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# The Theory of Capital Structure

MILTON HARRIS and ARTUR RAVIV\*

## ABSTRACT

This paper surveys capital structure theories based on agency costs, asymmetric information, product/input market interactions, and corporate control considerations (but excluding tax-based theories). For each type of model, a brief overview of the papers surveyed and their relation to each other is provided. The central papers are described in some detail, and their results are summarized and followed by a discussion of related extensions. Each section concludes with a summary of the main implications of the models surveyed in the section. Finally, these results are collected and compared to the available evidence. Suggestions for future research are provided.

THE MODERN THEORY OF capital structure began with the celebrated paper of Modigliani and Miller (1958). They (MM) pointed the direction that such theories must take by showing under what conditions capital structure is irrelevant. Since then, many economists have followed the path they mapped. Now, some 30 years later it seems appropriate to take stock of where this research stands and where it is going. Our goal in this survey is to synthesize the *recent* literature, summarize its results, relate these to the known empirical evidence, and suggest promising avenues for future research.<sup>1</sup>

As stated, however, this goal is too ambitious to result in a careful understanding of the state of capital structure research. Consequently, we have chosen to narrow the scope of our inquiry. First, we focus on the *theory* of capital structure. Although we discuss the empirical literature as it relates to the predictions of theory, we make no attempt to give a comprehensive survey of this literature. We simply take the empirical results at face value and do not review or criticize the methods used in these papers. Second, we

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<sup>1</sup> Some other recent surveys include Taggart (1985), Masulis (1988), Miller (1988), Ravid (1988), and Allen (1990) and comments on Miller (1988) by Bhattacharya (1988), Modigliani (1988), Ross (1988), and Stiglitz (1988). Taggart (1985) and Masulis (1988) are general surveys. Allen (1990) focuses on security design, and Ravid (1988) concentrates on interactions between capital structure and the product market.

arbitrarily exclude theories based primarily on tax considerations. While such theories are undoubtedly of great empirical importance, we believe that they have been adequately surveyed.<sup>2</sup> Moreover, tax-based research is not our comparative advantage. Third, we systematically exclude certain topics that, while related to capital structure theory, do not have this theory as their central focus. These include literature dealing with the call or conversion of securities, dividend theories, bond covenants and maturity, bankruptcy law, pricing and method of issuance of new securities, and preferred stock. In short, we concentrate on nontax-driven capital structure theories.

Although the above considerations exclude many papers, a fairly large literature remains. To highlight the current state of the art, we consider mainly papers written since 1980. The only exception to this statement is the inclusion of papers written in the mid-to-late 1970's that serve as the foundation for the more recent literature. A diligent search of both published and unpublished research meeting the above criteria for inclusion resulted in over 150 papers. Obviously, we could not survey all these papers here in detail. Consequently, we were forced to pick and choose those papers that, in our opinion, are the most important or the most representative of a given stream of research. Naturally, this selection process is biased by our own tastes and interests. Thus, we tend to emphasize papers based on the economics of information, incentives, and contracting. We apologize to those authors whose papers were omitted or were not given the attention the authors believe them to deserve.

In organizing the survey, several options were available. One approach which has proved fruitful in other areas is to construct or identify a very general model and then examine how existing models specialize this framework. This approach has the advantage of showing clearly the interrelationships among models. In the case of capital structure, however, the set of features one must include in such a general model is so large and complicated that the resulting structure would not yield clear insights. A related approach is to ask what issues might be resolved by theories of capital structure. This "wish list" would include questions such as what the effect is on capital structure of changes in the volatility of cash flows, firm size, elasticity of demand for the product, the extent of insider private information, etc. The survey would then proceed to document the answers available in the literature. The problem with organizing the survey in this way is that often a single model addresses several issues. Such a model would then require discussion in several places. Moreover, a closely related model focusing on a different issue would be presented separately, making a comparison of the two models difficult to exposit. Because of these difficulties, we have chosen instead to organize our survey based on the forces that determine capital structure.

Grouping models based on the force driving capital structure allows discussion of the model to be consolidated in one place and facilitates an examina-

<sup>2</sup> In addition to those surveys mentioned in footnote 1, see Bradley, et al. (1984).

tion of the relationships among similar models. We have identified four categories of determinants of capital structure. These are the desire to

- ameliorate conflicts of interest among various groups with claims to the firm's resources, including managers (the agency approach),
- convey private information to capital markets or mitigate adverse selection effects (the asymmetric information approach),
- influence the nature of products or competition in the product/input market, or
- affect the outcome of corporate control contests.

Each of these four categories is discussed in a separate section. Many of the papers we survey fit well in more than one category. We include these in the category corresponding to the most important driving force of the model.

In each topic, we first give a brief overview of the papers surveyed and their relation to each other. We then describe in some detail the central papers and their results. This is generally followed by a discussion of related extensions. Note that we do not exposit all the subtleties of even the models on which we focus the most attention. Instead we try to present the main idea in its most stripped-down form. Each section concludes with a summary of the main implications of the models surveyed in the section. Finally, we collect these results and compare them to the available evidence. Since each section is self-contained, readers not interested in the entire survey can pick and choose sections. Moreover, the summary subsection in each of Sections I through IV can also be read independently. Readers interested only in the overall summary and conclusions should read Sections V and VI.

In this survey, we consider only papers that deal with the determination of the relative amounts of debt and equity, taking these securities as exogenous. There is, however, an incipient literature that considers the more fundamental question of why corporate securities are designed the way they are. Many of these papers attempt to explain the allocation of both cash flows and control rights across securities. We review security design models in a separate paper (Harris and Raviv (1990b)).

Briefly, our conclusions are as follows. First, the models surveyed have identified a large number of *potential* determinants of capital structure. The empirical work so far has not, however, sorted out which of these are important in various contexts. Second, the theory has identified a relatively small number of "general principles." Several properties of the debt contract have important implications for determining capital structure. These are the bankruptcy provision, convexity of payoffs of levered equity, the effect of debt on managerial equity ownership, and the relative insensitivity of debt payoffs to firm performance. Third, the empirical evidence is largely consistent with the theory, although there are a few instances where the evidence seems to contradict certain models. These inconsistencies cannot, however, be regarded as conclusive, because the empirical studies were not designed specifically to test the models and were, therefore, not careful about satisfying the *ceteris paribus* conditions. With regard to further theoretical work, it appears

that models relating to products and inputs are underexplored, while the asymmetric information approach has reached the point of diminishing returns. Finally, with regard to further empirical work, it seems essential that empirical studies concentrate on testing particular models or classes of models in an attempt to discover the most important determinants of capital structure in given environments.

