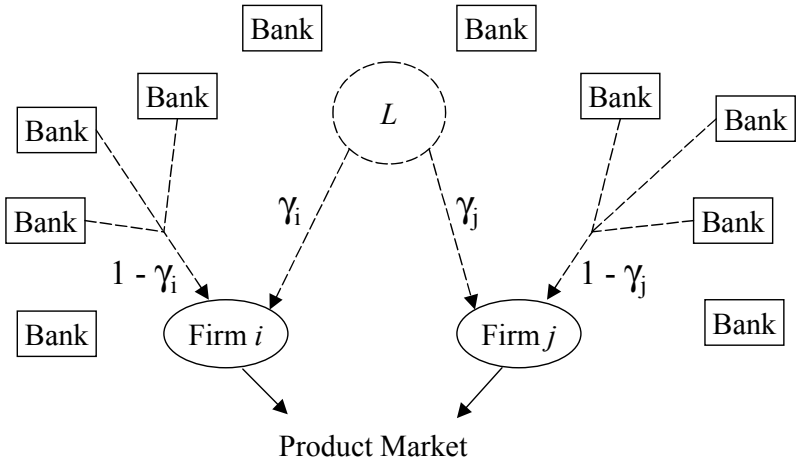

Figure 4:

4 Multiple lenders and "bankers on boards"

4.1 Multiple and asymmetric lenders

One might think that, with competitive credit markets a multiplicity of unrelated lenders would greatly reduce the pro-collusive effects of debt. So what if no lender or coalition of lenders is large enough or willing to completely finance both firms?

4.1.1 Multiple lenders

Suppose that each firm i is financed by a pool of many, say N_i independent banks, that the loan market is competitive, and that only one bank is in both pools (or is allied to one of the banks in the other pool), holding a share γ_i, where $0 < \gamma_i < 1$, of each firm i's debt.

As a benchmark, consider first the case of equal involvement of the common (allied) lender(s) with the two competing firms, so that $\gamma_i = \gamma_j = \gamma$. We obtain the following result.

Proposition 4 *Suppose common/allied lenders have a share γ of firms' debt. Then, by raising high levels of covenant-protected debt (with $b_i = \pi_i^B = \pi_i^M - B_i$, $\forall i$) owners can:*

(i) Make managerial contracts renegotiation-proof and implement the joint monopoly collusive agreement at any discount rate as long as $\gamma \geq \frac{\widehat{\pi}_i^M - \pi_i^M}{\pi_j^M - \underline{\pi}_j^M - B_j}$ $\forall i$.

(ii) For any $\gamma > 0$, they make managerial contracts renegotiation-proof and implement the joint monopoly collusive agreement as the unique collusive equilibrium at higher discount rates than the maximum at which owners could sustain it.

Moreover, accepting the debt contract is a (strictly) dominant strategy for each owner.

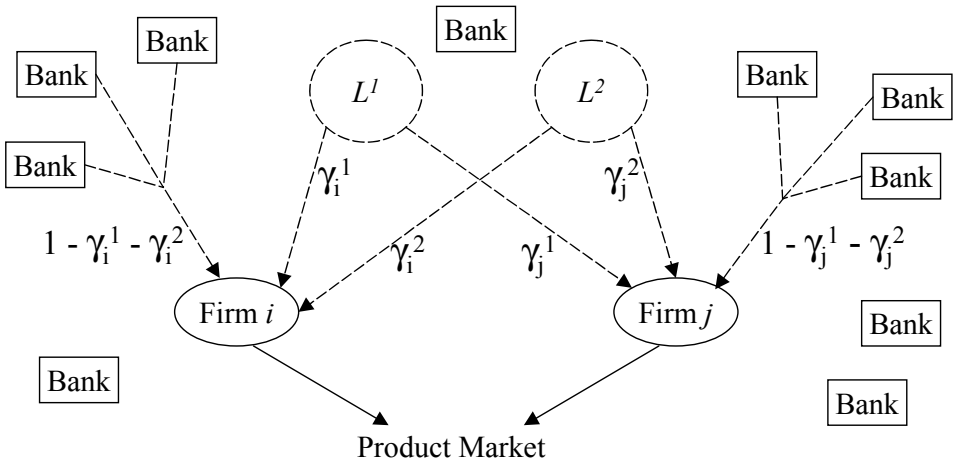

Figure 5:

4.1.2 Asymmetries

To understand the role of asymmetries in the common lender's claims towards competing firms we let here $\gamma_i \neq \gamma_j$.

The case of a **single common lender** is straightforward. The pro-collusive effect of debt applies only as long as it prevents deviations from *both* firms. When $\gamma_i > \gamma_j$, the common lender (or the couple of allied lenders) loses less when firm i deviates than when firm j does, hence the cost of a secret renegotiation that leads the manager to deviate from a collusive agreement is smaller for firm i. Because owners of firm j are aware of this, they will stick to collusion only if firm i's cost of secret renegotiation (increasing in γ_j) is high enough to prevent it. It follows that the pro-collusive effect of a common lender's debt is increasing in $\min\{\gamma_i, \gamma_j\}$, and therefore is maximal when $\gamma_i = \gamma_j$.

This reasoning can be summarized as follows.

Proposition 5 *Given the total amount of the common lender's claims, the pro-collusive effect of debt decreases with the asymmetry in firms' loans.*

At first glance one might think of this result as a practical 'rule of thumb' to distinguish between cases where common lending may and may not have serious anti-competitive consequences. However, such a rule of thumb would be misleading, since it applies *only* to the case of a single common lender (or a single set of allied lenders).

In fact, consider the case of **more than one common lender**. Suppose that, say, two of the N_i and N_j lenders, named L^1 and L^2, are in both pools of creditors. Let γ_i^h, $h \in \{1, 2\}$, denote the share of lender h's total loans to the industry that goes to firm i, and suppose that the common lenders' exposure is strongly asymmetric, so that each lender specializes by lending much more to one firm than to the other.

We obtain the following.

Proposition 6 *Suppose two (or more) lenders are in common but are specialized with (i.e. lend relatively more to) different firms. Then the pro-collusive effect of debt increases with* $\min\left\{\gamma_i^1+\gamma_i^2;\ \gamma_j^1+\gamma_j^2\right\}$.

That is, with many common lenders what matters is the asymmetry of *total* claims from common lenders. When a common lender is specialized with one firms, he suffers a big loss if secret renegotiation followed by a deviation takes place for the firm with which he is *not* specialized. Therefore, when two common lenders are specialized with different firms, for each firm there will be one non-specialized common lender with a strong interest in blocking secret renegotiation. This guarantees against renegotiation in both firms and allows collusion to be implemented. In this situation, a rule of thumb based on the asymmetry of each common lender's claims would be highly misleading. For example, with two common lenders of equal size, the maxima of $\min\left\{\gamma_i^1+\gamma_i^2;\ \gamma_j^1+\gamma_j^2\right\}$ are obtained when $\gamma_i^1+\gamma_i^2=\gamma_j^1+\gamma_j^2$, which is satisfied when $\gamma_i^1=\gamma_j^2$ is very large and $\gamma_j^1=\gamma_i^2$ is very small. Hence *with more than one common lender, what would appear to be a "marginal" degree of common lending because of the extreme asymmetry at each lender's claims, has the strongest possible anti-competitive effect.*[27]

4.2 'Bankers on boards' and independent lenders

In this section we show that another device, also often observed in reality, can replicate the effects of a debt covenant allowing the lender(s) to confer credibility to commitments to 'conservative management'. Firms can set up a Board of directors and confer this the right to choose the CEO and his incentive scheme, complying with most existing (and fashionable) "Corporate Governance Codes." By serving on firms' Boards as outside directors, lenders will then be in the position to observe any proposed change of management's incentives.

4.2.1 'Bankers on boards' with common/allied lenders

Suppose the debt contract does not assign lenders formal control rights on the choice of managers and their incentives, but that the lender sits on borrowers' Board of Directors. Suppose further that – by firms' charter – it is the Board that hires, fires, and determines the compensation of top managers, so that directors must be informed in advance of any proposed change in managers' incentives. We obtain the following.

Proposition 7 *Suppose the lender(s) is represented on firms' boards, or has the right to be informed when boards renegotiate managers' contracts.*

Then, as long as $\underline{\pi}_i^{NC}>\underline{\pi}_j^{M}$ *and*

$$\widehat{\pi}_i^M+\underline{\pi}_j^M-\pi_i^{NC}-\pi_j^{NC}\leq B_i<\frac{\pi_i^M+\pi_j^M-\pi_j^{NC}-\pi_i^{NC}}{r}+\pi_i^M+\pi_j^M-\widehat{\pi}_i^M-\underline{\pi}_j^M,\ \forall i,j,$$

[27] When each common lender is composed of a couple of allied but distinct lenders, so that a lender L_i^1 in N_i holding γ_i^1 of firm i's debt is cooperating with a lender $L_j^1\in N_j$ holding γ_j^1 of firm j's debt, and the same happens with two other lenders $L_i^2\in N_i$ and $L_j^2\in N_j$, a highly pro-collusive degree of common lending appears even more marginal, if it appears at all (most cooperative relations between banks are implicit and carefully concealed to outsiders).

high levels of debt (with $b_i = \pi_i^M - B_i = \pi_i^B$, $\forall i$) make managerial contracts renegotiation-proof and implement the joint monopoly agreement in the product market as the unique subgame perfect stationary collusive equilibrium.

