CAPITAL STRUCTURE AND PRODUCT MARKET RIVALRY: HOW DO WE RECONCILE THEORY AND EVIDENCE?

By

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ABSTRACT

This paper presents empirical evidence on the interaction of capital structure decisions and product market behavior. We examine when firms recapitalize and increase the proportion of debt in their capital structure. The evidence in this paper shows that firms with low productivity plants in highly concentrated industries are more likely to recapitalize and increase debt financing. This finding suggests that debt plays a role in highly concentrated industries where agency costs are not significantly reduced by product market competition. Following the empirical evidence we introduce the "strategic investment" effects of debt and argue that this effect, in conjunction with agency costs, appears to fit the data.

Keywords: Debt Financing, Capital Structure, Exit, Investment

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1. Introduction

Until the mid-eighties, industrial economists had not considered the effects of capital structure on product market behavior. Financial economists, on the other hand, had largely ignored the role of product market rivalry in assessing the choice of capital structure. Pioneering approaches to these issues were taken in the mid-to-late eighties. In a pair of companion papers James Brander and Tracy Lewis (1986, 1988) outlined the "limited liability" and "strategic bankruptcy" effects of debt on product market strategies and Vojislav Maksimovic (1986) analyzed the limited liability effect in the context of an infinite horizon model of collusion. These papers demonstrated how capital structure precommitment could influence the strategic behavior of firms in imperfect competitive markets. In a separate literature dealing with agency problems when product and factor market competition provides insufficient managerial discipline, Michael Jensen (1986) outlines the "free cash flow" theory of agency costs and detailed the role of debt in reducing these costs. However, Jensen did not address the effect of debt on the strategic interaction of firms in product markets.

The purpose of this paper is to present empirical evidence on the interaction of capital structure decisions and product market behavior and to examine these theories in light of the evidence. The evidence in this paper shows that firms with low productivity plants in highly concentrated industries are more likely to recapitalize and increase debt financing. This finding suggests that debt plays a role in highly concentrated industries where agency costs are not significantly reduced by product market competition. Following this evidence, we review our previous work showing that recapitalizing firms exhibit more passive investment behavior following recapitalization, while their rivals become more aggressive. Total industry output following recapitalization decreases. We conclude that our evidence is inconsistent with the most widely accepted version of the limited liability effect on debt. The strategic bankruptcy effect of debt does not appear consistent with the evidence, although versions of this model may be consistent when agency costs are present. Finally, we introduce the "strategic investment" effect of debt and argue that this effect, in conjunction with agency costs, appears to fit the data.

2. Why Do Firms Recapitalize and What is the Effect?

We examine the recapitalization decision using two classes of variables: (1) relative plant efficiency measured by total factor productivity, and (2) variables which capture market

structure and industry demand conditions: including 4 firm market share indexes, industry capacity utilization, output price variance and the change in demand.[1] The data is from the Longitudinal Research Database[2](LRD), located at the center for Economic Studies at the Bureau of the Census. The LRD database contains detailed plant level data on both public and private firms in the manufacturing industries. We aggregate plant level data to the firm level to examine recapitalization decisions. We confine our analysis to 1979 - 1990, which allows us to examine several lags of our independent variables before the first of our capital structure changes.

Productivity is measures by calculating total factor productivity (TFP). TFP is calculated using a regression based approach assuming that the production function is Cobb-Douglas, similar to Frank Lichtenberg and Donald Siegel (1990). It is a relative measure of productivity - thus average TFP for an industry will be zero. For demand variables we include capacity utilization, the variance of the output prices, and the change in demand. Capacity utilization data are from *The Annual Survey of*

[1]Kenneth Lehn and Annette Poulsen (1989) examine the leveraged buyout decision using accounting data but do not examine demand or productivity measures.

[2]See McGuckin, Robert H. and G. Pascoe, (1988). The Longitudinal Research Database (LRD) is unique in that it contains the underlying plant level micro-data that is released in aggregate form in the Annual Survey of Manufactures (ASM) and the Census of Manufacturers. The LRD covers approximately 50,000 plants every year in the ASM, the database we utilize.

Capacity Utilization, a publication of the Bureau of the Census. The external demand variables are from the Federal Reserve Board and represent demand indices for *the user* of the industry's product. We calculate the variance of output prices using monthly disaggregated 7 digit SIC code product-level data contained from the Bureau of Labor Statistics.

