Capital Structure and Product Market Strategy

Chong-en Bai and Shan Li [*]

School of Economics and Finance,
University of Hong Kong,
Pokfulam Road, Hong Kong.
E-mail: baic@hku.hk.

This paper develops a general framework to analyze the relationship between a firm's capital structure and its product market strategy and presents a taxonomy of whether debt makes a firm *tough* or *soft* in product market competition and how strategic considerations affect the leverage of a firm based on the nature of the firm's agency problem and the characteristics of the product market. We then offer a unified picture of the related literature and point out some unexplored linkages between capital structure and product market strategies. Finally, we discuss the empirical implications of our theoretical results. © 2000 Peking University Press

Key Words: Capital structure; Agency; Oligopoly; Competition.
JEL Classification Numbers: L13, G32.

1. INTRODUCTION

There is a large literature on the relationship between a firm's capital structure and its strategy when competing in the product market. Some of the pioneering theoretical works are Brander and Lewis (1986), Maksimovic (1988) and Bolton and Scharfstein (1990). These papers arrive at different conclusions as a result of different assumptions. In particular, Brander and Lewis (1986) and Maksimovic (1988) conclude that a high debt level makes a firm *tough* in product market competition,[1] while Bolton and Scharfstein (1990) conclude that a high debt level makes a firm *soft*. The papers also have different implications for the leverage of a firm. *Ceteris*

---

[1] Following Fudenberg and Tirole (1984), we say that debt makes the firm *tough* (*soft*) in product market competition if it makes the firm more (less) aggressive.

paribus,[2] oligopolists tend to have more debt than monopolists or firms in competitive industries[3] according to Brander and Lewis, but they tend to have less debt according to Maksimovic and Bolton and Scharfstein. The results from empirical research are also ambiguous. For example, Chevalier (1995) finds support for the view of Bolton and Scharfstein (1990); Phillips (1994) finds mixed results.

In this paper, we develop a general framework that offers a unified picture of the existing theoretical work and that can reconcile the differences in the existing empirical work. We wish to point out here that we do not attempt to review all papers in this literature; we only choose some leading pioneering works. The framework also leads us to some unexplored linkages between capital structure and product market strategies. As a result, we have a taxonomy of whether debt makes a firm *tough* or *soft* in product market competition and how strategic considerations affect the leverage of a firm based on the nature of the firm's agency problem and the characteristics of the product market.

The core idea of this paper can be stated simply. Managers are imperfect agents of investors and agency costs arise due to conflict of interests between them. A firm's capital structure has important effects on these agency costs, as is demonstrated by a large literature on capital structure based on agency costs initiated by Jensen and Meckling (1976). It is also well known that capital structure affects the firm's strategic position in product market competition. An optimal capital structure should balance its agency effects and strategic effects. The relationship between capital structure and product market strategy depends on the nature of agency problems and the characteristics of the product market. Therefore the optimal capital structure changes with these factors.

An example of agency costs is the asset substitution effect of debt advanced by Jensen and Meckling (1976). They assume that the manager is a perfect agent of shareholders but an imperfect agent of creditors and argue that the manager has incentives to substitute risky activities for safe ones because the shareholders (in contrast to creditors) can enjoy the benefit of the upside of the added risk without bearing the cost of the downside. Such risky activities could be unprofitable, and thus asset substitution could be costly to all investors, both creditors and shareholders, on the whole. Other examples of agency costs are too much investment by managers led by their empire-building motives (Jensen (1986) and Hart and Moore (1990)) or too little productive investment by managers because they want to reserve funds for enhancing their private benefit through other

---

[2] The precise meaning of "*ceteris paribus*" here is made clear in Section 3.

[3] In this paper, we concentrate on the comparison of leverage between oligopolists and monopolists but ignore such a comparison between oligopolists and firms in competitive industries.

uses (Grossman and Hart (1982)). These agency costs are all affected by the capital structure of the firm.

An example of the strategic effects of capital is the idea advanced by Brander and Lewis (1986) that debt enables a firm to commit to a high production quantity and thus receive high profits if the manager of the firm only represents the interests of its shareholders and all firms in the product market are competing in quantities. The reason is that, due to the asset substitution effect of debt mentioned above, the manager has an incentive to produce more than the profit maximization quantity because higher quantity makes the firm's return riskier and increases the payoff to the shareholders. Other strategic effects of debt include its ability to help a firm commit to a desirable action or its tendency to restrict the firm to an undesirable action, depending on the circumstance. This can mean producing more or less, or charging a higher or lower price than would otherwise be the case.

A particularly interesting unexplored link between capital structure and product market strategies is discussed in Section 4.3. There we have a model in which debt is used to overcome underinvestment and has a positive agency effect. As a result, the firm's cost and price are both lowered, which implies a negative strategic effect of debt.

The direct implications of our taxonomy on these examples of agency costs and strategic effects include the following: (1)When asset substitution is the major source of agency cost, debt makes the firm *tough* in product market competition when actions taken by competing firms are strategic substitutes, and *soft* when they are strategic complements.[4] In both cases, the strategic effect of debt is positive and an oligopolist should have more debt than a monopolist facing the same market demand.[5] (2)When managers' private benefits are the investors' major concern, debt makes the firm *tough* when the manager tends to under-invest and actions taken by competing firms are strategic complements, and *soft* when the manager tends to over-invest and the actions are strategic substitutes. In both cases, the strategic effect of debt is negative and an oligopolist should have less debt than a monopolist facing the same market demand.