The plan of the paper is as follows. In Section I, we discuss models based on agency costs. Models using asymmetric information are considered in Section II. Interactions of capital structure with behavior in the product or input market or with characteristics of products or inputs are taken up in Section III. Section IV surveys models based on corporate control considerations. In Section V, we summarize the theoretical results and compare them with the evidence. Finally, our conclusions are presented in Section VI.

### **I. Models Based on Agency Costs**

A significant fraction of the effort of researchers over the last 10 years has been devoted to models in which capital structure is determined by agency costs, i.e., costs due to conflicts of interest. Research in this area was initiated by Jensen and Meckling (1976) building on earlier work of Fama and Miller (1972).

Jensen and Meckling identify two types of conflicts. Conflicts between shareholders and managers arise because managers hold less than 100% of the residual claim. Consequently, they do not capture the entire gain from their profit enhancement activities, but they do bear the entire cost of these activities. For example, managers can invest less effort in managing firm resources and may be able to transfer firm resources to their own, personal benefit, e.g., by consuming "perquisites" such as corporate jets, plush offices, building "empires," etc. The manager bears the entire cost of refraining from these activities but captures only a fraction of the gain. As a result managers overindulge in these pursuits relative to the level that would maximize firm value. This inefficiency is reduced the larger is the fraction of the firm's equity owned by the manager. Holding constant the manager's absolute investment in the firm, increases in the fraction of the firm financed by debt increase the manager's share of the equity and mitigate the loss from the conflict between the manager and shareholders. Moreover, as pointed out by Jensen (1986), since debt commits the firm to pay out cash, it reduces the amount of "free" cash available to managers to engage in the type of pursuits mentioned above. This mitigation of the conflicts between managers and equityholders constitutes the benefit of debt financing.<sup>3</sup>

<sup>3</sup> Another benefit of debt financing is pointed out by Grossman and Hart (1982). If bankruptcy is costly for managers, perhaps because they lose benefits of control or reputation, then debt can create an incentive for managers to work harder, consume fewer perquisites, make better investment decisions, etc., because this behavior reduces the probability of bankruptcy.

Conflicts between debtholders and equityholders arise because the debt contract gives equityholders an incentive to invest suboptimally.<sup>4</sup> More specifically the debt contract provides that if an investment yields large returns, well above the face value of the debt, equityholders capture most of the gain. If, however, the investment fails, because of limited liability, debtholders bear the consequences. As a result, equityholders may benefit from “going for broke,” i.e., investing in very risky projects, even if they are value-decreasing. Such investments result in a decrease in the value of the debt. The loss in value of the equity from the poor investment can be more than offset by the gain in equity value captured at the expense of debtholders. Equityholders bear this cost to debtholders, however, when the debt is issued if the debtholders correctly anticipate equityholders’ future behavior. In this case, the equityholders receive less for the debt than they otherwise would. Thus, the cost of the incentive to invest in value-decreasing projects created by debt is borne by the equityholders who issue the debt. This effect, generally called the “asset substitution effect,” is an agency cost of debt financing.<sup>5</sup>

Jensen and Meckling argue that an optimal capital structure can be obtained by trading off the agency cost of debt against the benefit of debt as previously described.<sup>6</sup> A number of implications follow. First, one would expect bond contracts to include features that attempt to prevent asset substitution, such as interest coverage requirements, prohibitions against investments in new, unrelated lines of business, etc. Second, industries in which the opportunities for asset substitution are more limited will have higher debt levels, *ceteris paribus*. Thus, for example, the theory predicts that regulated public utilities, banks, and firms in mature industries with few growth opportunities will be more highly levered. Third, firms for which slow or even negative growth is optimal and that have large cash inflows from operations should have more debt. Large cash inflows without good investment prospects create the resources to consume perquisites, build empires, overpay subordinates, etc. Increasing debt reduces the amount of “free cash” and increases the manager’s fractional ownership of the residual

<sup>4</sup> Obviously, conflicts between security holders do not arise if each investor holds all securities in proportion to their values, i.e., if each investor holds a “strip.” Consequently, this literature assumes that equityholders are disjoint classes of investors.

<sup>5</sup> Myers (1977) points out another agency cost of debt. He observes that when firms are likely to go bankrupt in the near future, equityholders may have no incentive to contribute new capital even to invest in value-increasing projects. The reason is that equityholders bear the entire cost of the investment, but the returns from the investment may be captured mainly by the debtholders. Thus larger debt levels result in the rejection of more value-increasing projects. This agency cost of debt yields conclusions about capital structure similar to those of Jensen and Meckling.

<sup>6</sup> Several authors have pointed out that agency problems can be reduced or eliminated through the use of managerial incentive schemes and/or more complicated financial securities such as convertible debt. See Barnea et al. (1985), Brander and Poitevin (1989), and Dybvig and Zender (1989). For a counter view, see Narayanan (1987) and the reply by Haugen and Senbet (1987).

claim. According to Jensen (1989) industries with these characteristics today include steel, chemicals, brewing, tobacco, television and radio broadcasting, and wood and paper products. The theory predicts that these industries should be characterized by high leverage.

All the theories based on agency problems surveyed in the remainder of this section use one of the conflicts introduced by Jensen and Meckling as a starting point. Consequently, we classify these papers into two subsections corresponding to the conflict between equityholders and managers and the conflict between equityholders and debtholders.

### *A. Conflicts between Equityholders and Managers*

The two papers surveyed in this subsection share a common concern with manager-shareholder conflicts but differ according to the specific way in which this conflict arises. More importantly, they also differ in how debt alleviates the problem and in the disadvantages of debt.