We examine recapitalization decision in ten commodity industries: broadwoven fabrics, mattresses, paper products, polyethylene, flat glass, fiberglass, gypsum, car and consumer batteries, and tractor trailers. We identified 40 firms that increased debt using discrete changes, including leveraged buyouts, management buyouts and public recapitalization. Kovenock and Phillips (1994) describes how the recapitalizing firms and industries were identified.

We estimates a logistic regression to test whether the firm productivity and industry demand factors influence a firms decision to recapitalize. The dependent variable equals one if the firm recapitalized using a leveraged buyout or leveraged recapitalization. The independent variables capture the firm and market conditions for the recapitalization firm and the industry firms at the time of recapitalization. We lag the productivity and demand variables to reduce the problem that the variables measured reflect any effects of the recapitalization decision.

Table 1 shows that firms are more likely to recapitalize when they have individual plants of low productivity when they

operate in an industry that is highly concentrated and when industry capacity utilization is low. To check the economic significance of these results, we estimated the probability of recapitalization using the logit coefficients from table 1 and held all variables other than TFCP at the sample means. The probability of recapitalization increases from 3.01% to 5.07% as TFP decreases from the 90th to the 10th percentile. At the sample mean for all variables, the probability of recapitalization is 3.91%.

In Kovenock and Phillips (1994), we find that the effects of high leverage on investment and plant closing are significant when the industry is highly concentrated. Recapitalizing firms in industries with high concentration are more likely to close plants and less likely to invest. Rival firms also change their behavior when faced with highly leveraged firms. Increased debt makes recapitalizing firms more passive while rivals become more aggressive. In addition, we find that rival firms become more aggressive. In addition, we find that rival firms are less likely to close plants and more likely to invest when the market share of leveraged firms is higher. The probability of closing a plant, evaluated at the means of the explanatory variables is 2.38% for non-recapitalizing firms versus 5.39% for recapitalizing firms. Judith Chevalier (1995) also finds that competitors of LBO firms are more likely to enter and expand in the supermarket industry. Phillips (1995) shows that in three

out of four highly leverage industries, industry output decreases and industry price increases, controlling for demand and marginal costs changes. This evidence does not seen to imply that the highly leveraged firms are subject to predation in these industries.

These results are consistent with the hypothesis that debt can be a mechanism that reduces excess investments in industries where highly concentration reduces the disciplinary effect of product market competition. They are also consistent with the importance of capital structure as a strategic variable in highly concentrated markets. We now review existing theory and , guided by the empirical evidence, propose a new model of the strategic effect of debt.

3. The Empirical Implications of Existing Theory

In this section we attempt to reconcile theory and evidence. The Brander and Lewis (1986) limited liability model showed that a firm;s capita; structure may serve as a credible precommitment in affecting strategic interaction between firms. They consider a two-stage game in which debt levels are simultaneously set in the first stage game in which debt levels are simultaneously set in the first stage to maximize firm value and quantity is chosen simultaneously in the second stage to maximize the return to equity. At the second stage, demand (or some other profit-relevant variable) is still uncertain, so output choice affects

the probability of default. Due to the limited liability of equity, a unilateral increase in debt leads to an output strategy that raises returns in good states and lower returns in bad states.

In assessing the empirical implications of the Brander-Lewis limited liability model, we adopt the common interpretation of quantity setting models as a reduced form for a choice of scale or capacity that determines firms' cost functions. With this interpretation, quantity adjustment in the Brander-Lewis model may be equated with scale or capital adjustment, i.e., investment.[3] Hence, under the "normal" case analyzed by Brander-Lewis (where marginal profit with respect to the strategic variable is higher in better states of the world), a firm's unilateral increase in debt would have a positive effect on its own investment and a negative effect on rival investment. The recapitalizing firms profit would increase and its rivals profit would decrease. Total industry profit would be lower. These predictions appear inconsistent with the evidence presented on the competitive and investment effects of increased leverage.[4]

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[3]Brander and Lewis claim to abstract away from the investment decision (p957), but note that if investment is chosen after financial structure is set the effect is similar to their analysis (p963). Our interpretation of quantity setting as a two-stage game of capacity choice followed by price competition is therefore consistent with choosing investment after financial structure.