Some leading models in the existing literature can be put into a unified picture by using our framework. In Brander and Lewis (1986), the agency effect of debt is negative and the strategic effect of debt is positive. In Bolton and Scharfstein (1990), the agency effect of debt is positive and the strategic effect of debt is negative. Maksimovic (1988) is an incomplete case where the agency effect does not exist and the strategic effect is nonpositive.

---

[4]Following Bulow, Geanakoplos and Klemperer (1985), we also consider the actions of competing firms to be strategic substitutes if their reaction curves are downward sloping, and strategic complements if upward sloping.

[5]The precise meaning of facing the same market demand is made clear in Section 3.

There are some similarities between our framework and that of Fudenberg and Tirole (1984), which analyzes firms' business strategies and can be used to predict the outcomes of many important strategic interactions of industrial organization. Their framework differs from ours in that it abstracts from agency considerations and therefore is not general enough to be used to analyze the issues discussed in our paper.

Our paper is closely related to a recent paper by Dasgupta and Titman (1998). They also attempt to reconcile mixed empirical findings on the effect of debt on product market strategies. Their explanation is based on the comparison of the Nash and the Stackelberg cases of product market competition.

The remainder of our paper is organized as follows: Section 2 presents a general model to derive the optimal contract between a firm's investors and managers that balances its agency and strategic effects. Section 3 applies this general framework to analyzing a firm's optimal capital structure and provides a taxonomy of the relationship between a firm's capital structure and its product market strategy. Section 4 first shows that Brander and Lewis (1986) corresponds to one category of the taxonomy. Then we give three examples to illustrate unexplored linkages between capital structure and product market strategies. Finally, we show that the framework can also accommodate Maksimovic (1988) and Bolton and Scharfstein (1990) as special cases. Section 5 discusses the empirical implications of the model, the existing empirical literature and concludes the paper.

2. A GENERAL MODEL

We consider a case of duopoly. One of the duopolists, firm AM (mnemonic for agent-managed), is managed by a self-interested manager. The manager is given the power to make operational decisions, denoted by x, which the investors lack the sophistication to make, either because x itself is very complicated, or because the optimal choice of x depends on complicated contingencies. Examples of x include investment, production quantity, and price. The investors, however, can affect the manager's behavior by choosing a control variable, k, before x is chosen. An example of k is the firm's debt level. We assume that k is publicly observable. The payoffs to the manager and the investors of firm AM are also affected by the action, denoted by y, of its rival, firm OM (mnemonic for owner-managed).[6] x and y are chosen simultaneously by the manager of firm AM and the owner of

---

[6] That one of the duopolists is owner-managed is a simplifying assumption. The results will be the same if both duopolists are agent-managed.

firm OM, respectively. Let $U(x; k, y)$ be the expected utility of the manager of firm AM, $\Pi(k; x, y)$ the expected profit to the investors of firm AM.[7]

Given k and y, the manager of firm AM takes action, x, to maximize his expected utility, i.e. to solve

$$\max_x U(k, x, y) \tag{1}$$

The solution to this problem is the response function of firm AM to the action, y, taken by its rival, firm OM, given the control variable, k. Denote the response function by

$$x = R(y, k). \tag{2}$$

For simplicity, we assume that firm OM is an owner-managed firm with expected profit function $\overline{\Pi}(y; x, k)$.[8] The owner-manager of firm OM chooses its action, y, to maximize its expected profit, i.e. to solve

$$\max_y \overline{\Pi}(y; x, k). \tag{3}$$

The solution to this problem is firm OM's response function to firm AM's action, x, given the observed k. Denote this response function by

$$y = \overline{R}(x, k). \tag{4}$$

The above two response functions solved simultaneously yield $x^* = x^*(k)$, $y^* = y^*(k)$.[9] The optimal k should be chosen by the owners of firm AM to be the solution to the following problem:

$$\max_k \Pi(k, x^*(k), y^*(k))$$

The solution to this problem satisfies the following first-order condition:[10]

$$\frac{d\Pi}{dk} = \frac{\partial \Pi}{\partial k} + \frac{\partial \Pi}{\partial x} \frac{dx^*}{dk} + \frac{\partial \Pi}{\partial y} \frac{dy^*}{dk} = 0 \tag{5}$$

---

[7]Notice that we assume the environment is uncertain and use expected utility and expected profits. The presence of uncertainty is crucial for the investigation to be non-trivial. If there were no uncertainty, there would be incentive schemes that make the agent perfect so that the firm would behave as if it were owner-managed. In this case, the control variable would have no effect on product market competition. In the rest of this paper, the term profit means expected profit if not otherwise stated.

[8]Firm AM's choice of k may affect firm OM's profit directly. For example, if k is the debt level of firm AM, high level of k makes it easier for firm OM to drive firm AM out of business, as discussed in Bolton and Scharfstein (1990).

[9]We make the usual assumptions about functions $U(x; k, y)$ and $\overline{\Pi}(y; x, k)$ so that the solution exists and is unique and stable.

[10]For the sake of simplicity, we assume throughout this paper that the optimal k and later, the optimal debt level, D, are interior solutions to the corresponding optimization problems.