In Harris and Raviv (1990a) and Stulz (1990), managers and investors disagree over an operating decision. In particular, in Harris and Raviv managers are assumed to want always to continue the firm's current operations even if liquidation of the firm is preferred by investors. In Stulz, managers are assumed to want always to invest all available funds even if paying out cash is better for investors. In both cases, it is assumed that the conflict cannot be resolved through contracts based on cash flow and investment expenditure. Debt mitigates the problem in the Harris and Raviv model by giving investors (debtholders) the option to force liquidation if cash flows are poor. In Stulz, as in Jensen (1986), debt payments reduce free cash flow. Capital structure is determined by trading off these benefits of debt against costs of debt. In Harris and Raviv, the assertion of control by investors through bankruptcy entails costs related to the production of information, used in the liquidation decision, about the firm's prospects. The cost of debt in Stulz's model is that debt payments may more than exhaust "free" cash, reducing the funds available for profitable investment. This comparison of Harris-Raviv and Stulz is summarized in Table I where the relationship of these two models to Jensen and Meckling (1976) and Jensen (1986) is also shown.<sup>7</sup>

The optimal capital structure in Harris and Raviv trades off improved liquidation decisions versus higher investigation costs. A larger debt level improves the liquidation decision because it makes default more likely. In the absence of default, incumbent management is assumed not to liquidate the firm even if the assets are worth more in their next best alternative use.

<sup>7</sup> Another approach that involves manager-investor conflicts is taken by Williamson (1988). In his view, the benefits of debt are the incentives provided to managers by the rules under which debtholders can take over the firm and liquidate the assets. The costs of debt are that the inflexibility of the rules can result in liquidation of the assets when they are more valuable in the firm. Thus, Williamson concludes that assets that are more redeployable should be financed with debt.

**Table I**  
**Comparison of Agency Models Based on Manager-Shareholder Conflicts**

| Model                      | Conflict               | Benefit of Debt                      | Cost of Debt        |
|----------------------------|------------------------|--------------------------------------|---------------------|
| Jensen and Meckling (1976) | Managerial perquisites | Increase managerial ownership        | Asset substitution  |
| Jensen (1986)              | Overinvestment         | Reduce free cash                     | Unspecified         |
| Harris and Raviv (1990a)   | Failure to liquidate   | Allows investors option to liquidate | Investigation costs |
| Stulz (1991)               | Overinvestment         | Reduce free cash                     | Underinvestment     |

Following a default, however, investors control the liquidation decision, and they expend resources to obtain additional information pertinent to this decision. Since investors choose an optimal liquidation decision based on their information, default improves this decision. More frequent default, however, is more costly as resources are expended investigating the firm when it is in default.

The Harris and Raviv model predicts that firms with higher liquidation value, e.g., those with tangible assets, and/or firms with lower investigation costs will have more debt and will be more likely to default but will have higher market value than similar firms with lower liquidation value and/or higher investigation costs. The intuition for the higher debt level is that increases in liquidation value make it more likely that liquidation is the best strategy. Therefore, information is more useful and a higher debt level is called for. Similarly, decreases in investigation costs also increase the value of default resulting in more debt. The increase in debt results in higher default probability. Harris and Raviv also obtain results on whether a firm in bankruptcy is reorganized or liquidated. They show that the probability of being reorganized decreases with liquidation value and is independent of investigation costs. Using a constant-returns-to-scale assumption they show that the debt level relative to expected firm income, default probability, bond yield, and the probability of reorganization are independent of firm size. Combining these results, Harris and Raviv argue that higher leverage can be expected to be associated with larger firm value, higher debt level relative to expected income, and lower probability of reorganization following default.

The optimal capital structure in Stulz is determined by trading off the benefit of debt in preventing investment in value decreasing projects against the cost of debt in preventing investment in value increasing projects. Thus, as in Jensen (1986), firms with an abundance of good investment opportunities can be expected to have low debt levels relative to firms in mature, slow-growth, cash-rich industries. Moreover, Stulz argues that, in general, managers will be reluctant to implement the optimal debt levels but are more likely to do so the greater is the threat of takeover. Thus, firms more likely to be takeover targets can be expected to have more debt, *ceteris*

*paribus*, while firms with anti-takeover measures will have less debt. Finally, firms whose value-increasing investment opportunities create more value than the value-decreasing ones destroy will have less debt than firms in the opposite situation. The reason is that such firms are primarily concerned with not losing the value-creating opportunities.<sup>8</sup>

### *B. Conflicts between Equityholders and Debtholders*

This subsection surveys two papers in which reputation moderates the asset substitution problem, i.e., the incentive of levered equityholders to choose risky, negative net-present-value investments.<sup>9</sup> Diamond (1989) and Hirshleifer and Thakor (1989) show how managers or firms have an incentive to pursue relatively safe projects out of reputational considerations.<sup>10</sup>

Diamond's model is concerned with a firm's reputation for choosing projects that assure debt repayment. There are two possible investment projects: a safe, positive NPV project and a risky, negative NPV project. The risky project can have one of two payoffs ("success" or "failure"). Both projects require the same initial investment which must be financed by debt. A firm can be of three, initially observationally equivalent types. One type has access only to the safe project, one type has access only to the risky project, and one type has access to both. Since investors cannot distinguish the firms *ex ante*, the initial lending rate reflects their beliefs about the projects chosen by firms on average. Returns from the safe project suffice to pay the debtholders (even if the firm is believed by investors to have only the risky project), but returns from the risky project allow repayment only if the project is successful.

Because of the asset substitution problem, if the firm has a choice of projects, myopic maximization of equity value (e.g., in a one-period situation) would lead the firm to choose the risky project. If the firm can convince lenders it has only the safe project, however, it will enjoy a lower lending rate. Since lenders can observe only a firm's default history, it is possible for a firm to build a reputation for having only the safe project by not defaulting.

<sup>8</sup> A similar approach is taken by Hart and Moore (1990) with similar results. In particular, Hart and Moore (1990) also focus on the agency problems of overinvestment by managers. There are two major differences between the approach of Hart and Moore (1990) and that of Stulz (1990). First, Hart and Moore derive debt as an optimal security in this setting (see Harris and Raviv (1990b)). Second, debt does not prevent overinvestment in the Hart and Moore approach by reducing available free cash flows. Instead, the existence of senior debt constrains the amount of external funds that can be raised since the outstanding debt represents a prior claim on all assets, including new investments. For further discussion of the effects of seniority rules on the under- and overinvestment incentives, see Berkovitch and Kim (1990).

