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Capital Structure and Product-Market Rivalry: How Do We Reconcile Theory and Evidence?

Dan Kovenock
Chapman University, kovenock@chapman.edu

Gordon Phillips
University of Southern California

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By DAN KOVENOCK AND GORDON PHILLIPS*

Until the mid-1980's, 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 1980's. 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. 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 imperfectly competitive markets. In a separate literature dealing with agency problems when product- and factor-market competition provides insufficient managerial discipline, Michael Jensen (1986) outlined 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 a recapitalization decreases. We conclude that our evidence is inconsistent with the most widely accepted version of the limited-liability effect of debt. The strategic-bankruptcy effect of debt does not appear to be 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.

I. Why Do Firms Recapitalize and What Is the Effect?

We examine the recapitalization decision using two classes of variables: (i) relative plant efficiency measured by total factor productivity, and (ii) variables which capture market structure and industry demand conditions, including four firm market-share indexes, industry capacity utilization, output price variance, and the change in demand.[1] The data are from the Longitudinal Research Database (LRD), located at the Center for Economic Studies at the Bureau of the Census (see Robert H. McGuckin

*Krannert Graduate School of Management, Purdue University, West Lafayette, IN 47907, and College of Business, University of Maryland, College Park, MD 20742, respectively. We are grateful to Kathleen Weiss Hanley, Julie Hunsaker, Vojislav Maksimovic, and David Scharfstein for helpful discussions and comments. The empirical part of this research was conducted at the Center for Economic Studies, Bureau of the Census. Any interpretations of the results, as well as any errors or omissions, are the authors'.

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

and George A. Pascoe, 1988).[2] 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 measured by calculating total factor productivity (TFP). TFP is calculated using a regression-based approach assuming that the production function is Cobb-Douglas, similar to the approach of 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 Capacity Utilization*, a publication of The Bureau of the Census. The external demand variables are from the Federal Reserve Board and represent demand indexes for *the user* of the industry's product. We calculate the variance of output prices using monthly disaggregated seven digit SIC-code product-level data obtained from the Bureau of Labor Statistics.

We examine recapitalization decisions 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 recapitalizations. In Kovenock and Phillips (1994) we describe how the recapitalizing firms and industries were identified.

We estimate a logistic regression to test whether the firm-productivity and industry-demand factors influence a firm's decision to recapitalize. The dependent variable equals 1 if the firm recapitalized using a leveraged buyout or leveraged recapitalization. The independent variables capture the firm and market conditions for the recapitalizing firm and the industry firms at the time of the 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—THE DECISION TO RECAPITALIZE, LOGIT ANALYSIS

Variable	Coefficient (*t*-statistic)
Least productive plant, TFP_{t-1}	−0.945
	(−3.07)**
Concentration, $C4_{t-1}$	1.494
	(2.12)*
Firm size ($ thousands)	0.0031
	(7.23)**
Demand variables:	
Change in demand	−8.649
	(−4.05)**
(Output price variance)$_{t-1}$	0.0088
	(0.725)
(Output price variance)$_{t-2}$	0.0015
	(0.172)
(Capacity utilization)$_{t-1}$	−0.0106
	(−0.638)
(Capacity utilization)$_{t-2}$	−0.0392
	(−2.148)*
Chi-squared statistic:	56.18
(*p* value):	(0.00)
Number of firms:	867
Number of recapitalizing firms (dependent variable = 1):	40

Notes: TFP is total factor productivity. It is calculated using a regression-based approach assuming the production function is Cobb-Douglas. C4 is the market share of firm shipments for the largest four firms at the four-digit SIC code level.

*Statistically significant at the 5-percent level.

**Statistically significant at the 1-percent level.

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 TFP at the sample means. The probability of recapitalization increases from 3.01 percent to 5.07 percent

[2]The LRD is unique in that it contains the underlying plant-level micro data that is released in aggregate form in the Annual Survey of Manufacturers (ASM) and the Census of Manufacturers. The LRD covers approximately 50,000 plants every year in the ASM, the data base we utilize.

as TFP decreases from the 90th to the 10th percentile. At the sample mean for all variables, the probability of recapitalization is 3.91 percent.

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 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 percent for non-recapitalizing firms versus 5.39 percent for recapitalizing firms. Judith Chevalier (1995) also finds that competitors of leveraged-buyout firms are more likely to enter and expand in the supermarket industry. Phillips (1995) shows that in three out of four highly leveraged industries, industry output decreases and industry price increases, controlling for demand and marginal cost changes. This evidence does not show that 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 investment in industries where high 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.

II. 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 capital 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 to maximize firm value and quantity is chosen simultaneously in the second stage to maximize the return to equity. In 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 lowers 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 and Lewis (1986) (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 firm's profit would increase, and its rival's profit would decrease; total industry profit would be lower. These predictions appear to be inconsistent with the evidence presented on the competitive and investment effects of increased leverage.[4]

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

[3]Brander and Lewis (1986) claim to abstract away from the investment decision (p. 957), but note that if investment is chosen after financial structure is set the effect is similar to their analysis (p. 963). 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 states, a firm's increase in debt will lower its own quantity and increase its rival's quantity. In this case there is no incentive to issue debt.

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 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 leveraged firm is lower than the pre-debt level, while the quantity of the unleveraged rival is higher. Interpreting quantity as capacity, this represents a reduction in the leveraged firm'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 debt obligations, affect the firm's output decisions. In the case most prominent in Brander and Lewis's 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 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 the role of debt payments in constraining the ability of a leveraged 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 states 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 it 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 rival's best-response function, both firms' prices are higher, the leveraged firm's output is lower, and rival's 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 constraint binds. 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 firm's profits and an increase in the rival's profits. Hence, we would not expect to see a positive level of debt.[5]

[5]There are quantity-setting models with profit-maximizing firms in which the internal funding con-

Where does this leave our quest to reconcile theory and the evidence that large increases in debt due to recapitalizations 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. Recapitalizations 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 interpretation of the price-setting models is the assumption that the scale of production is set contingent on prices. Most scholars in industrial organization (we believe) would adhere to the view that, at least for most markets, prices are set contingent on the scale of production. If this is true, the interpretation of the price-setting models is based on an unrealistic assumption.

If one takes the view that strategic-substitute 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 supraoptimal 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 Chaim Fershtman and Kenneth L. Judd's (1987) model of precommitment to managerial incentive schemes in which the intercept term on the market demand function is stochastic. 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 cost 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 made 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 set 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 weight is on sales. In this context, the equilibrium compensation scheme leads to overly aggressive behavior when the realization of demand is low. The weight on sales in the manager's contract is higher than is desired by the firm's owners. The firm would like to be able to get its manager to behave less

straint imposed by leverage may increase a firm's profit. This may arise, for instance, in the case where debt constrains a Stackelberg follower's ability to expand output.

[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.

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

aggressively, by producing a lower quantity for each quantity of the rival. However, it cannot do so because the compensation weights cannot be made contingent on the realization of demand.

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

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[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.