On the right hand side of equation (5), the first term represents the direct effect of k on the firm's profit. The second term represents the indirect effect of k on the profit through its effect on the agent-manager's choice of x, which we call the agency effect of k. The third term represents another indirect effect of k on the profit through its effect on the rival owner-managed firm's choice of y, which we call the strategic effect of k. The optimal k is chosen by the investors of firm AM to balance these three effects.

3. CAPITAL STRUCTURE AND PRODUCT MARKET STRATEGY: A TAXONOMY

To analyze the relationship between capital structure and product market strategy, we consider a special case of the general model where the control variable of firm AM is its debt level, i.e. $k = D$. We assume that debt affects a firm's value only through its effects on its agent's action and its competitor's action, i.e. $\frac{\partial \Pi}{\partial D} = 0$ and thus $\Pi = \Pi(x, y)$.[11] Therefore, equation (5) becomes

$$\frac{d\Pi}{dD} = \frac{\partial \Pi}{\partial x}\frac{dx^*}{dD} + \frac{\partial \Pi}{\partial y}\frac{dy^*}{dD} = 0, \tag{6}$$

where the first term, $\frac{\partial \Pi}{\partial x}\frac{dx^*}{dD}$, is the agency effect of debt and the second term, $\frac{\partial \Pi}{\partial y}\frac{dy^*}{dD}$, is the strategic effect of debt.

Let's start with an investigation of how the sign of the strategic effect, $\frac{\partial \Pi}{\partial y}\frac{dy^*}{dD}$, is determined by both the characteristics of the strategic interaction of the duopolists and the sign of the effect of firm AM's debt on firm OM's profit. For simplicity, we make the following assumptions.

Assumption 1: *The effect of one duopolist's action on the other duopolist's profit is symmetric, i.e.* $sign[\frac{\partial \Pi}{\partial y}] = sign[\frac{\partial \overline{\Pi}}{\partial x}]$.

Assumption 2: *Firm AM's debt, D, has no direct effect on firm AM's profit. In other words, firm OM's profit is $\overline{\Pi}(y; x)$.*

By Assumption 2 and (3), equation (4) becomes

$$y = \overline{R}(x) \tag{4'}$$

This implies that $\frac{dy^*}{dD} = \frac{dx^*}{dD}\overline{R}'$. Therefore, by Assumption 1,

$$sign[\frac{\partial \Pi}{\partial y}\frac{dy^*}{dD}] = sign[\frac{\partial \overline{\Pi}}{\partial x}\frac{dx^*}{dD}]sign[\overline{R}'] = sign[\frac{d\overline{\Pi}}{dD}]sign[\overline{R}'],^{12}$$

i.e. the sign of the strategic effect of firm AM's debt, D, is determined by the slope of firm OM's response function and the effect of firm AM's debt

---

[11]We abstract from tax considerations in this paper.

TABLE 1.

Sign of strategic effect of debt

Product market actions	Debt makes the firm	
	Tough	*Soft*
Strategic complements	Negative	Positive
Strategic substitutes	Positive	Negative

on firm OM's profit. Following Fudenberg and Tirole (1984), we say D makes the firm *tough* if $\frac{d\overline{\Pi}}{dD} < 0$, and D makes the firm *soft* if $\frac{d\overline{\Pi}}{dD} > 0$. The duopolists' product market actions are strategic substitutes if $\overline{R}' < 0$, and strategic complements if $\overline{R}' > 0$. Table 2.1 gives the sign of the strategic effect as determined by: (1) the sign of the slope of the response function – the nature of the strategic interaction of the duopolists, and (2) the sign of the effect of firm AM's debt on firm OM's profit – whether debt makes the firm *tough* or *soft*.

We next investigate how strategic considerations affect the firm's capital structure. As a benchmark for comparison with our duopoly case, we consider the following monopoly case where firm OM's action, y, is given and there are no strategic interactions of y with debt, D, and action, x, of firm AM.

Assumption 3: *Firm AM faces the same demand for its product in both the duopoly and the monopoly cases.*

Particularly, the given action of firm OM here is the same as the duopoly equilibrium action, y^*, that we have found earlier; the effective demand faced by firm AM in the duopoly case is the same as that in the monopoly case. In this case, given D, the manager of firm AM chooses his action to be $x = R(y^*, D)$, where R is the same response function of firm AM that is given by (2). The investors of firm AM choose D to maximize

$$\Pi(R(y^*, D), y^*).$$

The first-order condition of the investors' maximization problem is

$$\frac{d}{dD}[\Pi(R(y^*, D), y^*)] = \frac{\partial \Pi}{\partial x}(R(y^*, D), y^*)\frac{\partial R}{\partial D}(y^*, D) = 0. \qquad (7)$$

Denote a solution of this equation by D^M. A sufficient second-order condition for D^M to be the unique solution to the investors' maximization

TABLE 2.

Effect of product market competition on the firm's leverage

Product market actions	Debt makes the firm	
	Tough	*Soft*
Strategic complements	$D < D^M$	$D > D^M$
Strategic substitutes	$D > D^M$	$D < D^M$

problem is that

$$\frac{d^2}{dD^2}[\Pi(R(y^*, D), y^*)] < 0 \quad \text{for all } D. \tag{8}$$

We can prove the following relationship between the optimal monopoly debt level, D^M, and the optimal duopoly debt level, D.