<sup>9</sup> Another literature considers factors that alleviate the underinvestment cost of debt pointed out by Myers (1977) (see footnote 5). Stulz and Johnson (1985) focus on collateral, John and Nachman (1985) focus on reputation, and Bergman and Callen (Forthcoming) consider renegotiation with debtholders. Berkovitch and Kim (1990) and Kim and Maksimovic (Forthcoming) show how debt can be used to trade off the overinvestment and underinvestment effects.

<sup>10</sup> Green (1984) offers another method of mitigating this agency cost. He points out that convertible bonds and warrants "reverse the convex shape of levered equity over the upper range of the firm's earnings" (p.115) and therefore reduce the asset substitution problem.

The longer the firm's history of repaying its debt, the better is its reputation, and the lower is its borrowing cost. Therefore, older, more established firms find it optimal to choose the safe project, i.e., not engage in asset substitution to avoid losing a valuable reputation. Young firms with little reputation may choose the risky project. If they survive without a default, they will eventually switch to the safe project. As a result, firms with long track records will have lower default rates and lower costs of debt than firms with brief histories. Although the amount of debt is fixed in Diamond's model, it is plausible that an extension of the model would yield the result that younger firms have less debt than older ones, other things equal.

Managers may also have an incentive to pursue relatively safe projects out of a concern for *their* reputations. Hirshleifer and Thakor (1989) consider a manager who has a choice of two projects, each with only two outcomes—success or failure. Failure means the same for both projects, but from the point of view of the shareholders, the high-risk-high-return project yields both higher expected returns and higher returns if it succeeds. Suppose that from the point of view of the manager's reputation, however, success on the two projects is equivalent, i.e., the managerial labor market can only distinguish "success" *versus* "failure." Thus the manager maximizes probability of success while shareholders prefer expected return. If the safer project has a higher probability of success, the manager will choose it even if the other project is better for the equityholders. This behavior of managers reduces the agency cost of debt. Thus, if managers are susceptible to such a reputation effect, the firm may be expected to have more debt than otherwise. Hirshleifer and Thakor argue that managers of firms more likely to be takeover targets are more susceptible to the reputation effect. Such firms can be expected to have more debt, *ceteris paribus*. Conversely, firms that have adopted anti-takeover measures will use less debt, other things equal.

### C. Summary of Section I

Agency models have been among the most successful in generating interesting implications. In particular, these models predict that leverage is positively associated with firm value (Hirshleifer and Thakor (1989), Harris and Raviv (1990a), Stulz (1990)), default probability (Harris and Raviv (1990a)), extent of regulation (Jensen and Meckling (1976), Stulz (1990)), free cash flow (Jensen (1986), Stulz (1990)), liquidation value (Williamson (1988), Harris and Raviv (1990a)), extent to which the firm is a takeover target (Hirshleifer and Thakor (1989), Stulz (1990)), and the importance of managerial reputation (Hirshleifer and Thakor (1989)). Also, leverage is expected to be negatively associated with the extent of growth opportunities (Jensen and Meckling (1976), Stulz (1990)), interest coverage, the cost of investigating firm prospects, and the probability of reorganization following default (Harris and Raviv (1990a)). Some other implications include the prediction that bonds will have covenants that attempt to restrict the extent to which equityholders can pursue risky projects that reduce the value of the debt

(Jensen and Meckling (1976)) and that older firms with longer credit histories will tend to have lower default rates and costs of debt (Diamond (1989)). Finally, the result that firm value and leverage are positively related follows from the fact that these two endogenous variables move in the same direction with changes in the exogenous factors (Hirshleifer and Thakor (1989), Harris and Raviv (1990a), Stulz (1990)). Therefore, leverage increasing (decreasing) changes in capital structure caused by a change in one of these exogenous factors will be accompanied by stock price increases (decreases).

## **II. Asymmetric Information**

The introduction into economics of the explicit modeling of private information has made possible a number of approaches to explaining capital structure. In these theories, firm managers or insiders are assumed to possess private information about the characteristics of the firm's return stream or investment opportunities. In one set of approaches, choice of the firm's capital structure signals to outside investors the information of insiders. This stream of research began with the work of Ross (1977) and Leland and Pyle (1977). In another, capital structure is designed to mitigate inefficiencies in the firm's investment decisions that are caused by the information asymmetry. This branch of the literature starts with Myers and Majluf (1984) and Myers (1984). We survey the various approaches in the following subsections.

### *A. Interaction of Investment and Capital Structure*

In their pioneering work, Myers and Majluf (1984) showed that, if investors are less well-informed than current firm insiders about the value of the firm's assets, then equity may be mispriced by the market. If firms are required to finance new projects by issuing equity, underpricing may be so severe that new investors capture more than the NPV of the new project, resulting in a net loss to existing shareholders. In this case the project will be rejected even if its NPV is positive. This underinvestment can be avoided if the firm can finance the new project using a security that is not so severely undervalued by the market. For example, internal funds and/or riskless debt involve no undervaluation, and, therefore, will be preferred to equity by firms in this situation. Even (not too) risky debt will be preferred to equity. Myers (1984) refers to this as a "pecking order" theory of financing, i.e., that capital structure will be driven by firms' desire to finance new investments, first internally, then with low-risk debt, and finally with equity only as a last resort.<sup>11</sup>

<sup>11</sup> Strictly speaking, Myers and Majluf show only that debt whose value is not sensitive to the private information is preferred to equity (e.g. riskless debt). Moreover, if such debt is available, the theory implies that equity never be issued by firms in the situation of extreme information asymmetry they model. Consequently, the "pecking order" theory requires an exogenous debt constraint in the Myers and Majluf model. Note also that there can be a pooling equilibrium in which all firms issue securities, because the project's NPV exceeds the worst underpricing. This equilibrium would not have the properties of the separating equilibrium mentioned in the text.