Moreover, as long as $g_i < \frac{\pi_i^M - B_i - \pi_j^{NC}}{r}$ accepting the debt contract is owners' (strictly) dominant strategy.

As when covenants give them veto power on renegotiation, when corruption is too expansive common/allied lenders sitting on firms' Boards can solve their enforcement and coordination problems, implementing the joint monopoly agreement as the unique collusive equilibrium in the otherwise competitive product market. As long as the common lender sits on the Board of Directors he knows per time when a firm's shareholders plan to renegotiate their manager's compensation and can block it by credibly threatening to reveal it to the competing firm (who would immediately react by defecting and nullifying gains from renegotiation). The condition in the proposition ensures that the lender's threat of revealing the other firm that contract renegotiation is occurring is a credible one (right hand side inequality), and that the lender is effectively interested in blocking renegotiation (left hand side inequality). As long as $\underline{\pi}_i^{NC} > \underline{\pi}_j^M$, which is satisfied for many specifications of the underlying game, the condition is satisfied when (1) is not.[28]

Again, the result is independent of competitive conditions on the loan market: as for debt covenants, whether the credit market is competitive or contestable will only affect the distribution of collusive rents and the incentive to take the initiative.

4.2.2 No common lenders: networks of indirectly interlocking directors

Suppose now that our firms are financed by distinct and fully independent lenders, and that lenders have no men on the borrowers' boards, nor veto power nor rights to be informed of the renegotiation of managers' contracts. Assume that each duopolist is financed by a distinct lender, each lender belongs to a distinct business group (e.g. a pyramid), and business groups are fully independent and rival, that is, they behave non-cooperatively towards each other. Still, it may happen (or be made to happen) that among the companies in business group G_i, to which firm i's lender L_i belongs, there is a firm, say the insurance company I_i, in business relation (e.g. regularly supplying products) to firm j. Analogously, among the companies in business group G_j – to which firm j's lender L_j belongs – there may be, say, the shipping company T_j who regularly sells services to firm i. Since I_i is a business partner of firm j, nobody would be surprised to find a representative of firm I_i (that is, of group G_i) on the board of directors of firm j; and the same can be said for a T_j's (therefore G_j's) man on firm i's board. This situation is represented in Figure 1.

It is easy to derive the consequences of such a (common) situation. Without proof, one can state what follows.

[28] Because of the condition to be satisfied, the pro-collusive effect characterized here appears weaker than the one of debt covenants characterized in Proposition 3. However, it is easy to verify that the condition become much weaker when there are more common/allied lenders each specialized with a different firm, as described in Section 4.1.2, and that it is always satisfied (so that the statement of Proposition 3 would hold also for "bankers on boards" without covenants) when the asymmetry is substantial. Similarly, it would be easy to show that the condition is weakened – so that the threat of revealing renegotiation is credible for at higher discount rates – when the bank borrow to many industries, so that they can build a reputation for not "holding up" its borrowers by withholding important information.

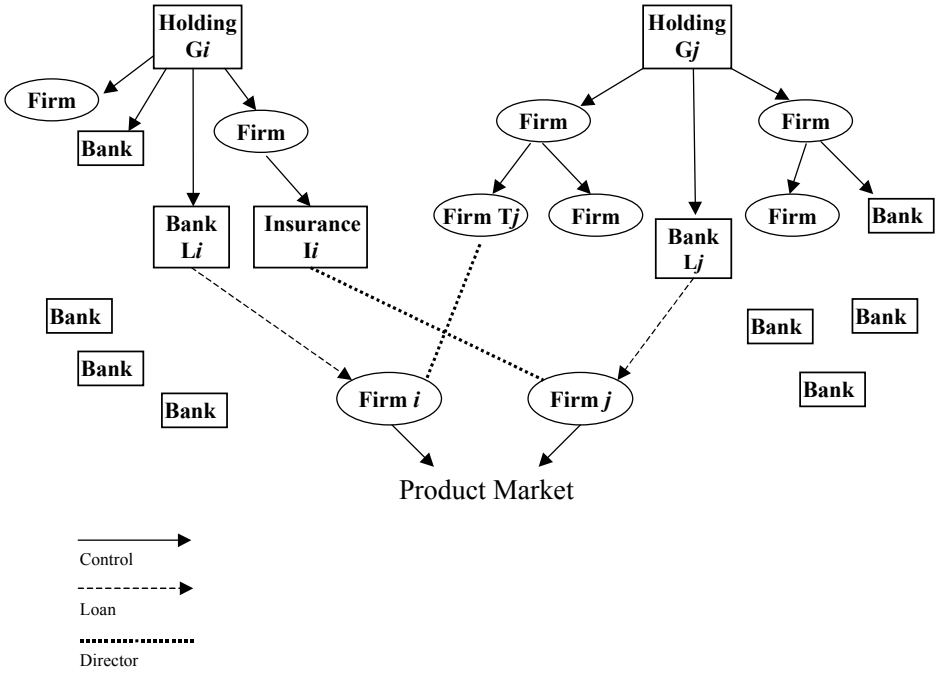

Figure 6:

Proposition 8 *Suppose that there are no common/allied lenders, and that lenders have no seats on firms' boards, nor veto power, nor rights to be informed of managerial contracts' renegotiation.*

As long as on each firm's board sits a loyal member of the business group that (directly or indirectly) controls the lender of the competing firm*, managerial contracts are credible commitments and bonus contracts with* $\pi_i^B = \pi_i^M$ *implement the joint monopoly agreement as the unique subgame perfect collusive equilibrium in the product market at any level of the discount rate.*

To reduce lender L_i's losses, group G_i's man on firm j's board would immediately inform firm i of any renegotiation of managerial contract that might lead firm j to unilaterally deviate from a collusive agreement, and *vice versa*. A firm informed that the other firm is renegotiating its contractual precommitment to a prudent behavior would immediately react abandoning the collusive agreement, thereby nullifying all gains from renegotiation.

Note, though, that although indirectly interlinked directors may in principle replicate the effects of common/allied lenders, when the number of firms in the oligopoly grows this mechanism becomes unfeasible, as it requires that the size of each firm board grows along with the number of firms.[29]

[29] At the beginning of the century, J.P. Morgan had directors on the boards of some thirty firms in the transport industry (railways, shipping companies, etc.). If these firms were to coordinate through a network of indirectly interlocking directors rather than through a common lender, then each firm's board would have to be composed of more than thirty directors.

5 Extensions, policy implications, and related literature

5.1 Extensions

Other stakeholders. There is a debate on the role of Stakeholders in firms' governance, and several problems linked to the idea of a "stakeholders' society" have already been spelled out, for example by Jean Tirole (2001). Our results highlight additional problems linked to the influence of organized stakeholders on firms' governance. Any industry-wide *stakeholder* other than a bank can facilitate downstream industries' monopolization when given sufficient influence on firms' choices. In Germany, for example, industry-wide trade unions have seats on firms' boards and a strong say on the choice of top managers and their compensation. In light of our results, it is clear that these unions can easily substitute or complement banks in the coordinating role we described, with shareholders, debtholders and managers sharing the collusive rent with unionized employees. Similar considerations of course apply to networks of common *shareholders* and for firms that themselves have cross-shareholdings.[30]

Entry. A financial entry deterrence effect fully analogous to that in Bhattacharya and Chiesa (1995), Cestone and White (2003) and Hellmann and Da Rin (2002) emerges in our model if one assumes that while bank and firms are sustaining a collusive equilibrium among those we characterized, a potential entrant unexpectedly overcomes other barriers and asks for finance to enter the industry. If the collusive agreement maximizes joint bank-firms-managers profits, then it is a dominant strategy for the bank not to finance the entrant (he could not increase discounted industry profits but would claim part of them, reducing incumbents' profits and the value of existing loans without bringing any potential benefit (a formal extension of the model showing this would be rather trivial). However, contrary to the pro-collusive effects characterized in previous sections this financial entry deterrence effect is limited to extremely concentrated or underdeveloped credit market: in all these models it is sufficient that a second comparable lender is present, just one more bank with analogous skills and cost of funds, that financial entry deterrence disappears all together.[31]

5.2 Policy implications

Competition policy. To our knowledge, no competition authority in this world pays attention to who is lending to oligopolistic firms suspected of price-fixing, and to who is sitting on their boards of directors. The model suggests that this is unfortunate. We have shown that a common lender, a coalition of allied lenders, or even fully independent and competing lenders with firm-interlocking directorships can easily monopolize an otherwise competitive downstream product market. The result is a "hidden horizontal merger" which has worse social welfare consequences than a real horizontal merger.[32] When there is suspicion of price coordination in an oligopolistic

[30] It is "folk wisdom" in Industrial Organization that the more cross-(or common-)shareholdings is present in an oligopoly, static or dynamic, the less competitive is the product-market outcome (a formal model of this relation would be trivial).

[31] The obvious reason is that if the bank funding the incumbent(s) refuses to finance the entrant, the second bank will do it as long as entry is profitable. Consistently, Cetorelli (2002) finds that credit market concentration induces industry concentration in countries with underdeveloped financial markets, but that the effet disappears for countries with developed ones.

[32] A real merger to monopoly might bring about efficiency gains, besides market monopolization, while common, allied, or interlocking lenders can only monopolize the product market.

industry, competition authorities should check who is financing oligopolistic firms and who is sitting on their boards; and in the case of different lenders, what is the ultimate relation between them (e.g. do lenders belong to the same pyramid, are there cross-shareholdings?).