THEOREM 3.1. *If the stability condition for the duopoly problem and the sufficient second-order condition (8) hold, then $D^M > D$ ($D^M < D$) if the strategic effect, $\frac{\partial \Pi}{\partial y} \frac{dy^*}{dD}$, is negative (positive).*

The proof of the theorem is given in the appendix.

The results of the theorem are very intuitive. When strategic considerations are taken into account, a positive (negative) strategic effect adds more benefit of debt and hence more (less) debt should be used as compared to the case where strategic considerations are not relevant.

Table 2.1 gave the sign of the strategic effect. By the theorem, we can infer Table 2.2 which gives a taxonomy of the effect of product market competition on the firm's leverage. When product market actions are strategic complements, product market considerations lower the firm's optimal debt level when debt makes the firm *tough*, and raises it when debt makes the firm *soft*. The opposite is true when product market actions are strategic substitutes.

Now that we have studied the effect of strategic considerations on the firm's leverage, we shift our focus to the effect of debt on product market competition, which is also a concern of the existing literature. When the product market actions are strategic complements, i.e. $R' > 0$, $\frac{d\overline{\Pi}}{dD}$ has the same sign as the strategic effect, which, in equilibrium, has the opposite sign of the agency effect.[13] Therefore, if the agency effect is positive (negative),

---

[13]Recall that we have assumed that the optimal D is an interior solution in an earlier footnote.

TABLE 3.

Effect of debt on product market competition

Product market actions	Agency effect of debt	
	Positive	Negative
Strategic complements	*Tough*	*Soft*
Strategic substitutes	*Soft*	*Tough*

then $\frac{d\overline{\Pi}}{dD} < 0 (> 0)$, i.e. debt makes the firm *tough* (*soft*) in product market competition. The opposite is true when the product market actions are strategic substitutes. Table 2.3 summarizes these results.

Tables 2.2 and 2.3 are the results of looking at the same problem from two different angles. In fact, there is a one-to-one correspondence between cases in Table 2.2 and those in Table 2.3. For example, the upper-left corner of Table 2.2 corresponds to the upper-left corner of Table 2.3, the lower-left corner of Table 2.2 corresponds to the lower-right corner of Table 2.3, etc. These cases will be illustrated by examples in the next section.

4. EXAMPLES

In this section, we illustrate that our general framework includes Brander and Lewis (1986), Maksimovic (1988), and Bolton and Scharfstein (1990) as special cases. These three pioneering papers are discussed in examples 1, 5, and 6, respectively. Table 3.1 summarizes the relationship between the papers on the interaction between capital and product markets using our framework.

TABLE 4.

Existing literature

Authors	Agency Effect	Strategic Effect	Debt makes the firm
Brander and Lewis	Negative	Positive	*Tough*
Maksimovic	None	Negative	*Tough*
Bolton and Scharfstein	Positive	Negative	*Soft*

In addition, we offer three other examples (examples 2 - 4) that point out some unexplored linkages between capital structure and product market

TABLE 5.

Four examples

Example	Agency problem	Market actions	Optimal debt	Debt makes the firm
1	Asset substitution	Strategic substitutes	$D > D^M$	*Tough*
2	Asset substitution	Strategic complements	$D > D^M$	*Soft*
3	Under-investment	Strategic complements	$D < D^M$	*Tough*
4	Over-investment	Strategic substitutes	$D < D^M$	*Soft*

strategies. Brander and Lewis (1986) and the three new stories correspond to the four cases in Tables 2.2 and 2.3. The results of these four examples are summarized in Table 3.2.

In the first two cases in Table 3.2, the agent is assumed to represent the interest of the shareholders. Debt induces conflict of interests between the shareholders and the creditors and reduces the total value of the firm.[14] Consequently, the agency effect of debt is negative, and the strategic effect of debt is positive. However, in the next two cases in Table 3.2, we assume that the manager of the firm has his own agenda and may not represent the interest of the shareholders, nor that of the creditors, which is different from the story told by Brander and Lewis (1986). Debt can be used to curb the manager's ability to pursue his own agenda. Therefore, the agency effect of debt is positive and the strategic effect of debt is negative.

4.1. Example 1: Asset substitution and strategic substitutes (Brander and Lewis [1986])

Brander and Lewis (1986) is an example where debt has a negative agency effect, the product market actions are strategic substitutes, and strategic interactions increase the leverage of the firm. In their model, two firms engage in quantity competition in the product market. Both firms borrow from creditors, and managers represent the interests of the shareholders. It is assumed that the marginal profit of output is higher in better states of the world. Therefore, the marginal profit of output in the good states is higher than the expected marginal profit of output. Due to limited liability, the presence of debt makes the shareholders care only about profits in the good states. Thus the managers have an incentive to produce more

---

[14]The total value of the firm is the sum of the values of equity and debt.

than an expected-profit maximizer would. This has two opposite effects on the firm's value: it gives the firm an edge in product market competition because the firm is pre-committed to be aggressive; it decreases the value of the firm by increasing the cost of debt financing because a conflict of interests is created between the shareholders and the creditors. The optimal debt level is determined by balancing these two opposing effects.