To understand why firms may pass up positive NPV projects, suppose there are only two types of firms. The current assets of the firm are worth either  $H$  or  $L < H$ , depending on type. Initially, the firm's type is known only to the firm's managers whose objective is to maximize the true value of the current shareholders' claim.<sup>12</sup> Outside investors believe the firm is of type  $H$  with probability  $p$  and type  $L$  with probability  $1 - p$ . Both types of firm have access to a new project that requires an investment of  $I$  and has NPV of  $v$  ( $I$  and  $v$  can be assumed to be common knowledge). The firm must decide whether to accept the project. If the project is accepted, the investment  $I$  must be financed by issuing equity to new shareholders. Consider the following candidate equilibrium. A type  $H$  firm rejects the project and issues no equity while a type  $L$  firm accepts the project and issues equity worth  $I$ . Investors believe that issuance of equity signals that the firm is of type  $L$ . To verify that this is an equilibrium, first notice that investor beliefs are rational. Second, given these beliefs, the equity issued by type  $L$  firms is fairly priced by the market, i.e., current shareholders give up a fraction  $\beta = I/(L + v + I)$  of the firm to new shareholders. Their payoff from taking the project and issuing equity is  $(1 - \beta)(L + v + I) = L + v$ . Consequently, the current shareholders of type  $L$  firms capture the NPV of  $v$  in the new project by issuing equity. They would not prefer to imitate type  $H$  firms since this would require passing up the project along with its positive NPV with no compensating gain in valuation of the existing assets, i.e., their payoff would be  $L$ . Third, if a type  $H$  firm passes up the project, the payoff to current shareholders is simply  $H$ . On the other hand, if a type  $H$  firm imitates a type  $L$  firm by issuing equity, this equity will be priced by the market as if the firm were type  $L$ . In this case, the current shareholders' payoff is  $(1 - \beta)(H + v + I)$ . The underpricing of the new equity can be so severe that current shareholders of the type  $H$  firm give up claims to the existing assets as well as the entire NPV of the new project. They are thus worse off by taking the project. This will happen when the above expression is less than  $H$ , or  $(H - L)\beta > v$ . Consequently, for parameters satisfying this inequality, in equilibrium, only type  $L$  firms will accept the positive NPV project. The left hand side of the inequality is the value transferred to the new equity holders who acquire the fraction  $\beta$  of the firm at the bargain price of  $L$  instead of the true value  $H$ . The inequality then states that underinvestment occurs if this transfer exceeds the NPV of the project.

What are the empirical implications of Myers' "pecking order" theory? Probably the most important implication is that, upon announcement of an equity issue, the market value of the firm's existing shares will fall. Prior to the announcement, the firm's market value (of current shares) is  $pH + (1 -$

<sup>12</sup> This objective function assumes that outside investors will discover the true value of the firm's existing assets soon after the decision to invest is made and that current shareholders will not sell their stakes before this occurs. Dybvig and Zender (1989) point out that optimal contracts with managers could completely resolve the underinvestment problem rendering capital structure irrelevant. The papers surveyed in this section thus implicitly assume that such contracts are ruled out.

$p)(L + v)$ , reflecting prior beliefs about firm type and the equilibrium behavior of the firm. Upon announcement of an equity issue, investors realize that the firm is of type  $L$ , so firm value becomes  $L + v$ . For parameter values satisfying the above inequality,  $pH + (1 - p)(L + v) > L + v$ , i.e., announcement of the equity issue results in a fall in the price of current shares. Moreover, financing via internal funds or riskless debt (or any security whose value is independent of the private information) will not convey information and will not result in any stock price reaction. A second implication is that new projects will tend to be financed mainly from internal sources or the proceeds of low-risk debt issues.<sup>13</sup> Third, Korajczyk, et al. (1990b,c) argue that the underinvestment problem is least severe after information releases such as annual reports and earnings announcements. Therefore equity issues will tend to cluster after such releases and the stock price drop will be negatively related to the time between the release and the issue announcement.<sup>14</sup> Finally, suppose firms with comparatively little tangible assets relative to firm value are more subject to information asymmetries. For such firms, then, the underinvestment problem will occur more often than for similar firms with less severe information asymmetries. These firms can be expected to accumulate more debt over time, other things equal.

A number of authors have extended the basic Myers-Majluf idea. Krasker (1986) allows firms to choose the size of the new investment project and the accompanying equity issue. He confirms the results of Myers and Majluf in this context and also shows that the larger the stock issue the worse the signal and the fall in the firm's stock price.

Narayanan (1988) and Heinkel and Zechner (1990) obtain results similar to Myers and Majluf using a slightly different approach. They show that when the information asymmetry concerns only the value of the new project, there can be overinvestment, i.e., some negative NPV projects will be taken. The reason is that full separation of firms by project NPV is impossible when the only observable signal is whether the project is taken. The equilibrium involves pooling of firms with projects of various NPV with the equity issued by all such firms being priced at the average value. Firms whose projects have low NPV will benefit from selling overpriced equity. This may more than compensate for a negative project NPV. The result is a negative cut-off NPV such that all firms with project NPV above the cut-off accept the project. In Narayanan's model, because (risky) debt is less overpriced than equity, the cut-off level is higher when projects are financed by debt issues.

<sup>13</sup> For example, Bradford (1987) shows that if managers are allowed to purchase the new equity issued by firms in the situation described by Myers and Majluf (1984), then the underinvestment problem is mitigated.

<sup>14</sup> Lucas and McDonald (1990) consider a model in which Myers-Majluf type informational asymmetries are temporary and firms can delay the adoption of projects. They show that firms with private information that current earnings are low will not delay projects, while firms whose current earnings are high will delay until this information becomes public. The result is that, on average, equity is issued after a period of abnormally high returns to the firm and to the market. They also obtain the result that, on average, stock price drops in response to stock issues.

In Heinkel and Zechner, existing debt makes investment less attractive (as in Myers (1977)) and increases the cut-off level. Thus new (Narayanan) or existing (Heinkel and Zechner) debt reduces the overinvestment problem relative to all equity financing. The models imply that when a firm accepts a new project, the firm's stock price will increase since the market discovers that the firm's new project's NPV is above the cut-off level. Narayanan shows that when firms are allowed to issue either debt or equity, all firms either issue debt or reject the project. In this sense, his results are consistent with the "pecking order" theory. Since project acceptance is associated with issuing debt, debt issues are good news, i.e., result in an increase in the firm's stock price. This implication is the opposite of Myers and Majluf (1984). Debt is not a signal in Heinkel and Zechner since it is issued before firms have private information. Also, internal funds can substitute for debt in Heinkel and Zechner. Note that it is crucial to the results of both Narayanan and Heinkel-Zechner that acceptance or rejection of the project is the signal. If investors could observe only whether the firm issues securities, firms with negative NPV projects could imitate good firms by issuing the same security but investing the proceeds in Treasury bills.