Bank competition and financial stability. Most previous work on the effects of banking competition on financial stability highlights its negative impact in terms of increased incentives to take risks (Michael Keeley 1990; Carmen Matutes and Xavier Vives, 1996; Hellmann et al. 2000), and reduced incentives to screen prospective borrowers (Thorsten Broecker, 1990; Michael Riordan, 1993). The policy prescriptions originating from these contributions is limiting bank competition to balance welfare gains from increased financial stability and efficiency losses from market power *in the credit market only.* And indeed, for the sake of financial stability, regulators have been very conservative in terms of encouraging competition in the banking sector in the last decades (with few notable exceptions). Our results imply that this policy attitude is biased against credit market competition, since it disregards the concentrated credit market's ability to soften competition and innovation *in the whole real sector.*

Bank mergers and universal banks. In evaluating the effects of the recent wave of mergers in the banking industry, concerns about the increase in concentration are typically limited to the cost of market power in the credit market only (see e.g. Jean Dermine, 2000). Again, this policy attitude appears too accommodating towards banks' supermergers, since it overlooks the additional welfare costs linked to large banks' greater ability to curb competition in downstream industries.

Also, there has been a policy debate on whether in the US the Glass-Steagall Act's (1933) prohibition of banks' shareholdings in industrial firms should be relaxed (see e.g. Anthony Saunders, 1994). One of the major concerns has been the question whether such a reform could "...recreate the cartels of [J.P.] Morgan's day?" (*The Economist*, Feb. 1st 1997). This paper shows that this concern should not be dismissed too easily. Shareholdings reinforce banks' influence on borrowing firms' decisions. According to our results, stronger bank influence can facilitate the monopolization of downstream product markets.

5.3 Related literature

Besides work mentioned in the introduction, the paper is related to most previous research on the interaction between firms' financial structure and product market competition. It stands in contrast to the two most established theories on the subject, the "long purse" and the "limited liability" ones. According to John McGee's (1958) and Lester Telser's (1966) "long purse" or "deep pockets" theory, when some firms issue debt, their unleveraged competitors will find it convenient to engage in a market war in order to drive them bankrupt and eventually out of the market.[33] According to Brander and Lewis' (1986) "limited liability" theory, the "asset substitution" problem highlighted by Michael Jensen and William Meckling (1976) should lead shareholders of leveraged firms to disregard low product market states – from which they are protected by limited liability – and choose overly aggressive product market strategies.[34] These theories cannot explain the evidence mentioned in the introduction, as their natural implication

[33] This argument has been formalized in models of "predation," for example, by Jean-Pierre Benoit (1984), Drew Fudenberg and Jean Tirole (1986), and Patrick Bolton and David Scharfstein (1990).

[34] This argument was also made by Maksimovic (1986). The strictly related argument that owners' limited liability limits leveraged firms' ability to sustain tacit collusion was developed by Maksimovic (1988), and extended by Rune Stenbacka (1994) and Ulrich Hege (1998).

is that debt finance should increase product market competition by leading either leveraged firms or their competitors to behave more aggressively.

The paper perhaps closest in spirit to our work is Poitevin (1989), which focuses on the coordinating role of a common lender in a one-shot oligopoly.[35] Both this paper and Poitevin (1989) are related to the work of Douglas Bernheim and Michael Whinston (1985), who showed that a common (marketing) agent can be used by competing firms to facilitate tacit collusion. The first part of our paper builds on the literature on strategic delegation which – extending Thomas Schelling's (1960) insight that contracts with third parties can have strategic effects – explores the commitment value of managerial incentives in oligopolistic environments.[36]

The model is related to the literature on banks as 'gatekeepers' of product markets pioneered by Sudipto Bhattacharya and Gabriella Chiesa (1995), analyzing the effects of a monopolist lender on downstream industries by focussing on entry, rather than behavior. Bhattacharya and Chiesa show that a common lender internalizes market externalities between borrowing firms, facilitating information-sharing in R&D *and ensuring that only one firm enters the product market*. Similarly, Giacinta Cestone and Lucy White (2003) show that a monopolist/dominant bank would neglect finance to potential product market entrant when it is already financing an incumbent firm, and that banks are more prone to exclude entrants when they hold equity in the incumbent.[37] We discuss entry in Section 6, where we note that a similar deterrence effect emerges also in our model, but that contrary to the effects on collusion, financial entry deterrence can only be relevant when credit markets are extremely concentrated/underdeveloped.

The paper contributes to the debate on the relation between finance, competition and innovation. From a product market point of view, Shumpeterian theories suggest that monopoly rents foster innovation and growth.[38] Empirical evidence, however, indicates that robust competition improves firms' performance and stimulates innovation.[39] Our model suggests that competition in *credit* markets may foster innovation by hindering collusive underinvestment agreements in product markets. Alexander Gershenkron (1962) argued that size and market power facilitated the coordinating and investment-fostering role that banks played in the early stages of the German and Italian industrialization.[40] Our paper looks at the other face of the coin by focussing on mature industries with several established incumbents, where a concentrated/collusive banking sector can play another 'coordinating role': helping incumbents maintain profitable collusive

[35] Within a two-stage model analogous to Brander and Lewis (1986), Poitevin shows that when firms borrow from a common lender their overly aggressive product market behavior may be reduced by a suitable choice of the interest rates. Still, in his model the overall effect of debt finance remains *pro*-competitive.

[36] Classical references include John Vickers (1985); Chaim Fershtman and Kenneth Judd, (1987); and Steven Sklivas, (1987). Our approach is perhaps closest to Spagnolo (2000), where the dynamic effects of managerial incentives are analized.

[37] Thomas Hellmann and Marco DaRin (2002) reach the same two conclusions in an extension of their "big push" model. On the contrary, Stefan Arping (2002) finds that if the bank holds a moderate equity stake in the incumbent firm, it may be *more* prone to finance rivals, increasing product market compeition.

[38] See e.g. Philippe Aghion and Peter Howitt, (1992). More recently, Aghion, Mathias Dewatripont and Patrick Rey (1999a) obtain a positive relation between competition and innovation by introducing agency costs and conservative managers in a Schumpeterian growth model.

[39] See e.g. Martin Baily and Hans Gersbach (1995), Richard Blundell et al. (1995), and Stephen Nickell (1996). Aghion et al. (2002) find evidence of an inverted-U relationship between competition and innovation. A collusive agreement would place any industry at the left edge of the inverted-U.

[40] Hellman and DaRin (2002) provide a formal model of this idea. The related 'micro' theory by Mitchel Petersen and Raghuram Rajan (1995) suggests that without market power banks would not finance small firms, as they could not recover the cost of the initial risky investment when firms grow and become profitable (firms could then switch to competing banks).

arrangements.

Finally, the model has implications for bank specialization.[41] Bank specialization automatically leads to situations where several competing firms are financed by the same bank. Here we show that there may be important additional benefits for banks to specialize on a certain type of borrowers, over and above informational ones. It will become clear that the model is relevant to a number of other literatures, including those on pyramids and business groups, on Boards of directors, on interlocking directorships and on the role of stakeholders in a market economy.

Other theories have been proposed to rationalize the positive empirical relation between leverage and markups often found in product markets. For example, Jacob Glazer (1994), Dean Showalter (1995), Antoine Faure-Grimaud (2000), and Erlend Nier (1998) obtain anti-competitve effects of debt finance by modifying the assumptions of Brander and Lewis' (1986) model. And Philippe Aghion, Mathias Dewatripont and Patrick Rey (1999b) develop a model where entrepreneurs can commit towards finance providers to increase effort at a cost, and find that an increase in external finance may either increase or decrease competition in oligopolistic product markets, depending on its initial level.

None of these paper deals with the relation between debt finance and firms' ability to sustain tacit collusion in dynamic competition. On this issue, the "state of the art" is the work of Maksimovic (1988, 1995), Stenbaka (1994) and Hege (1998), according to which debt always hinders firms' ability to sustain collusve agreements.

6 Concluding remarks: testable predictions

In this paper we have questioned the established view that debt finance hinders firms' ability to sustain collusive behavior in product markets. We have shown that by controlling borrowers' choice of managers and managerial incentives, a concentrated or collusive banking sector can implement collusion and monopolize otherwise competitive downstream product markets. Even when the banking sector is competitive and firms have multiple lenders, having either common or allied lenders, or even independent lenders with interlocking directors facilitate collusive behavior among oligopolistic firms.

The model generates several testable predictions. It implies, ceteris paribus, that where credit markets are more competitive product markets should also be more competitive and R&D investment should be more intense; that large banks (or coalitions of banks) that specialize with particular industries, especially with concentrated ones, should be relatively more profitable; and conversely that markups should be higher and R&D investment lower in industries where large industry-specialized banks are present. An other implication is that managerial rents and pro-collusive low-powered incentive schemes should be more common where industry leverage is positively related to firms' markups. In cross-country studies, this correlation should be increasing with the concentration in credit markets and the predominance of bank finance. The model also predicts a positive relation between dense networks of (directly and indirectly) interlocked directors and industry markups. Finally, an indirect implication of the model is that the highest quality managers should leave countries with highly concentrated credit markets, since their competitive and innovative skills are less valued in these collusive environments.

[41] Andrew Winton (1999), Heidrun Hoppe and Ulrich Lehman-Grube (2002), and Alex Stomper (2001) showed from different perspectives that banks may have strong informational incentives to specialize, functionally or geographically.