To tell the story using our framework, assume that only one of the duopolists, firm AM, is considering debt financing while the rival firm OM is an owner-managed firm without debt. Regarding firm AM, the objective function of the principal (investors) here is the total value of the firm $\Pi = V_E + V_C$, where V_E and V_C are payoffs to the shareholders and creditors, respectively. The manager's objective function is $U = V_E$. x and y are production quantities of firm AM and its rival firm OM, respectively. Given firm OM's action y, x would be chosen such that $\frac{\partial \Pi}{\partial x} = 0$ if there were no debt. However, the presence of debt induces asset substitution, which is manifested by the manager choosing a larger x where $\frac{\partial \Pi}{\partial x} < 0$. Therefore, the agency effect of debt is negative. Because x and y are strategic substitutes, firm AM's choice of a larger x in the presence of debt lowers the demand for the product, and thus reduces the profit, of the rival firm OM. Therefore, debt makes firm AM *tough*, as is indicated by the lower-right corner of Table 2.3. In response to the larger x, the rival firm OM lowers its choice of y, which increases the demand for the product, and raises the value, of firm AM. Therefore, the strategic effect of debt is positive. The debt level, D, is chosen ex ante by firm AM, according to equation (6), to maximize the total value of the firm, Π, with the firm anticipating two opposite effects: a negative agency effect and a positive strategic effect. Notice that the optimal choice of the debt level here is greater than zero, which would be the optimal choice if no strategic consideration were taken. The lower-left corner of Table 2.2 corresponds to this case.

4.2.   Example 2: Asset substitution and strategic complements

In Brander and Lewis (1986), debt is used as a pre-commitment for the firm to be *tough*. This depends on the assumption that the product market actions are strategic substitutes. However, if the actions are strategic complements and it is still assumed that marginal profits of the action are higher in better states of the world, then the role of debt is reversed. Debt now is a device to pre-commit the firm to be *soft*, because a higher level of debt induces the manager to take a higher level of action, and a higher level of action here could mean being *soft*.

One simple case is price competition between two firms producing differentiated products. Here debt can be used as a pre-commitment for the firms to be collusive. Again assume that one of the duopolists, firm AM, is debt financed with the manager representing the interest of its share-

holders, and its rival firm OM is an owner-managed firm without debt. Also assume that the demand function for firm AM's product is $d(x, y) + \epsilon$, where x and y are prices charged by firm AM and its rival firm OM, respectively, ϵ is a random noise with zero mean, and firm OM's demand function is symmetric to this. Assuming the marginal cost of production is 0, we can write the profit function of firm AM as $\Pi = p[d(x, y) + \epsilon]$. Here the marginal profit of price is higher when ϵ is higher, i.e. the state of the world is better. According to the intuition given by Brander and Lewis (1986), debt induces the manager to charge a price higher than the expected-profit maximizing price due to its asset substitution effect. Therefore, debt has a negative agency effect on the value of the firm. Because x and y here are strategic complements, the larger x induced by the debt increases the demand for the product, and thus raises the profit, of the rival firm OM. Therefore, firm AM's debt improves its rival's profit, i.e. it makes firm AM *soft*, as is indicated by upper-right corner of Table 2.3. Although charging a higher price lowers firm AM's profit if y is taken as fixed, it induces firm OM to raise its price y, which benefits firm AM indirectly. The positive indirect effect could dominate the negative direct effect, so the combined effect (the strategic effect) is positive, as is illustrated by Hotelling's "linear city" model with quadratic transportation cost (Hotelling (1929)). In the model, the demand function of a firm is $d(x, y) = (y - x + t)/2t + \epsilon$, where t is the coefficient measuring transportation cost. The Nash solution here is $x^* = y^* = t$. However, if the firm can commit to a price, the optimal x to be committed to is $\frac{3}{2}t$. At $x = \frac{3}{2}t$, the expected profit is $\Pi = \frac{9}{16}t$, while at $x = t$, the expected profit is $\Pi = \frac{1}{2}t$. The positive indirect effect of raising x from t to $\frac{3}{2}t$ dominates its negative direct effect due to the benefit of commitment. Debt helps the firm with such a commitment.

This is the case where debt has negative agency effect and the strategies are complementary. Notice that the optimal choice of the debt level here is greater than zero, which would be the optimal choice if no strategic consideration were taken. The upper-right corner of Table 2.2 corresponds to this case.

4.3.   Example 3: Under-investment and strategic complements

Example 3 is a case where debt has a positive agency effect, product market strategies are complementary, and strategic interactions reduce the leverage of the firm. Here we borrow the capital structure story from Grossman and Hart (1982). The idea is that debt can be used to pre-commit the manager of firm AM to undertake desirable investment. We assume here that investment can be made to reduce the marginal cost of production. The manager raises funds by selling equity to, and borrowing debt from, investors. Investors cannot observe how much of the fund the manager puts into productive use, nor can they write an incentive contract

with the manager based on the profit of the firm, because the profit is not verifiable to a third party. The manager enjoys the funds left over after the investment when the firm is solvent, but gets no utility when the firm is bankrupt. If there were little or no debt, the manager would not need to worry about bankruptcy and would therefore have no incentive to invest in order to reduce the marginal cost of production. Investment would reduce his residual funds and provide him no benefit. If the debt level is significant, however, the manager worries about the possibility of bankruptcy, and he will make productive investment to avoid it. In the absence of strategic considerations, the optimal debt level should balance its positive effect on the manager's investment incentive and its negative effect on the probability of bankruptcy, i.e. the agency effect of debt should be zero.[15]