Brennan and Kraus (1987), Noe (1988), and Constantinides and Grundy (1989) cast doubt on the "pecking order" theory. These papers enrich the set of financing choices that a firm may make when faced with the situation modeled by Myers and Majluf (1984).<sup>15</sup> They conclude that firms do not necessarily have a preference for issuing straight debt over equity and that the underinvestment problem can be resolved through signaling with the richer set of financing options.

Brennan and Kraus offer an example similar to those in Myers and Majluf. There are two types of firms, say  $L$  and  $H$ , as above. Here, each type of firm has debt outstanding initially. In equilibrium, firm type  $H$  issues enough equity to finance the new project *and* retire its outstanding debt at face value. Firm type  $L$  issues only enough equity to finance the new project. Investors infer the firm type correctly. The debt of type  $H$  firms is risk free in this example. Therefore, type  $H$  firms obtain a "fair" deal on both their equity issue and debt repurchase. Type  $H$  firms do not imitate type  $L$  firms because by so doing the type  $H$  firm's equity would be underpriced. Type  $L$  firms do not imitate type  $H$  firms because repurchase of their debt at full face value entails an overpayment (i.e., for type  $L$  firms, the debt is risky). The cost of this overpayment for the debt exceeds the benefits available from selling overpriced equity. Thus, in equilibrium, both types of firms issue equity and accept the positive NPV project. Obviously, the underinvestment result of Myers and Majluf does not obtain in this example. Moreover, firms are allowed to issue debt but do not. This is inconsistent with the "pecking order" theory. Finally, issuing equity in the Brennan and Kraus model is a

<sup>15</sup> Brennan-Kraus and Constantinides-Grundy use a method similar to one first introduced by Heinkel (1982) to obtain costless signaling (see Section II.B).

negative signal, but simultaneously issuing equity and using *part* of the proceeds to repurchase debt is a positive signal.

Constantinides and Grundy (1989) allow firms to issue any type of security and to repurchase existing equity. Another variation from the basic Myers-Majluf setup is that managers are assumed to have an equity stake in the firm whose true value they maximize. Constantinides and Grundy show that there is a fully separating equilibrium (even with a continuum of firm types) in which all types of firm take the positive NPV investment financed by an issue of a security that is neither straight debt nor equity. The new security is issued in an amount sufficient to finance the new investment and repurchase some of the firm's existing equity. This issued security is locally convex in firm value at the true value and locally concave for at least some firm value below the true value (see their (1989) Theorem 3). Constantinides and Grundy interpret these characteristics as being those of convertible debt. The basic idea is that the repurchase of equity makes it costly for firms to overstate their true value while the issuance of a security that is sensitive to firm value makes it costly to understate true value. Separation is attained by the design and size of the new issue so that, at the true value of the firm, these effects balance at the margin. In this model, the underinvestment problem is costlessly resolved. Although firms may issue some form of debt, the model does not support the "pecking order" rule. That is, there is no overriding reason to finance using internal funds or riskless debt.

Noe (1988) allows firms to issue either debt or equity. He presents an example with three firm types, say  $L$ ,  $M$ , and  $H$ . In equilibrium all types accept the positive NPV project, but types  $L$  and  $H$  issue debt while type  $M$  issues equity. Investors revise their beliefs about firm type using Bayes' rule (e.g., they correctly identify type  $M$ ). Either security issued by type  $L$  would be overpriced as a result of being confused either with type  $M$  or type  $H$ . Debt is less sensitive to firm type than equity, but, since firm type  $H$  is much better than firm type  $M$  in this example,  $L$ 's debt is more overpriced than its equity. Consequently, type  $L$  chooses to "imitate" type  $H$ . Debt issued by type  $M$  is actually risk free, but, if it is confused with debt of type  $L$ , will be perceived to be risky by investors. Consequently, if type  $M$  issues debt, the debt will be underpriced. Therefore, type  $M$  prefers to issue fairly priced equity. Either security issued by type  $H$  would be underpriced. In the example, firm type  $H$ 's debt is less underpriced both because it is less sensitive to firm quality and because the probability that a firm is of type  $L$  (the only type whose debt is risky) is low. Consequently, type  $H$  prefers to "imitate" type  $L$  and issue debt. Notice that all three types accept the project, that one type actually prefers to issue equity, and that the equity issuing firm is not the lowest quality.<sup>16</sup>

<sup>16</sup> Nachman and Noe (1989) consider a similar situation in which firms have private information about the value of a new investment. They assume, however, that firms can issue any monotone increasing security in a broad class. They show, under certain assumptions on the ordering of firm types, that the only equilibrium is one in which all firms issue debt.

Brennan and Kraus, Constantinides and Grundy, and Noe demonstrate that allowing firms a wider range of financing choices can invalidate the Myers-Majluf results in some cases. Whether the type of examples identified in these papers are more important empirically than those of Myers-Majluf is an open question. We note, however, that Noe shows that the average quality of firms issuing debt is higher in equilibrium than that of firms issuing equity. Therefore, like Myers-Majluf, Noe's model predicts a negative stock market response to an announcement of an equity issue. Noe also predicts a positive market response to an announcement of a debt issue. Moreover, when Constantinides and Grundy further extend the model to allow different firm types to have different optimal investment levels and assume that investment is observable, they show that firms can fully separate using investment and the size of a straight bond issue (with some share repurchase) as signals. Thus, in this situation straight debt is a preferred financing tool, although the reason here is that it helps to signal a firm's true type while in Myers-Majluf, debt is a device to avoid signaling. Also in this variant of the model, the market reaction to a stock repurchase financed by debt is more favorable the larger is the transaction.

### *B. Signaling with Proportion of Debt*

In the previous subsection, capital structure emerged as part of the solution to problems of over- and underinvestment. We turn now to models in which investment is fixed and capital structure serves as a signal of private insider information.