[4]When the marginal return to capacity is lower in good stated a firms increase in debt will lower its own quantity and increases its rivals quantity. In this case there is no incentive to issue

Limited liability has a different effect if the strategies available to firms are strategic complements (see Paul de Bijl and Bernard van Bunnik, 1990). Suppose that the strategic variable is price and that the marginal return with respect to price is higher for states in which the total return is higher (as would be the case with demand intercept, but not unit cost, shocks). Starting from a position of zero debt, a small increase in debt by the one firm causes that firm to increase its price best response for each price chosen by the rival. If the rival firm maintains a zero debt level, equilibrium in the price setting game will involve higher profits and prices for both firms. At the resulting prices the quantity produced by the leverages firm is lower than the pre-debt level while the quantity as capacity, this represents a reduction in the leveraged firms's scale and an increase in the rival's scale. Hence, with price setting, the limited liability model can be interpreted as consistent with the evidence.

The "strategic bankruptcy" effect of debt financing, while implicit in a long line of articles on predation and "deep pockets," was also pioneered by Brander and Lewis (1988). The basic assumption underlying this effect is that costs incurred by a firm when it is unable to meet its debt obligations, or benefits that arise when rivals are unable to meet their

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debt.

obligations, affect the firms output decisions. In the case most prominent in their analysis, the case of fixed bankruptcy costs, a unilateral increase in debt leads to more aggressive firm behavior. They also present assumptions under which this result is reversed. However, when the effect does lead to more aggressive firm behavior. They also present assumptions under which this result is reversed. However, when the effect does lead to more passive recapitalizing firm behavior it is not clear why the firm would increase debt.

This issue also arises in the "strategic investment" effect of debt. This effect, based on the pecking-order model of finance (see Stuart Myers, 1984), refers to role of debt payments in constraining the ability of a leverage firm to invest using cheaper internal funds or in increasing the cost of external funds Its relevance is based on the belief that in most tight oligopolies the margin between stated in which investment is internally financed and states in which external financing is necessary is more likely to be relevant than states in which firms default on debt.

To see how this precommitment to costly expansion of capacity affects the equilibria of the second stage game, suppose that the market is characterized by price competition with goods that are imperfect substitutes. Internal funds and borrowed funds must be used to finance capacity before revenues are earned. A firm's price reaction curve is initially upward

sloping at a level reflecting the internal cost of funds. When the curve reaches the level of output at which internal funds are exhausted the slope of the curve becomes steeper. For a given price of the rival, lower price responses are more costly because outputs beyond the internally financed level are more costly. The reaction curve coincides with the price that yields the internally funded quantity constraint until the best response function corresponding to the higher, external unit cost of output is reached, and then moves along that curve. Hence, by choosing a high debt level a firm can commit itself to a higher price response over the relevant range. A unilateral increase in debt to a point where the Bertrand output cannot be internally funded can increase profit. The price equilibrium moves up the rivals's best response function, both firms' prices are higher, the leveraged firms' output is lower, and rival output is higher. Profits for both firms increase.

With second stage quantity setting, the quantity best response function shifts down at the quantity at which the internal funding constraints bind. This can cause the leveraged firm's output to decrease and the rival firm's output to increase. Again, interpreting output as capacity, this yields an effect consistent with the evidence. Own investment would decrease following recapitalization and rival investment increase. However, with quantities chosen to maximize profits, this would lead to a decrease in the leveraged firms' profits,

and an increase in rival profits. Hence, we would not expect to see a positive level of debt.[5]

Where does this leave our quest to reconcile theory and the evidence that large increases in debt due to recapitalization arise in concentrated industries, and lead to lower industry output with reduced leveraged firm investment and increased rival firm investment? This evidence seems consistent only with the price setting version of the limited liability model when marginal profit with respect to price is increasing in the state variable or with the price setting version of the strategic investment effect.

Capacity setting (strategic substitute) versions of the strategic bankruptcy effect and the strategic investment effect yield the appropriate effects upon own and rival investment, but do not provide justification for the existence of debt. Recapitalization involving increases in debt are value reducing actions.