7 Appendix

Proof of Lemma 1. With regard to the stage game, managers' compensation under profit–sharing contracts is a monotone transformation of their firms' profit functions; that is, managers' objective function is a monotone transformation of owners' objective function. The set of Nash equilibria of a game is not affected by monotone transformations of payoff functions because these generate ordinally equivalent games. **Q.E.D.**

Proof of Lemma 2. Statement (*i*) follows from (2) and (3) being equivalent to (1). Statement (*ii*) follows from (3a) being always strictly less stringent than (2). Statement (*iii*) follows from (3b) being less stringent than (2) when

$$r^{**} < r'' \iff \frac{\pi_i^A - b_i}{\widehat{\pi}_i^A - \pi_i^A} < \frac{\pi_i^A - b_i - \pi_i^{NC}}{\widehat{\pi}_i^A - \pi_i^A - \frac{C_i + c_i(b_i - \pi_i^{NC})}{\alpha}},$$

which a few algebraic manipulations simplify to $\mathbf{C}_i < \alpha(\widehat{\pi}_i^A - \pi_i^A)\frac{\pi_i^{NC}}{\pi_i^A - b_i}$. **Q.E.D.**

Proof of Proposition 1. Since for collusion to be sustainable it must be $b_i \leq \pi_i^A$, (1) not being satisfied, or being satisfied as a strict equality, implies that short-run gains from a unilateral deviation are larger than, or equal to, the discounted flow of future coupons, that is

$$\widehat{\pi}_i^A + \frac{\pi_i^{NC}}{r} \geq \pi_i^A + \frac{\pi_i^A}{r} \Rightarrow \widehat{\pi}_i^A + \frac{\pi_i^{NC}}{r} \geq b_i + \frac{b_i}{r}.$$

Then, if managers can retain all profits after a deviation they have sufficient funds to avoid bankruptcy, in which case the relevant condition for collusion being sustainable is (3), which reduces exactly to (1). It follows that when managers under NPS contract can retain all profits, collusion cannot be sustained when (1) is not satisfied, but it can be sustained when (1) holds as equality. Finally, suppose (1) is strictly satisfied. Then, when $b_i = \pi_i^A$ bankruptcy cannot be avoided after a deviation, the condition for a manager under NPS being willing to collude is (3a) if managers are replaced after bankruptcy and (3b) if they are not, these condition are also satisfied as long as, respectively

$$r' = \frac{\pi_i^A - b_i}{\widehat{\pi}_i^A - \pi_i^A - \frac{\mathbf{C}_i}{\alpha}} \geq \frac{\pi_i^A - \pi_i^{NC}}{\widehat{\pi}_i^A - \pi_i^A} = r^* \Leftrightarrow \mathbf{C}_i > \alpha\frac{b_i - \pi_i^{NC}}{r^*},$$

and

$$r'' = \frac{\pi_i^A - \pi_i^{NC} - b_i}{\widehat{\pi}_i^A - \pi_i^A - \frac{\mathbf{C}_i + c_i(b_i - \pi_i^{NC})}{\alpha}} \geq \frac{\pi_i^A - \pi_i^{NC}}{\widehat{\pi}_i^A - \pi_i^A} = r^* \Leftrightarrow \mathbf{C}_i > \alpha\frac{b_i}{r^*},$$

and statement (i) follows. To prove (ii), suppose that managers are committed to pay out as dividends a fraction $0 < \beta < 1$ of net profits, when these are positive. Then, even when (1) is not satisfied, when $b_i = \pi_i^A$ and

$$(1 - \beta)(\widehat{\pi}_i^A - \pi_i^A) < \frac{\pi_i^A - \pi_i^{NC}}{r},$$

a deviating manager will not be able to avoid bankruptcy. In this case, even though (1) is not satisfied, the condition for a manager under NPS being willing to collude is (3a) if managers are

replaced after bankruptcy and (3b) if they are not, and as long as respectively $\mathbf{C}_i > \alpha \frac{b_i - \pi_i^{NC}}{r^*}$ or $\mathbf{C}_i > \alpha \frac{b_i}{r^*}$, collusion can be sustained by leveraged firms but not by unleveraged ones. **Q.E.D.**

Proof of Proposition 2. *Part A.* Suppose the manager is under penalty contracts and unconstrained with regard to dividend policy. Then, when (1) is not satisfied, a deviating manager can avoid bankruptcy by retaining short-run profits from the deviation forever, invest them at the market rate r, and pay the debt's coupons. Given his flat wage, he is indifferent between respecting a collusive agreement and deviating, and therefore chooses to deviate to maximize the firm's profits. On the other hand, when (1) is satisfied, if $b_i > \pi_i^{NC}$ a deviation drives the deviating firm bankrupt in the following period. Then the manager strictly prefers to respect a collusive agreement as long as

$$W + \frac{W}{r} \geq W + \frac{1}{1+r}(W - T)$$

which, because the manager's individual rationality constraint requires $W \geq 0$, is always satisfied. Suppose instead that the manager cannot retain profits forever, that he is constrained to distribute (part or all) net profits to shareholders. Then, even when (1) is not satisfied, if $b_i > \pi_i^{NC}$ the market war that follows a deviation may drive also the deviating firm bankrupt, so that the condition for the manager being willing to support a collusive agreement is the one above, which is always satisfied.

Part B. Suppose all managers are under bonus contracts with $\pi_i^B = \pi_i^A$ and $B_i > 0$. Consider the following strategies for managers: "respect collusive agreement A (leading to per-period profit π_i^A) as long as all other managers do it; if a defection is observed, play the static Nash equilibrium of the oligopoly game forever after." This is a subgame perfect equilibrium of the repeated oligopoly game played by managers because each manager i under bonus contract with $\pi_i^B > 0$ finds it convenient to respect any agreement such that $\pi_i^B \leq \pi_i^A$, whatever the discount rate is. By sticking to the agreement a manager expects total discounted expected payoffs $\frac{W_i + B_i}{1-\delta}$. A unilateral deviation from any such collusive agreement leaves the manager's wage unaffected, allows him to get the bonus in the period of the deviation, but triggers a punishment phase during which profits are zero and the bonus is not paid. Discounted expected payoffs from the unilateral deviation are therefore $B_i + \frac{W_i}{1-\delta}$, with a net loss of $\delta \frac{B_i}{1-\delta}$. **Q.E.D.**

Proof of Lemma 3. After the contract is concluded and debt is issued by both owners, if collusion is sustained each period then owners get $\pi_i^A - b_i - B_i$, managers get B_i, and the lender gets $b_i + b_j$. If instead one owner persuades the manager to deviate, that owner gets $\widehat{\pi}_i^A - b_i - B_i$ immediately and $\pi_i^{NC} - b_i$ afterwards, i.e. net expected gains $\widehat{\pi}_i^A - \pi_i^A - \frac{\pi_i^A - B_i - \pi_i^{NC}}{r} > 0$. If a manager deviates he loses future bonuses $\frac{B_i}{r}$, and must be compensated for such loss in order to be persuaded to deviate. Regarding the lender, we must distinguish two cases. When $b_i \leq \underline{\pi}_i^A$, if a firm deviates the competing firm does not go bankrupt. Then the lender loses and gains nothing from a deviation, since even during the punishment phase owners can repay the debt. It follows that an owner has just to compensate the manager in order to renegotiate the contract, and therefore the contract is renegotiation-proof if

$$\frac{B_i}{r} \geq \widehat{\pi}_i^A - \pi_i^A - \frac{\pi_i^A - B_i - \pi_i^{NC}}{r}, \;\; \Leftrightarrow \;\; 0 \geq \widehat{\pi}_i^A - \pi_i^A - \frac{\pi_i^A - \pi_i^{NC}}{r},$$

which is never satisfied, since the RHS is strictly positive according to our assumption that condition (1) is not satisfied. Statement (i) follows. When $\pi_i^{NC} > b_i > \underline{\pi}_i^A$, if a firm deviates the

other firm goes bankrupt. Then, when a deviation occurs the lender loses immediately $b_i - \underline{\pi}_i^A$ from the non deviating firm who goes bankrupt, but he also obtains the right to its residual profit flow $\frac{\pi_i^{NC}-b_i}{r}$. When $\frac{\pi_i^{NC}-b_i}{r} \geq b_i - \underline{\pi}_i^A$ the lender will also have incentives to induce one manager to deviate, and the managerial contract is renegotiation-proof when

$$7\frac{B_i}{r} \geq \widehat{\pi}_i^A - \pi_i^A + \frac{\pi_i^{NC} - b_i}{r} - (b_i - \underline{\pi}_i^A) - \frac{\pi_i^A - B_i - \pi_i^{NC}}{r},$$

or, equivalently,

$$0 \geq \widehat{\pi}_i^A - \pi_i^A - (b_i - \underline{\pi}_i^A) + \frac{\pi_i^{NC} - b_i}{r} - \frac{\pi_i^A - \pi_i^{NC}}{r},$$

which is always false, since the RHS is strictly positive by the assumption that (1) is not satisfied. When $\frac{\pi_i^{NC}-b_i}{r} < b_i - \underline{\pi}_i^A$ the lender needs to be compensated for the loss $b_i - \underline{\pi}_i^A - \frac{\pi_i^{NC}-b_i}{r}$, and debt makes the managers' contracts renegotiation-proof when

$$\frac{B_i}{r} + b_i - \underline{\pi}_i^A - \frac{\pi_i^{NC} - b_i}{r} \geq \widehat{\pi}_i^A - \pi_i^A - \frac{\pi_i^A - B_i - \pi_i^{NC}}{r},$$

or, equivalently,

$$b_i - \underline{\pi}_i^A - \frac{\pi_i^{NC} - b_i}{r} \geq \widehat{\pi}_i^A - \pi_i^A - \frac{\pi_i^A - \pi_i^{NC}}{r}.$$

Q.E.D.