The seminal contribution in this area is that of Ross (1977). In Ross' model, managers know the true distribution of firm returns, but investors do not. Firm return distributions are ordered by first order stochastic dominance. Managers benefit if the firm's securities are more highly valued by the market but are penalized if the firm goes bankrupt. Investors take larger debt levels as a signal of higher quality.<sup>17</sup> Since lower quality firms have higher marginal expected bankruptcy costs for any debt level, managers of low quality firms do not imitate higher quality firms by issuing more debt.

The following is a simple formal model. Suppose that the date-one returns  $\tilde{x}$  of a firm of type  $t$  are distributed uniformly on  $[0, t]$ . The manager is privately informed about  $t$ . He chooses the face value of debt  $D$  to maximize a weighted average of the market value of the firm at date zero and the expected value at date one, net of a penalty  $L$  for bankruptcy.<sup>18</sup> We denote by

<sup>17</sup> An equivalent approach is to assume that managers can commit to paying dividends and suffer a penalty if the promised dividend is not paid. Ravid and Sarig (1989) consider a combination of debt and dividend commitment. They show that both dividends and debt level increase with firm quality.

<sup>18</sup> This objective function reflects the implicit assumptions that the manager's welfare is increasing in the current and future stock price and decreases in the event of bankruptcy. This "bankruptcy penalty" could result from loss of reputation or search costs of finding a new position. The penalty is not a bankruptcy cost since it effects only the manager's welfare and not firm value.

$V_0(D)$  the value assigned to the firm at date zero by the market if the debt level is  $D$ . The manager's objective function is then

$$(1 - \gamma)V_0(D) + \gamma(t/2 - LD/t).$$

The parameter  $\gamma$  is a weight. The expected payoff at date one, given the manager's information is simply  $t/2$ . He evaluates the bankruptcy probability as  $D/t$ . If investors infer that  $t = a(D)$  when the manager issues debt of face value  $D$ , then

$$V_0(D) = a(D)/2.$$

Substituting this into the objective function and taking the derivative with respect to  $D$  gives the first order condition. In equilibrium, investors correctly infer  $t$  from  $D$ , i.e., if  $D(t)$  is the manager's optimal choice of debt level as a function of the firm type  $t$ , then  $a(D(t)) \equiv t$ . Using this in the first order condition and solving the resulting differential equation gives

$$D(t) = ct^2/L + b,$$

where  $c$  and  $b$  are constants.

The main empirical result is that firm value (or profitability) and the debt-equity ratio are positively related.<sup>19</sup> It is also easily seen from the above formula that increases in the bankruptcy penalty, other things equal, decrease the debt level and the probability of bankruptcy. Ross also shows that this probability is increasing in firm type  $t$ . Thus firm value, debt level, and bankruptcy probability are all positively related in this model.

Heinkel (1982) considers a model similar to Ross but does not assume that firm returns are ordered by first order stochastic dominance. Instead, the return distribution is assumed to be such that "higher" quality firms have higher overall value but lower quality bonds (lower market value for given face value), hence higher equity value. This allows firms to separate costlessly when insiders maximize the value of their residual claim subject to raising a given amount of external capital.<sup>20</sup> The reason is that any firm attempting to convince the market that it is a type other than its true type will gain from overvaluation of one security and lose from undervaluation of the other. In equilibrium, the amounts issued of the two securities for each type firm are such that the gains and losses balance at the margin. High value firms issue more debt. To imitate a high value firm, a lower value firm must issue more underpriced debt and reduce the amount of overpriced equity. Similarly, to imitate a low value firm, a higher value firm must issue

<sup>19</sup> This can be seen by calculating the value of the debt and equity as functions of  $D(t)$  and  $t$ , taking the ratio, and showing that this ratio is increasing in  $t$  (see Ross (1977, p.37)). As will be seen below, many other models also imply a positive relation between firm profitability and leverage. Interestingly, Chang (1987), using an agency model, obtains the opposite results. Since Chang derives optimal securities, his paper is considered in our companion survey, Harris and Raviv (1990b).

<sup>20</sup> See also Franke (1987) for a similar financial signaling model with costless separation of firms.

less overpriced debt and more underpriced equity. Since higher quality firms have higher total value, the result that they issue more debt is consistent with Ross' result.<sup>21</sup>

Another model that uses debt as a signal is that of Poitevin (1989) which involves potential competition between an incumbent firm and an entrant. The entrant's marginal costs are privately known by the entrant.<sup>22</sup> In equilibrium, low cost entrants signal this fact by issuing debt while the incumbent and high cost entrants issue only equity. The cost to a firm of issuing debt is that it makes the firm vulnerable to predation by the other firm, possibly resulting in bankruptcy of the debt-financed firm. The benefit of debt is that the financial market places a higher value on the debt financed firm since it believes such a firm to be low cost. High cost entrants will not issue debt since the resulting probability of bankruptcy due to predation by the incumbent renders the cost of misleading the capital market too high (incumbents prey equally on all debt-financed firms, even if thought to be low cost). The main result, like the other models in this subsection, is that issuance of debt is good news to the financial market. Since predation is used only to drive one's rival into bankruptcy, there will be predation only against debt-financed firms.

### C. Models Based on Managerial Risk Aversion

Several studies exploit managerial risk aversion to obtain a signaling equilibrium in which capital structure is determined. The basic idea is that increases in firm leverage allow managers to retain a larger fraction of the (risky) equity. The larger equity share reduces managerial welfare due to risk aversion, but the decrease is smaller for managers of higher quality projects. Thus managers of higher quality firms can signal this fact by having more debt in equilibrium.<sup>23</sup>

A simple formal model based on Leland and Pyle (1977) is as follows. Consider an entrepreneur whose project returns  $\tilde{x} = \mu + \tilde{\epsilon}$  with  $E\tilde{\epsilon} = 0$  and

<sup>21</sup> Another signaling model that obtains this result is John (1987).