Whether price setting versions of these models are plausible descriptions of investment behavior is debatable. Embedded in the interpretations of the price setting models is the assumption that scale of production is set contingent on prices. Most

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[5] There are quantity setting models with profit maximizing firms in which the internal funding constraint imposed by leverage may increase a firms profit. This may arise, for instance, in the case where debt constraints a Stackelberg follower's ability to expand output.

scholars in industrial organization would, we believe, adhere to the view that, at least for most markets, prices are set contingent on the scale of production. If this is true, the interpretations of the price setting models based on an unrealistic assumption.

If one takes the view that strategic substitution quantity setting models are the canonical models of imperfect competition this forces one to look elsewhere for an explanation of these effects. One explanation appears to be Jensen's observation that agency problems cause managers to maintain capacity at supra optimal levels. This observation, the foundation of Jensen's (1986) model of free cash flow, provides a potential explanation of how a capacity reduction can be profit increasing, even when partially offset by rival expansion. Patrick Bolton and David Scharfstein (1990) illustrate a strategic bankruptcy effect in their model of optimal financial contracts with agency problems and potential predation. The existence of agency problems in the Bolton Scharfstein model leads to inefficiently low investment.[6]

We illustrate a strategic investment effect with agency by adapting a version of the Fershtman and Judd (1987) model of precommitment to managerial incentive schemes in which the intercept term on the market demand function is stochastic.

[6]In both of the Brander and Lewis (1986, 1988) papers the potential importance of agency costs is noted, but does not play a role in the analysis.

Firms' owners simultaneously choose incentive contracts for their respective managers that are constrained to be proportional to convex combinations of profits and sales. Once contracts are set, the intercept term is revealed and then quantities are simultaneously chosen.

Suppose that the availability of debt as a tool for increasing investment costs is not known a priori, so that optimal managerial contracts do not reflect this possibility.[7] Furthermore, suppose that debt is a sufficiently flexible tool that the level of debt can be mad contingent on the realization of the intercept term of the market demand curve (but again managerial incentive contracts cannot be reset contingent on this realization). Quantities remain more flexible and can be made contingent on debt levels.

In this environment owners optimally compensate managers in part based on sales. The expectation of the intercept term determines the particular weight chosen; the higher the expectation, the more the wright on sales. In this context, the equilibrium compensation weights cannot be made contingent on the realization of demand.

If debt may be issues contingent on demand, a desired restriction in output can be attained by forcing the manager to externally fund all output (investment) beyond that level

[7]This is a simplifying assumption. Alternative formulations only strengthen the claims made.

maximizing the owners' profits on the rival manager's quantity best response function.[8] This action, if taken unilaterally, would reduce output of the leveraged firm, increase the output of the rival firm, and increase both firms' profits.

This view of the strategic effect of leverage is one that is consistent with the empirical evidence presented in this paper, and has considerable intuitive appeal. In a world in which managerial compensation packages cannot be fine-tuned to demand or cost conditions, leverage may act as a way to constrain managers from pursuing aggressive policies in downturns, when these policies might be desirable under more favorable market conditions. With incomplete contracts, owners may have an ex ante incentive to encourage aggressive behavior and may find it optimal to use other tools (such as debt) to rein in managers in bad states of demand. However, the benefits of such a policy are partially offset by more aggressive rival behavior.

Table 1 - The Decision to Recapitalize

Logit Analysis: t-statistics in parentheses

Variable	Coefficient (t-statistic)
Least Productive Plant: TFP_{t-1}	-.945 (-3.07)*
Concentration $C4_{t-1}$	1.494 (2.12)**

[8]If the difference in cost of external and internal funds is small this maximizer may not be attained but a marginal increase in profit is possible.

Firm Size ($ thousands)	.0031 (7.23)*
Demand Variables	
Change in Demand	-8.649 (-4.05)*
Output Price Variances$_{t-1}$	.0088 (.725)
Output Price Variances$_{t-2}$	.0015 (.172)
Capacity utilization$_{t-1}$	.0106 (.638)
Capacity utilization$_{t-2}$	.0392 (-2.148)**
Chi-Squared Statistic	56.18
(p - value)	(.00)
Number of Firms	867
Number of Recapitalization Firms (dependent variable = 1)	40

***,** significance a the 1%, 5% level respectively.**

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