Proof of Lemma 4. After debt is issued, managers can sustain a collusive agreement delivering per-period profits $\pi_i^A \geq \pi_i^B$, in which case each period owners get $\pi_i^A - b_i - B_i$, managers get B_i, and the lender gets $b_i + b_j$. To have the lender and the manager agree to a contract renegotiation that leads the manager to deviate, the owner must compensate both of them for their expected losses from the deviation. When a manager deviates unilaterally, his owner i gets $\widehat{\pi}_i^A - b_i - B_i$ immediately and zero afterwards, and his net expected gains are $\widehat{\pi}_i^A - \pi_i^A - \frac{\pi_i^A - b_i - B_i}{r}$, strictly positive according to Assumption 2. If the manager distributes gains from deviation as dividends, the lender of the deviating firm i loses $b_j - \underline{\pi}_j^A$ from the non-deviating firm's immediate default on debt-service payments, the discounted expected flow of debt repayments from the bankrupt non-deviating firm minus its residual value $\frac{b_j}{r} - \frac{\pi_j^{NC}}{r}$, and the discounted expected flow of debt repayments from the deviating firm minus its residual value $\frac{b_i}{r} - \frac{\pi_i^{NC}}{r}$, since in the period after the deviation the deviating firm earns only $\pi_i^{NC} < b_i$ and therefore goes also bankrupt. (Alternatively, the manager of the deviating firm may choose to avoid bankruptcy, either by retaining part of the short-run gains from deviations to pay future coupons, or by buying back all debt immediately; in both cases nothing changes, since avoiding bankruptcy implies a payment to the lender of $\frac{b_i}{r} - \frac{\pi_i^{NC}}{r}$, exactly as when bankruptcy occurs.) If a manager deviates unilaterally, he loses the flow of future bonuses $\frac{B_i}{r}$ whether or not his firm goes bankrupt. The managerial contract is renegotiation-proof if an owner's gains from a unilateral deviation in the product market are not sufficient to compensate both the manager and the lender for their losses from the deviation, that is, if

$$\widehat{\pi}_i^A - \pi_i^A - \frac{\pi_i^A - B_i - b_i}{r} < \frac{B_i}{r} + \left[b_j - \underline{\pi}_j^A + \frac{b_j - \pi_j^{NC}}{r} + \frac{b_i - \pi_i^{NC}}{r} \right], \forall i, j$$

or, equivalently, if

$$r\left[\widehat{\pi}_i^A - \pi_i^A - (b_j - \underline{\pi}_j^A)\right] < \pi_i^A - \pi_i^{NC} + (b_j - \pi_j^{NC}),\ \forall i, j.$$

When $\widehat{\pi}_i^A - \pi_i^A - (b_j - \underline{\pi}_j^A) > 0$ we can divide and obtain

$$r < r_i^D = \frac{\pi_i^A - \pi_i^{NC} + (b_j - \pi_j^{NC})}{\widehat{\pi}_i^A - \pi_i^A - (b_j - \underline{\pi}_j^A)} > 0.$$

By inspection r_i^D is increasing in b_j, and by direct comparison with inequality (1) $r_i^D > r_i^*$ for every $b_j > \pi_j^{NC}$. This proves statement (i).

When $\widehat{\pi}_i^A - \pi_i^A - (b_j - \underline{\pi}_j^A) \leq 0$

$$r\left[\widehat{\pi}_i^A - \pi_i^A - (b_j - \underline{\pi}_j^A)\right] < \pi_i^A - \pi_i^{NC} + (b_j - \pi_j^{NC})$$

is always satisfied because its LHS is weakly negative and

$$\pi_i^A - \pi_i^{NC} + (b_j - \pi_j^{NC}) > 0.$$

Statement (ii) follows. **Q.E.D.**

Proof of Proposition 3. The first statement follows straightforwardly from part B of Proposition 2 together with Lemma 4. For the second statement, consider owners' expected payoffs when a debt contract is offered. If both owners accept the deal each of them gets $D_i = \frac{b_i}{r} - g_i$ immediately and expects net profits $\pi_i^M - b_i - B_i$ in each future period, with total expected profits $\frac{\pi_i^M - B_i}{r} - g_i$. If both owners refuse the deal, they remain stuck at the static Cournot-Nash equilibrium for ever. If one owner, say j, accepts but owner i does not, collusion cannot be supported and firms are again stuck at the Cournot-Nash equilibrium. However, while the firm that refuses the deal gets expected profits $\frac{\pi_i^{NC}}{r}$, the firm that accepts it gets $D_j = \frac{b_j}{r} - g_j$ immediately and expects net profits $max\left\{\pi_j^{NC} - b_j, 0\right\}$ in each future period. When $b_i = \pi_i^B = \pi_i^M - B_i$ owners' expected payoffs matrix in the "capital structure game" is

	Owner j accepts	Owner j rejects
Owner i accepts	$\frac{\pi_i^M - B_i}{r} - g_i, \frac{\pi_j^M - B_j}{r} - g_j$;	$\frac{\pi_i^M - B_i}{r} - g_i, \frac{\pi_j^{NC}}{r}$
Owner i rejects	$\frac{\pi_i^{NC}}{r}, \frac{\pi_j^M - B_j}{r} - g_j$;	$\frac{\pi_i^{NC}}{r}, \frac{\pi_j^{NC}}{r}$

By inspection, as long as the lender limits rent extraction by choosing $g_i < \frac{\pi_i^M - B_i}{r} - \frac{\pi_i^{NC}}{r}$, accepting the debt contract is owners' strictly dominant strategy. **Q.E.D.**

Proof of Proposition 4. If one firm renegotiates its manager's contract to induce him to deviate, the lender observes it through his man on the board. To block renegotiation, the lender can threaten to reveal that renegotiation is occurring to the other firm, which would react and nullify the renegotiating firm's gains from deviation in the product market. If it does so, the Cournot-Nash outcome occurs, both firms go bankrupt, and the lender receives $\pi_i^{NC} + \pi_j^{NC}$

immediately and then the residual value of the two firms $\frac{\pi_i^{NC}+\pi_j^{NC}}{r}$. If it does not, the lender gets immediately $\underline{\pi}_j^M$ from the side of the non-deviating firm, some compensation P for its silence from the deviating firm, where $P \leq \widehat{\pi}_i^M - B_i - \frac{B_i}{r}$ (B_i is the deviating manager's bonus, and $\frac{B_i}{r}$ is the amount that must be paid to the same manager to induce him to deviate), plus both firms' residual value $\frac{\pi_i^{NC}+\pi_j^{NC}}{r}$. Therefore, the lender's threat of revealing renegotiation to the competing firm is credible as long as

$$\pi_i^{NC} + \pi_j^{NC} \geq \underline{\pi}_j^M + \widehat{\pi}_i^M - B_i - \frac{B_i}{r} \Leftrightarrow B_i \geq \frac{r}{1+r}\left(\widehat{\pi}_i^M + \underline{\pi}_j^M - \pi_j^{NC} - \pi_i^{NC}\right).$$

From the proof of Lemma 4 we know that gains from deviation are not sufficient to compensate all parties for the losses caused by renegotiation and the following deviation if

$$\widehat{\pi}_i^M - \pi_i^M - \frac{\pi_i^M - B - b_i}{r} < \frac{B}{r} + \left[b_j - \underline{\pi}_j^M + \frac{b_j - \pi_j^{NC}}{r} + \frac{b_i - \pi_i^{NC}}{r}\right],$$

which, when $b_i = \pi_i^M - B$, becomes

$$\widehat{\pi}_i^M - \pi_i^M < \frac{B}{r} + \left[\pi_i^M - B - \underline{\pi}_j^M + \frac{\pi_i^M - B - \pi_i^{NC}}{r} + \frac{\pi_j^M - B - \pi_j^{NC}}{r}\right],$$

which a few algebraic steps reduce to

$$B < \frac{r}{1+r}(\pi_i^M + \pi_j^M - \widehat{\pi}_i^M - \underline{\pi}_j^M) + \frac{\pi_i^M - \pi_i^{NC}}{1+r} + \frac{\pi_j^M - \pi_j^{NC}}{1+r}.$$

It follows that as long as

$$\frac{r}{1+r}(\widehat{\pi}_i^M + \underline{\pi}_j^M - \pi_i^{NC} - \pi_j^{NC}) \leq B_i < \frac{\pi_i^M - \pi_i^{NC}}{1+r} + \frac{\pi_j^M - \pi_j^{NC}}{1+r} + \frac{r}{1+r}(\pi_i^M + \pi_j^M - \widehat{\pi}_i^M - \underline{\pi}_j^M),$$

or, equivalently,

$$\widehat{\pi}_i^M + \underline{\pi}_j^M - \pi_i^{NC} - \pi_j^{NC} \leq B_i < \frac{\pi_i^M + \pi_j^M - \pi_j^{NC} - \pi_i^{NC}}{r} + \pi_i^M + \pi_j^M - \widehat{\pi}_i^M - \underline{\pi}_j^M, \ \forall i,$$

the lender will oppose any secret renegotiation leading to a breach of the collusive agreement, and can prevent it by the credible threat of revealing the renegotiation to the competing firm. The last condition can be satisfied when

$$r < \frac{\pi_i^M + \pi_j^M - \pi_j^{NC} - \pi_i^{NC}}{2(\widehat{\pi}_i^M + \underline{\pi}_j^M) - \pi_i^{NC} - \pi_j^{NC} - \pi_i^M - \pi_j^M},$$

therefore, given (1), debt facilitates collusion as long as

$$\frac{\pi_i^M + \pi_j^M - \pi_j^{NC} - \pi_i^{NC}}{2(\widehat{\pi}_i^M + \underline{\pi}_j^M) - \pi_i^{NC} - \pi_j^{NC} - \pi_i^M - \pi_j^M} > + \frac{\pi_i^M - \pi_i^{NC}}{\widehat{\pi}_i^M - \pi_i^M},$$

or, equivalently,

$$(\pi_j^M - \pi_j^{NC})(\widehat{\pi}_i^M - \pi_i^M) > \left[\widehat{\pi}_i^M + 2\underline{\pi}_j^M - \pi_i^{NC} - \pi_j^{NC} - \pi_j^M\right](\pi_i^M - \pi_i^{NC}),$$

which, in our symmetric case reduces to $\pi_i^{NC} > \underline{\pi}_j^M$, which is satisfied for most specifications of the Cournot model. Finally, the last statement follows from the same argument made in the proof of Proposition 3. **Q.E.D.**