We assume that the duopolists engage in price competition. Because the duopolists' prices are strategic complements, in response to firm AM's cost-reducing investment which lowers its price, firm OM reduces its price too, which comes back to hurt firm AM by shifting down the demand curve for its product. Therefore the reaction of firm OM makes it less beneficial to use debt to pre-commit investment than it would be if there were no rival firm OM. Hence debt has a negative strategic effect here, which, according to equation (6), should be balanced by a positive agency effect. Therefore, the optimal debt level now should be lower than the one when no strategic effect exists. Notice that firm AM's choice of a lower price in the presence of debt shifts the demand curve for firm OM's product down and thus reduces firm OM's profits. Therefore, debt makes firm AM *tough*. The upper-left corners of both Table 2.2 and Table 2.3 correspond to this case.

4.4.   Example 4: Over-investment and strategic substitutes

This is an example where debt has a positive agency effect, product market strategies are substitutes, and strategic interactions reduce the leverage of the firm. We consider a firm AM whose manager has an incentive to over-invest due to his empire-building tendency. We assume that investment can be made to increase the firm's productive capacity and that there is no incentive scheme to control the manager's investment decision. Under such circumstances, as Hart and Moore (1990) point out, (senior) debt can be used to curb the empire-building ability of the manager. Without considering its strategic effect, debt has two competing objectives. On the one hand, if the debt level is too low, the manager will have too much room to raise funds and hence make unprofitable investments. On the other hand, if the debt level is too high, the manager may be forced to forego profitable investment opportunities. The optimal debt level should balance the

---

[15] Agency cost here includes cost of bankruptcy since firm can go bankrupt only when the agent (manager) borrows from the principal (investors).

cost of over-investment and under-investment such that the agency effect of debt is zero.

We assume that the duopolists engage in quantity competition. Suppose that firm AM introduces debt, which reduces its production capacity. Because production quantities of the duopolists are strategic substitutes, the rival firm OM increases its production and shifts the demand curve for firm AM's product down. This reduces firm AM's profit. Hence debt has a negative strategic effect which, according to equation (6), should be balanced by a positive agency effect. It follows that the optimal debt level should now be lower than when no strategic effect exists. Notice that firm AM's more limited production capacity in the presence of debt shifts the demand curve for firm OM's product up and thus increases firm OM's profits. Therefore, debt makes firm AM *soft*. The lower-right corner of Table 2.2 and lower-left corner of Table 2.3 correspond to this case.

Two important models: Maksimovic (1988) and Bolton and Scharfstein (1990), do not correspond exactly to the cases in Tables 2.2 and 2.3. In the rest of this section, we illustrate that they still fit into our general framework.

4.5.   Maksimovic (1988)

Maksimovic (1988) analyzes the relationship between capital structure and product market strategy in the context of a model of repeated oligopoly. The firm can achieve different profit levels from being either collusive or competitive. In the leading case of his paper collusive equilibrium can be sustained with a standard trigger strategy. The introduction of debt may create an incentive for the manager, who is assumed to represent the interests of the shareholders, to deviate from the cooperative equilibrium since shareholders are residual claimants of the firm's cash flow and hence would enjoy all the benefit, and only partially bear the cost, of deviation. The maximum amount of debt is constrained by the firm's intention to sustain implicit collusion with its rivals.[16] His model is incomplete since it derives only an upper bound on the firm's debt level and neglects the benefits of debt.

Our framework can easily accommodate this incomplete theory too. Now the objective function of the principal (investors) is the net present value of the firm's current and future production $\Pi = V_E + V_C$, where V_E and

---

[16]As we stated in an earlier footnote, the presence of uncertainty is crucial for the discussion to be non-trivial. Maksimovic does not explicitly make this assumption. In fact, in the absence of uncertainty (or any other conditions which lead to the incompleteness of incentive contracts), the debt contract in his paper is not an optimal one. In this case the creditors can observe whether the manager deviates and write into the debt contract a clause that gives them the option of calling the loan when observing deviation. Such a clause will deprive the manager of any incentive to deviate and eliminate the strategic effect of debt.

V_C are discounted current and future payoffs to the shareholders and the creditors, respectively. The agent-manager's objective function is $U = V_E$. Each period the manager of firm AM chooses production quantity x while the rival firm OM chooses its production quantity y. Assume that implicit collusion on production quantities x and y can be maintained by a trigger strategy if firm AM is entirely equity financed. When debt is included in firm AM's capital structure, due to the asset substitution effect, the manager of firm AM has an incentive to deviate from collusion and to increase the firm's production quantity x, which in turn triggers a harsh response from firm OM (i.e. y increases). Although this deviation increases the payoff to the shareholders, V_E, it reduces the payoff to the creditors, V_C, and the total value of firm AM, Π. Therefore, debt has a nonpositive strategic effect[17] (SE). Unlike other examples in this paper, there is no agency effect (AE). Therefore, our equilibrium condition (equation (6)) $AE + SE = 0$ reduces to $SE = 0$. The highest level of debt is $D = \max\{D : SE = 0\}$. In this model, debt makes firm AM *tough* since high debt level induces firm AM to deviate from collusion and therefore hurts the rival firm OM.