Proof of Proposition 5. As long as $g_i + g_j > 0$ there will be competition among lenders for this rent, and owners may use such competition to reduce the lender's stake indefinitely. Once $g_i + g_j = 0$ the lenders break even, and we can assume that firms will find at least one lender (or one couple of allied lenders) willing to offer and sign the debt contracts. The payoff matrix and the extensive form of the "capital structure game" will be as in the previous proof and, by inspection, because $g_i < \frac{\pi_i^M - B_i}{r}$ it is a strictly dominant strategy for both owners to sign the debt contract. **Q.E.D.**

Proof of Proposition 6. To induce a deviation through renegotiation, owners must compensate the manager for the expected loss of bonuses after the deviation, pay debtholders future coupons, and also compensate the common lender for the extra losses due to the non-deviating firm's financial distress. With $b_i = \pi_i^B = \pi_i^M - B_i$ and without deviations, non-common lenders together expect the full repayment streams with discounted value $(1-\gamma)\left(\pi_i^M - B_i + \frac{\pi_i^M - B_i}{r}\right)$, and the common lender expects the full repayment streams $\gamma\left(\pi_i^M - B_i + \frac{\pi_i^M - B_i}{r}\right) + \gamma\left(\pi_j^M - B_j + \frac{\pi_j^M - B_j}{r}\right)$. After a deviation each firm expects a flow of future profits $\frac{\pi_i^{NC}}{r}$. Therefore, to obtain renegotiation the owner of firm i the owner that firm must pay $\frac{B_i}{r}$ to the manager, $\frac{\pi_i^M - B_i - \pi_i^{NC}}{r}$ to debtholders, plus the common lender's losses from the non-deviating firm's financial distress $\gamma\left(\pi_j^M - B_j + \frac{\pi_j^M - B_j}{r}\right) - \gamma\left(\underline{\pi}_j^M + \frac{\pi_j^{NC}}{r}\right)$. Then managerial contracts are renegotiation-proof and the joint monopoly collusive agreement is supportable when

$$\widehat{\pi}_i^M - \pi_i^M < \frac{B_i}{r} + \left[\frac{\pi_i^M - B_i - \pi_i^{NC}}{r}\right] + \gamma\left[\pi_j^M - B_j - \underline{\pi}_j^M + \frac{\pi_j^M - B_j - \pi_j^{NC}}{r}\right],$$

or, equivalently,

$$r\left[\widehat{\pi}_i^M - \pi_i^M - \gamma(\pi_j^M - \underline{\pi}_j^M - B_j)\right] < \pi_i^M - \pi_i^{NC} + \gamma(\pi_j^M - B_j - \pi_j^{NC}).$$

As long as $B_j \leq \pi_j^M - \pi_j^{NC}$, which is always satisfied since no debt contract is feasible if more than total gains from collusion must be paid to the manager, the RHS is strictly positive. It follows that when

$$\widehat{\pi}_i^M - \pi_i^M - \gamma(\pi_j^M - \underline{\pi}_j^M - B_j) \leq 0,$$

or, equivalently,

$$\gamma \geq \frac{\widehat{\pi}_i^M - \pi_i^M}{\pi_j^M - \underline{\pi}_j^M - B_j},$$

the condition is satisfied for any r. This proves claim (i).

When $\gamma < \frac{\widehat{\pi}_i^M - \pi_i^M}{\pi_j^M - \underline{\pi}_j^M - B_j}$, the contract is renegotiation-proof as long as

$$r < r^\gamma = \frac{\pi_i^M - \pi_i^{NC} + \gamma(\pi_j^M - \pi_j^{NC} - B_j)}{\widehat{\pi}_i^M - \pi_i^M - \gamma(\pi_j^M - \underline{\pi}_j^M - B_j)},$$

and comparing it with (1) evaluated at $\pi_i^A = \pi_i^M$, $r^\gamma > r^*$ when

$$\frac{\pi_i^M - \pi_i^{NC} + \gamma(\pi_j^M - \pi_j^{NC} - B_j)}{\widehat{\pi}_i^M - \pi_i^M - \gamma(\pi_j^M - \underline{\pi}_j^M - B_j)} > \frac{\pi_i^M - \pi_i^{NC}}{\widehat{\pi}_i^M - \pi_i^M},$$

which, because $B_j < \pi_j^M - \pi_j^{NC}$ (if managers capture all gains from collusion owners are not interested in issuing debt in the first place) implies $\gamma(\pi_j^M - \pi_j^{NC} - B_j) > 0$ and $-\gamma(\pi_j^M - \underline{\pi}_j^M - B_j) < 0$, is always satisfied. This proves claim (ii).

Finally, the payoff matrix of the "capital structure game" is as in the proof of Proposition 3 with $g_i < \frac{\pi_i^M - B_i - \pi_i^{NC}}{r}$, and the last statement follows. **Q.E.D.**

Proof of Proposition 7. With $b_i = \pi_i^B = \pi_i^M - B_i \ \forall i$, and without deviations, the non-common lenders of each firm i expect the repayment streams with discounted value $(1 - \gamma_i^1 - \gamma_i^2)\left(\pi_i^M - B_i + \frac{\pi_i^M - B_i}{r}\right)$, while the common lenders expect repayment streams with discounted value $(\gamma_i^1 + \gamma_i^2)\left(\pi_i^M - B_i + \frac{\pi_i^M - B_i}{r}\right)$ from both firms. After a deviation the remaining value of each firm is $\frac{\pi_i^{NC}}{r}$. As before, to have debtholders and manager agree on renegotiation the owner must pay the amount $\frac{B_i}{r} + \frac{\pi_i^M - B_i - \pi_i^{NC}}{r}$, plus common lenders' compensation for their losses from the financial distress of the non-deviating firm $(\gamma_j^1 + \gamma_j^2)\left(\pi_j^M - B_j + \frac{\pi_j^M - B_j}{r}\right) - (\gamma_j^1 + \gamma_j^2)\left(\underline{\pi}_j^M + \frac{\pi_j^{NC}}{r}\right)$. Therefore, managerial contracts are renegotiation-proof and the joint monopoly collusive agreement supportable when the following no-renegotiation conditions for the two firms are simultaneously satisfied:

$$\widehat{\pi}_i^M - \pi_i^M < \frac{B_i}{r} + \left[\frac{\pi_i^M - B_i - \pi_i^{NC}}{r}\right] + (\gamma_j^1 + \gamma_j^2)\left[\pi_j^M - B_j - \underline{\pi}_j^M + \frac{\pi_j^M - B_j - \pi_j^{NC}}{r}\right],$$

$$\widehat{\pi}_j^M - \pi_j^M < \frac{B_j}{r} + \left[\frac{\pi_j^M - B_j - \pi_j^{NC}}{r}\right] + (\gamma_i^1 + \gamma_i^2)\left[\pi_i^M - B_i - \underline{\pi}_i^M + \frac{\pi_i^M - B_i - \pi_i^{NC}}{r}\right].$$

Firms' and agreement's symmetry and the common managerial labor market imply that these conditions are identical in all but the factors $(\gamma_j^1 + \gamma_j^2)$ and $(\gamma_i^1 + \gamma_i^2)$. Because the conditions must both be satisfied for collusion to be supported, firms' ability to collude is constrained by the more stringent of the conditions only. By inspection, the conditions are more stringent as the factors $(\gamma_j^1 + \gamma_j^2)$ and $(\gamma_i^1 + \gamma_i^2)$ become smaller. It follows that firms' ability to collude (the maximum discount rate at which collusion is supportable) is increasing in $\min\left\{\gamma_j^1 + \gamma_j^2;\ \gamma_i^1 + \gamma_i^2\right\}$. **Q.E.D.**

Proof of Proposition 10. Again, with $b_i = \pi_i^B = \pi_i^M - B_i \ \forall i$, and without deviations, managers expect their flow of bonuses, the non-common lenders expect the full repayment streams

with expected value $(1-\gamma)\left(\pi_i^M - B_i + \frac{\pi_i^M - B_i}{r}\right)$, and the common lender expects full repayment streams with expected value $\gamma\left(\pi_i^M - B_i + \frac{\pi_i^M - B_i}{r}\right)$ from both firms. To accept a renegotiation leading to a deviation, all these parties need to be compensated for any losses from the deviation induced by renegotiation. After the deviation the manager of deviating firm i expects no bonuses in the future, while the remaining value of the firm after the deviation is $\frac{\pi_i^{NC}}{r}$. Therefore, to obtain renegotiation the owner must pay the amount $\frac{B_i}{r} + \frac{\pi_i^M - B_i - \pi_i^{NC}}{r}$ to compensate firm i's manager and creditors, plus he must compensate the common lender for the extra losses due to the other firm's financial distress. After a firm i deviation, the common lender receives from the non-deviating firm in financial distress the amount

$$\min\left\{\gamma\left(\pi_j^M - B_j + \frac{\pi_j^M - B_j}{r}\right); \left[\underline{\pi}_j^M + \frac{\pi_j^{NC}}{r} - \eta(1-\gamma)\frac{\pi_j^M - B_j}{r}\right]\right\},$$

so that his extra loss from the side of the non-deviating firm only, denoted by $\Gamma(\eta)$, is

$$\begin{aligned}\Gamma(\eta) &= \gamma\left(\pi_j^M - B_j + \frac{\pi_j^M - B_j}{r}\right) \\ &\quad - \min\left\{\gamma\left(\pi_j^M - B_j + \frac{\pi_j^M - B_j}{r}\right); \left[\underline{\pi}_j^M + \frac{\pi_j^{NC}}{r} - \eta(1-\gamma)\frac{\pi_j^M - B_j}{r}\right]\right\}.\end{aligned}$$

By inspection, $\Gamma(\eta)$ is increasing in η. Renegotiation is impossible and collusion is credibly implemented as long as the following condition is satisfied

$$\widehat{\pi}^M - \pi^M < \frac{B}{r} + \frac{\pi^M - B - \pi^{NC}}{r} + \Gamma(\eta),$$

and since $\Gamma(\eta)$ is increasing in η, the larger the value of η, the easier it is to satisfy the inequality and implement collusion. **Q.E.D.**

References

[1] **Abreu, Dilip,** 1988, "On the Theory of Infinitely Repeated Games with Discounting", *Econometrica* 56, 383-396.

[2] **Acemoglu, Daron,** 1998, "Credit Market Imperfection and the Separation of Ownership and Control," *Journal of Economic Theory* 78, 355-81.

[3] **Aghion, Philippe, and Peter Howitt,** 1992, "A Model of Growth through Creative Destruction", *Econometrica*, 60, 323-357.

[4] **Aghion, Philippe, Dewatripont, Mathias and Rey, Patrick,** 1999a, Competition, Financial Discipline and Growth," *Review of Economic Studies*, 66, 825-852.

[5] **Aghion, Philippe, Mathias Dewatripont, andPatrick Rey,** 1999b, "Agency Costs, Firm Behaviour and the Nature of Competition," CEPR Discussion Paper 2130.

[6] **Aghion, Philippe; Bloom, Nicholas; Blundell, Richard; Griffith, Rachel; and Peter Howitt**, 2002, "Competition and Innovation: An Inverted-U Relationship", IFS Working Paper 0204.

[7] **Arping, Stefan,** 2002, "Banking, Commerce, and Antitrust," manuscript, University of Amsterdam.

[8] **Atsushi, Maki,** 1998, "How High Consumer Prices are in Japan!" *Japan and the World Economy* 10(2), 173-186.

[9] **Baily, Martin, and Gersbach, Hans,** 1995, "Efficiency in Manufacturing and the Need for Global Competition", *Brookings Papers on Economic Activity - Microeconomics,* No. 1, 307-347.

[10] **Battachayra, Sudipto, and Chiesa, Gabriella,** 1995, "Proprietary Information, Financial Intermediation, and Research Incentives," *Journal of Financial Intermediation* 4, 328-357.

[11] **Baumol, William,** 1958, "On the Theory of Oligopoly," *Economica* 25, 187-198.

[12] **Beck, Thorsten, Asli Demirgüç-Kunt, and Vojislav Maksimovic,** 2003, "Bank Competition and Access to Finance," manuscript (presented at the Federal Reserve Bank of Cleveland.and *Journal of Money, Credit, and Banking*, Annual Conference on Banking Consolidation and Competition).

[13] **Benoit, Jean-Pierre,** 1984, "Financially Constrained Entry in a Game with Incomplete Information," *RAND Journal of Economics* 15, 490-499.

[14] **Besanko, David, and Kanatas, George,** 1993, "Credit Market Equilibrium with Bank Monitoring and Moral Hazard", *Review of Financial Studies* 6, 213-232.

[15] **Bernheim, Douglas, and Whinston, Michael,** 1985, "Common Marketing Agency as a Device for Facilitating Collusion," *RAND Journal of Economics* 16(2), 269-281.

[16] **Blundell, Richard, Griffits, R. and Van Reenen, J.**, 1995, "Dynamic Count Data Model of Technological Innovations", *Economic Journal*, 105, 333-344.

[17] **Bolton, Patrick, and Sharfstein, David,** 1990, "A Theory of Predation Based on Agency Problems in Financial Contracting," *American Economic Review* 80, 93-106.

[18] **Bolton, Patrick, and Sharfstein, David,** 1996, "Optimal Debt Structure and the Number of Creditors," *Journal of Political Economy* 104, 1-25.

[19] **Brander, James, and Lewis, Tracy,** 1986, "Oligopoly and Financial Structure: The Limited Liability Effect," *American Economic Review* 76(5), 956-70.

[20] **Brander, James, and Poitevin, Michel,** 1992, "Managerial Compensation and the Agency Costs of Debt Finance," *Managerial and Decision Economics* 13, 55-64.

[21] **Broecker, Thorsten,** 1990, "Credit-Worthiness Tests and Interbank Competition," *Econometrica* 58, 429-252.

[22] **Carlin, Wendy and Mayer, Colin**, 2003, "Finance, Investment and Growth," *Journal of Financial Economics* 69(1), 191-226 .

[23] **Caillaud, Bernard; Jullien, Bruno and Picard, Pierre,** "Competing Vertical Structures: Precommitment and Renegotiation," *Econometrica,* 63(3), 621-46.

[24] **Cantillo Simon, Miguel,** 1998, "The Rise and Fall of Bank Control in the United States: 1890-1939," *American Economic Review* 88(5), 1077-93.

[25] **Cestone, Giacinta, and White, Lucy,** "Anti-Competitive Financial Contracting: The Design of Financial Claims," *Journal of Finance.*58(5), 2109-2141.

[26] **Cetorelli, Nicola,** 2001, "Does Bank Concentration Lead to Concentration in Industrial Sectors?" Federal Reserve Bank of Chicago Working Paper 2001-01.

[27] **Cetorelli, Nicola,** 2003, "Real Effects of Bank Concentration and Competition in Europe"„ manuscript, Federal Reserve Bank of Chicago.

[28] **Cetorelli, Nicola, and Strahan, Philip,** 2004, "Finance as a Barrier to Entry: Bank Competition and Industry Structure in Local U.S. Markets", Federal Reserve Bank of Chicago Working Paper 2004-04.

[29] **Chevalier, Judith**, 1995, "Capital Structure and Product Market Competition: Empirical Evidence from the Supermarket Industry," *American Economic Review* 85(3), 415-35.

[30] **De Long, Bradford,** 1991, "Did J. P. Morgan's Men Add Value?: An Economist's Perspective on Financial Capitalism," in Peter Temin, ed., *Inside the Business Enterprise: Historical Perspectives on the Use of Information* (Chicago, IL: University of Chicago Press for NBER), 205-36.

[31] **Deamon, Dick,** 1997, "Debt as a Collusive Device in an Oligopoly Supergame," *Journal of Economics* 66(3), 249-269.

[32] **Dermine, Jean,** 2000, "Bank Mergers in Europe, the Public Policy Issues", *Journal of Common Market Studies*, 38(3), 409-425.

[33] **Dewatripont, Mathias**, 1988, "Commitment Through Renegotiation-Proof Contracts with Third Parties," *Review of Economic Studies* 55, 377-90.

[34] **Faure-Grimaud, Antoine,** 2000, "Product Market Competition and Optimal Debt Contracts: The Limited Liability Effect Revisited," *European Economic Review* 44(10).

[35] **Fershtman, Chaim, and Judd, Kenneth,** 1987, "Equilibrium Incentives in Oligopoly," *American Economic Review* 77(5), 927-940.

[36] **Friedman, James,** 1971, "A Non-Cooperative Equilibrium for Supergames," *Review of Economic Studies* 28, 1-12.

[37] **Fudenberg, Drew, and Tirole, Jean**, 1986, "A 'Signal-Jamming' Theory of Predation," *RAND Journal of Economics* 17, 366-376.

[38] **Fulghieri, Paolo and S Nagarajan**, "Financial Contracts as Lasting Commitments: The Case of a Leveraged Oligopoly" *Journal of Financial Intermediation* 2(1), 2-32.

[39] **Gerschenkron, Alexander,** 1962, *Economic Backwardness in Historical Perspective,* Cambridge, M.A.: Harvard University Press.

[40] **Gilson, Stuart,** 1989, "Managerial Turnover and Financial Distress," *Journal of Financial Economics* 25(2), 241-262.

[41] **Gilson, Stuart, and Vetsuypens, Michael,** 1993, "CEO Compensation in Financially Distressed Firms: and Empirical Analysis," *Journal of Finance* 48(2), 425-458.

[42] **Glazer, Jacob,** 1994, "The Strategic Effects of Long-Term Debt in Imperfect Competition," *Journal of Economic Theory* 62, 428-443.

[43] **Greenwald, Bruce, and Stiglitz, Joseph,** 1990: "Asymmetric Information and the New Theory of the Firm: Financial Constraints and Risk Behavior," *American Economic Review* 80(2), 160-165.