4.6. Bolton and Scharfstein (1990)

Bolton and Scharfstein (1990) is another important paper on the interaction between the product and capital markets. They consider an entrant who has to borrow funds from the capital market and an incumbent who has "deep pockets". The entrant needs second-period refinancing to carry production beyond the first period. It chooses the optimal probabilities of refinancing in different states of the world with the following consideration in mind: while making the refinancing decision sensitive to the reported first-period performance of the firm induces the manager to report the true profit, it invites predation from the rival incumbent firm because higher sensitivity gives the incumbent more incentive to prey so that the entrant does not get refinancing and exits.

Using our notation, let k denote the sensitivity of the refinancing decision to the reported first-period performance of the entrant, x a measure of the tendency for the manager of the entrant to report the true state of the world, y a measure of the tendency for the incumbent to prey. k has a positive effect on y because high sensitivity of the refinancing decision to the reported performance encourages the incumbent to prey. This is the direct effect of k on y. k also has a positive effect on x because making the refinancing decision sensitive to the reported performance induces the manager to report the truth. x has a positive effect on y, because the more truthfully the manager reports performance, the more effective it is for the

---

[17]In Maksimovic (1988), a low debt level has no effect on the firm's production decision and therefore has no effect on the firm's value.

incumbent to prey. The combination of the last two effects is the positive indirect effect of k on y. The direct and indirect effects of k on y are in the same direction and have a negative impact on the entrant's profit since predation hurts the entrant. Therefore, the strategic effect of k is negative. The agency effect of k is its effect on the firm's profit through x, which is positive since truth-telling is always good for the investors. The optimal choice of k balances its agency and strategic effects.

One distinction between Bolton and Scharfstein (1990) and all the other examples above is the way in which the strategic effect is manifested. In the former, there are both direct and indirect effects of the control variable k on the action of the rival firm, y, while in the latter, the choice variable D only affect the rival's action indirectly through its effect on the action of one's own firm, x. In this model, the high sensitivity of its debt refinancing decision makes the firm *soft* since it increases the probability of successful predation by the incumbent rival.

5. CONCLUSION

This paper develops a general framework to address two basic questions regarding the interaction between a firm's capital structure and its product market strategy. First, what is the effect of product market competition on the firm's optimal capital structure choice? Second, what is the effect of debt on the firm's product market strategy?

The answer to the first question is summarized in Table 2.2. Product market considerations raise the optimal debt level when the strategic effect of debt is positive, and lower it when the strategic effect of debt is negative.

The answer to the second question is summarized in Table 2.3. In contrast to the existing literature on this topic, the framework does not imply the extreme position that debt always makes the firm *tough* (Brander and Lewis [1986], Maksimovic [1988]) or *soft* (Bolton and Scharfstein [1990], Chevalier [1995]). Instead, it includes the existing theories as special cases of our general framework (Table 3.1) and implies conditions under which debt makes the firm *tough* and those under which debt makes the firm *soft*. The key conditions include the nature of product market competition (i.e. strategic complements or substitutes) and the sources of agency problems.

Our results have important empirical implications. The conditions that we base our taxonomy on are in turn based on observable exogenous variables. For example, the nature of product market competition depends on the production technology.[18] On the one hand, if the production technology in the industry involves sharply rising marginal cost, capacity is very important in product market competition and we can consider that

---

[18]See the discussion in Chapter 5 of Tirole (1988).

competing firms engage in quantity competition. An example of such an industry is the hotel industry. On the other hand, if the marginal cost function is fairly flat, then there is little capacity constraint and we can consider that firms in the industry engage in price competition. The software industry is an extreme example of such an industry. Factors that determine the dominant source of agency costs of a firm include the size of the firm, the nature of ownership (whether it is publicly or privately held), the complexity of the operation, etc. Any empirical work, in our opinion, should take these factors into consideration.

Our results agree with or at least do not contradict the findings of empirical work done do far. Chevalier (1995) examines the relationship between firm leverage and product market competition in the supermarket industry. She finds that debt makes a firm *soft* in product market competition. In particular, LBO firms are less likely to expand than non-LBO firms and the competitors of more leveraged firms are more likely to expand or to enter the market. Her findings fit well the fourth case in Table 3.1 where product market actions are strategic substitutes and debt makes the firm *soft*. As for the dominant source of the agency problem, it is very unlikely to be asset substitution since it is relatively easy to specify assets in the supermarket industry in the debt covenant. It is not very likely to be under-investment either because in this case there do not seem to be very many opportunities for the manager to divert funds for perks due to the relative simplicity of the operation. Empire-building tendency seems to be the only reasonable source of agency costs here.

Phillips (1994) investigates the change in product market competition in "four industries where the leading firms have increased their financial leverage by more than 25 percent, and the four firm concentration ratio was close to or exceeded 50 percent". He finds that competition decreases in three of the industries and it increases in the fourth. It would be interesting to examine the four industries in more detail to see whether the characteristics of the industries are compatible with our theoretical results and the observed change in product market competition.