[44] **Greenwald, Bruce, and Stiglitz, Joseph,** 1993: "Financial Market Imperfections and Business Cycles," *Quarterly Journal of Economics* 108(1), 77-114.

[45] **Hall, Brian, and Liebman, Jeffrey**, 1998, "Are CEOs Really Paid Like Bureaucrats?" *Quarterly Journal of Economics* 113(2), 653-691.

[46] **Hallock, Kevin**, 1997, "Reciprocally interlocking boards of directors and executive compensation," *Journal of Financial and Quantitative Analysis* 32(3), 331-344.

[47] **Harris, Milton, and Raviv, Arthur**, 1991, "The Theory of Capital Structure," *Journal of Finance* 46, 297-355.

[48] **Hege, Ulrich,** 1998, "Bank Debt and Publicly Traded Debt in Repeated Oligopolies," *CentER Working Paper* No. 9871, Tilburg University.

[49] **Hellmann, Thomas, and Marco DaRin**, 2002, "Banks as Catalists for Industrialization", *Journal of Financial Intermediation* 11, 366-397.

[50] **Hellmann, Thomas; Murdock, Kevin and Joseph Stiglitz**, 2000, "Liberalization, Moral Hazard in Banking and Prudential Regulation: Are Capital Requirements Enough?", *American Economic Review*, 90(1), 147-165

[51] **Hoppe, Heidrun, and Ulrich Lehman-Grube,** 2002, "Specialization in Credit Markets," manuscript, University of Bonn.

[52] **Hellwig, Martin,** 1991,"Banking, Financial Intermediation and Corporate Finance," in Alberto Giovannini and Colin Mayer eds., *European Financial Integration*, Cambridge: C.U.P.

[53] **Hirshleifer, David, and Thakor, Anjan,** 1992, "Managerial Conservatism, Project Choice, and Debt," *Review of Financial Studies* 5, 437-470.

[54] **Holmström, Bengt and Tirole, Jean,** 1997, "Financial Intermediation, Loanable Funds, and the Real Sector", *Quarterly Journal of Economics,* Vol.52, S.663-692.

[55] **James, Christopher,** 1987, "Some Evidence on the Uniqueness of Bank Loans," *Journal of Financial Economics* 19(2), 217-235.

[56] **Jensen, Michael, and Meckling**, **William,** 1976, "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure," *Journal of Financial Economics* 3, 305-360.

[57] **Jensen, Michael, and Murphy**, **Kevin,** 1990, "Performance Pay and Top-Management Incentives," *Journal of Political Economy* 98, 225-64.

[58] **Kaplan, Steven,** 1994a, "Top Executive Rewards and Firm Performance: a Comparison of Japan and United States," *Journal of Political Economy* 102, 510-546.

[59] **Kaplan, Steven,** 1994b, "Top Executives, Turnover, and Firm Performance in Germany," *Journal of Law and Economics* 10(1), 142-159.

[60] **Katz, Michael,** 1991, "Game-Playing Agents: Unobservable Contracts as Precommitments," *RAND Journal of Economics* 22(3), 307-28.

[61] **Keeley**, **Michael,** 1990, "Deposit Insurance, Risk and Market Power in Banking", *American Economic Review*, 80, 1183-1200

[62] **Kovenock, Dan, and Phillips, Gordon,** 1995, "Capital Structure and Product Market Rivalry: How do we Reconcile Theory and Evidence," *American Economic Review* 85(2), 403-408.

[63] **Kovenock, Dan, and Phillips, Gordon,** 1997, "Capital Structure and Product Market Behavior: An Examination of Plant Exit and Investment Decisions," *Review of Financial Studies* 10(3), 767-803.

[64] **Kroszner, Randall, and Strahan, Philip,** 1998, "Bankers on Boards: Monitoring, Financing, and Lender Liability," manuscript, University of Chicago.

[65] **Maksimovic, Vojislav,** 1986, "Optimal Capital Structure in Oligopolies," Ph.D. Dissertation, Harvard University.

[66] **Maksimovic, Vojislav,** 1988, "Capital Structure in Repeated Oligopolies," *RAND Journal of Economics* 19, 389-407.

[67] **Maksimovic, Vojislav,** 1995, "Financial Structure and Product Market Competition," in **Jarrow, Robert; Maksimovic, Vojislav and William Ziemba** (eds.) *Finance*, Handbooks in Operations Research and Management Science, Vol. 9, North-Holland, Amsterdam, 887-920.

[68] **Marsh, Paul**, 1982, "The Choice Between Equity and Debt: an Empirical Study," *Journal of Finance* 37, 121-144.

[69] **Matutes, Carmen, and Vives, Xavier,** 1996, "Competition for Deposit, Fragility, and Insurance," *Journal of Financial Intermediation* 5, 184-216.

[70] **McGee, John,** 1958, "Predatory Price Cutting: The Standard Oil (N.J.) Case," *Journal of Law and Economics* 1, 137-169.

[71] **Miwa, Yoshiro,** 1996, *Firms and Industrial Organization in Japan,* New York: N.Y.U. Press.

[72] **Murphy, Kevin**, 1999, "Executive Compensation," in **Orley Ashenfelter and David Card** (eds.), Handbook of Labor Economics, Vol. 3, North Holland.

[73] **Nier, Erland,** 1998, "Managers, Debt and Industry Equilibrium," *F.M.G. Discussion Paper* No. 289, London School of Economics.

[74] **Nickell, Stephen J.**, 1996, "Competition and Corporate Performance", *Journal of Political Economy,* 104, 724-766.

[75] **Noland, Marcus**, 1995, "Why Are Prices in Japan So High?" *Japan and the World Economy* 7(3), 255-261.

[76] **Nocke, Volker,** 2000, "Underinvestment and Market Structure," mimeo, University of Pennsilvanya.

[77] **Petersen, Mitchell, and Rajan, Raghuram,** 1995, "The Effect of Credit Market Competition on Lending Relationships," *Quarterly Journal of Economics* 110, 406-443.

[78] **Phillips, Gordon,** 1995, "Increased Debt and Industry Product Markets: and Empirical Analysis," *Journal of Financial Economics* 37, 189-238.

[79] **Poitevin, Michel,** 1989, "Collusion and the Banking Structure of a Duopoly," *Canadian Journal of Economics* 22(2), 263-277.

[80] **Riordan, Michael,** 1993, "Competition and Bank Performance: a Theoretical Perspective," in Colin Mayer and Xavier Vives eds., *Capital Markets and Financial Integration*, Cambridge: CUP.

[81] **Ross, Stephen,** 1977, "The Determination of Financial Structure: the Incentive-Signalling Approach," *Bell Journal of Economics* 8(1), 23-40.

[82] **Saunders, Anthony**, 1994, "Banking and Commerce: an Overview of the Public Policy Issues," *Journal of Banking and Finance* 18, 231-254.

[83] **Schelling, Thomas**, 1960, *The Strategy of Conflict*, Oxford: Oxford University Press.

[84] **Showalter, Dean,** 1995, "Oligopoly and Financial Structure, Comment," *American Economic Review* 85(3), 647-653.

[85] **Simon, Herbert,** 1957, *Administrative Behavior,* (2nd ed.), New York: Macmillan.

[86] **Sklivas, Steven**, 1987, "The Strategic Choice of Managerial Incentives," *RAND Journal of Economics* 18(3), 452-58.

[87] **Spagnolo, Giancarlo**, 2000, "Stock-Related Compensation and Product-Market Competition," *RAND Journal of Economics* 31(1), 22-44.

[88] **Stenbaka Rune**, 1994, "Financial Structure and Tacit Collusion with Repeated Oligopoly Competition," *Journal of Economic Behavior and Organization* 25, 281-292.

[89] **Stomper, Alex,** 2001, "A Theory of Banks' Industry Expertise, Market Power, and Credit Risk," manuscript, University of Vienna.

[90] **Telser, Lester,** 1966, "Cutthroat Competition and the Long Purse," *Journal of Law and Economics* 9, 259-277.

[91] **Tirole, Jean,** 1992, "Collusion and the Theory of Organizations" in **Jean-Jacques Laffont** (ed.), *Advances in Economic Theory: Proceedings of the Sixth World Congress of the Econometric Society*, Cambridge: Cambridge University Press, vol.2: 151-206.

[92] **Tirole, Jean,** 2001, "Corporate Governance", *Econometrica*, 69 (1), 1-35.

[93] **Vickers, John**, 1985, "Delegation and the Theory of the Firm," *Economic Journal* 95 (Supplement), 138-147.

[94] **Vives, Xavier**, 2003, "Competitive Pressure and Innovation," manuscript, INSEAD.

[95] **Winton, Andrew,** 1999, "Don't Put All your Eggs in One Basket? Diversification and Specialization in Lending," Center for Financial Institutions Working Paper No. 00-16, University of Pennsylvania.

[96] **Wegenroth, Ulrich,** 1997, "Germany: Competition Abroad, Cooperation at Home 1870-1990," in *Big Business and the Wealth of Nations*, Alfred D. Chandler Jr, Franco Amatori, and Takashi Hikino Eds., Cambridge University Press.

[97] **Williamson, Oliver,** 1964, *Managerial Discretion and Business Behavior,* Engelwood Cliffs, N.J.: Prentice-Hall.

[98] **Zwiebel, Jeffrey**, 1996, "Dynamic Capital Structure under Managerial Entrenchment," *American Economic Review* 86(5), 1197-1215.