We have abstracted from tax considerations in determining the optimal capital structure of a firm. In spite of this, our framework is already rich enough to include the leading papers in this literature as special cases. Incorporating tax considerations in the model is a potentially productive future research topic. We believe that doing so will not change our result that product market considerations raise the optimal debt level when the strategic effect of debt is positive and lower it when the strategic effect of debt is negative, that is, Table 2.2 will still be valid. Neither will incorporating tax considerations change our result that whether debt makes the firm *tough* or *soft* depends on the nature of product market competition (i.e. strategic complements or substitutes) and the sources and severity of

agency problems. Table 2.3 will still hold if we change one of the determinants from the sign of the agency effect to whether the agency effect dominates tax considerations. The same thing can be said about incorporating in the framework other direct effects of debt on the value of the firm.

APPENDIX: PROOF OF THE THEOREM

Let's first look at the duopoly problem. Given firm AM's debt, D, the response function of firm OM is

$$y = \overline{R}(x), \tag{4'}$$

and the response function of firm AM's manager is

$$x = R(y, D). \tag{2}$$

Substituting response function $(4^{'})$ into response function (2), we have

$$x = R(\overline{R}(x), D). \tag{9}$$

From this equation, we can solve for x in terms of D. Let the solutions be $x^* = x^*(D)$. Substituting the solution back into (9), we have

$$x^*(D) = R(\overline{R}(x^*(D)), D).$$

Differentiate the above equation with respect to D, and rearrange. We have

$$(1 - \frac{\partial R}{\partial y}\overline{R}')\frac{dx^*}{dD} = \frac{\partial R}{\partial D}. \tag{10}$$

The investors of firm AM solve

$$\max_D \Pi(x^*(D), y^*(D)).$$

Here, Π does not directly depend on D because of the Modigliani-Miller Theorem. The solution to this problem satisfies the following first-order condition:

$$\frac{d\Pi}{dD} = \frac{\partial \Pi}{\partial x}\frac{dx^*}{dD} + \frac{\partial \Pi}{\partial y}\frac{dy^*}{dD} = 0 \tag{6}$$

Multiply both sides of (6) by $(1 - \frac{\partial R}{\partial y}\overline{R}')$ and substitute (10) into the resulting equation. Then

$$\frac{\partial \Pi}{\partial x}\frac{\partial R}{\partial D} + \frac{\partial \Pi}{\partial y}\frac{dy^*}{dD}(1 - \frac{\partial R}{\partial y}\overline{R}') = 0 \tag{11}.$$

The stability condition says that $(1 - \frac{\partial R}{\partial y}\overline{R}') > 0$. Therefore, the second term in (11) has the same sign as the strategic effect, $\frac{\partial \Pi}{\partial y}\frac{dy^*}{dD}$. When the sign of the strategic effect is positive, then the first term in equation (11) must be negative, i.e.

$$\frac{\partial \Pi}{\partial x}(R(y^*, D), y^*)\frac{\partial R}{\partial D}(y^*, D) < 0. \tag{12}$$

In Section 3, we have shown that the optimal debt level in the monopoly case, D^M, satisfies

$$\frac{\partial \Pi}{\partial x}(R(y^*, D^M), y^*)\frac{\partial R}{\partial D}(y^*, D^M) = 0. \tag{7}$$

By the sufficient second-order condition (8), (7) and (12) imply that

$$D^M < D.$$

Similarly, when the sign of the strategic effect is negative,

$$D^M > D.$$

REFERENCES

Brander, J. and T. Lewis, 1986, Oligopoly and financial structure. *American Economic Review* **76**, 956-970.

Bolton, P. and D. Scharfstein, 1990, A theory of predation based on agency problems in financial contracting. *American Economic Review* **80**, 93-106.

Bulow, J., J. Geanakoplos, and P. Klemperer, 1985, Multimarket oligopoly: Strategic substitutes and complements. *Journal of Political Economy* **93**, 488-511.

Chevalier, J., 1995, Do LBO supermarkets charge more? An empirical analysis of the effects of LBOs on supermarket pricing. *Journal of Finance* **50(4)**, 1095-1112.

Dasgupta, S. and S. Titman, 1998, Pricing strategy and financial policy. *Review of Financial Studies* **11(4)**, 705-737.

Fudenberg, D. and J. Tirole, 1984, The fat cat effect, the puppy dog ploy, and the lean and hungry look. *American Economic Review, Papers and Proceedings* **74**, 361-368.

Grossman, S. and O. Hart, 1982, Corporate financial structure and managerial incentives. In J. McCall, ed. *The Economics of Information and Uncertainty*, University of Chicago Press.

Hart, O. and J. Moore, 1995, Debt and seniority: An analysis of the role of hard claims in constraining management. *American Economic Review* **85**, 567-585.

Hotelling, H., 1929, Stability in competition. *Economic Journal* **39**, 41-57.

Jensen, M., 1986, Agency costs of free cash flow, corporate finance, and takeovers. *American Economic Review* **76**, 323–329.

Jensen, M. and Meckling, W., 1976, Theory of the firm: Managerial behavior, agency costs, and capital structure. *Journal of Financial Economics* **3**, 305-360.

Maksimovic, V., 1988, Capital structure in repeated oligopolies. *Rand Journal of Economics* **19**, 389-407.

Phillips, G., 1994, Increased debt and product market competition: An empirical analysis. *Journal of Financial Economics* **37**, 189-238.

Tirole, J., 1988, *The Theory of Industrial Organization*, MIT Press.