<sup>22</sup> Glazer and Israel (1990) also consider a model in which capital structure is used to signal costs of production. Unlike in Poitevin, in Glazer and Israel, an incumbent monopolist signals his cost to prevent entry. The incumbent's manager is assumed to be compensated based on the terminal value of equity, *not* including any dividends. Glazer and Israel assume that the proceeds of any debt issued are paid out in dividends. Therefore, leverage increases are costly for the manager. In equilibrium, potential entrants interpret more debt as indicative that the incumbent has lower marginal production costs. It is optimal for managers of low cost incumbents to issue more debt since for them the benefit of preventing entry exceeds the cost of debt. Managers of high cost incumbents will not imitate since for them the value of entry prevention is lower. Note, however, that signaling could work equally well using dividends financed by retained earnings or preferred stock instead of by debt. The authors recognize this point and do not claim that their results constitute a theory of capital structure. Gertner, et al. (1988) also consider a model in which firms use capital structure as a signal in the output market (as well as in the capital market). Their main result is that whether the equilibrium will involve pooling or separation depends on what is best for the informed firm.

<sup>23</sup> In addition to the papers discussed below, see Blazenko (1987).

who must raise  $I$  from external sources. The entrepreneur observes expected return  $\mu$ , but investors do not. He chooses the fraction of the equity he retains  $\alpha$  and the face value of default-free debt  $D$  to maximize his expected utility of end-of-period wealth  $Eu(\tilde{W})$  where:<sup>24</sup>

$$\tilde{W} = \alpha(\tilde{x} - D) + (1 - \alpha)(V(\alpha) - D) + D = \alpha\tilde{x} + (1 - \alpha)V(\alpha),$$

subject to the constraint that  $I$  of external funds must be raised.

$$(1 - \alpha)[V(\alpha) - D] + D = I.$$

Here  $V(\alpha)$  is the market's assessment of the value of the firm given that the entrepreneur retains the fraction  $\alpha$  of the equity. We have also assumed that there is no investment required ( $K = 0$  in Leland and Pyle's notation) since this does not affect the results. Although the debt level  $D$  does not affect the entrepreneur's objective directly, his choice of  $\alpha$  implies a debt level through the external-funds constraint.<sup>25</sup> It is clear from the formula for  $\tilde{W}$  that increases in the entrepreneur's share  $\alpha$  increase the riskiness of his portfolio (since  $V(\alpha)$  is riskless cash) but also increase the amount he obtains for the share sold to outsiders through signaling (since  $V$  is increasing in  $\alpha$ , in equilibrium).

The first order condition for  $\alpha$  is obtained by differentiating  $Eu(\tilde{W})$  with respect to  $\alpha$ , substituting the equilibrium condition that  $V(\alpha(\mu)) = \mu$  (where  $\alpha(\mu)$  is the entrepreneur's optimal ownership share if his expected return is  $\mu$ ), and setting the result equal to zero. It can be shown from this condition that the entrepreneur's equilibrium ownership share  $\alpha$  increases with firm quality. To translate this into a capital structure theory, we must calculate the effect on the debt level  $D$  of changes in firm quality using the external-funds constraint. Increases in  $\mu$  result in increases in  $\alpha$  as just shown; however, the increase in  $\alpha$  has two opposing effects on  $D$ . The increased ownership of the entrepreneur, other things equal, would require that more funds be raised by debt. Firm value  $V$  is, however, larger for larger  $\alpha$ , so that equity holders may pay more for the smaller fraction of the firm they receive. Consequently,  $D$  may not need to increase to finance the increased ownership share of the entrepreneur. Leland and Pyle (1977) derive some conditions on the parameters of an example that guarantee that debt increases with  $\alpha$ . Under these conditions, firms with larger debt also have a larger fraction of the equity owned by insiders and are of higher quality.<sup>26</sup>

<sup>24</sup> This expression reflects the assumption that the amount raised externally,  $(1 - \alpha)[V(\alpha) - D] + D$ , is invested in a riskless asset with zero return.

<sup>25</sup> In fact, the debt level determined in the Leland and Pyle model is the total debt issued by the corporation and the entrepreneur on personal account. The results can be interpreted as a theory of corporate capital structure only if personal debt is costly.

<sup>26</sup> Darrough and Stoughton (1986) incorporate moral hazard into the Leland and Pyle formulation. The manager is assumed to choose an effort level after securities are issued. The marginal product of effort  $\mu$  and the standard deviation of returns  $\sigma$  are known only to the entrepreneur, but investors know that  $\sigma = \mu^2$ . In this model, the fraction of equity retained by the entrepreneur is both a signal of  $\mu$  and  $\sigma$  and an incentive device. The entrepreneur retains a smaller fraction the more risky are the returns. There are no specific results linking debt level or capital structure to observable characteristics of the firm.

#### *D. Summary of Section II*

The main predictions of asymmetric information theories concern stock price reactions to issuance and exchange of securities, the amount of leverage, and whether firms observe a pecking order for security issues.

##### *Stock Price Effects of Security Issues*

- Debt: Myers and Majluf (1984) and Krasker (1986) predict the absence of price effects upon issuance of (riskless) debt. Noe (1988) and Narayanan (1988) predict a positive price effect of a (risky) debt issue.
- Equity: Myers and Majluf (1984), Krasker (1986), Noe (1988), Korajczyk, et al. (1990c), and Lucas and McDonald (1990) predict a negative price effect of an equity issue. This price drop will be larger the larger is the informational asymmetry and the larger is the equity issue. Moreover, Lucas and McDonald (1990) show that, on average, equity issues will be preceded by abnormal stock price increases.

##### *Stock Price Effects of Exchange Offers*

- Debt Increasing Offers: Constantinides and Grundy (1989) predict a positive stock price reaction that is larger the larger the exchange.
- Equity Increasing Offers: Brennan and Kraus (1987) predict a positive stock price reaction.

##### *Is There a Pecking Order?*

- Yes: Myers and Majluf (1984), Krasker (1986), and Narayanan (1988).
- No: Brennan and Kraus (1987), Noe (1988), Constantinides and Grundy (1989) dispute the pecking order result in models similar to that of Myers and Majluf. Other signaling models, such as Ross (1977), Leland and Pyle (1977), and Heinkel (1982) do not obtain a pecking order result.

##### *Leverage*

Myers and Majluf (1984) implies that leverage increases with the extent of the informational asymmetry. Ross (1977), Leland and Pyle (1977), Heinkel (1982), Blazenko (1987), John (1987), Poitevin (1989), and Ravid and Sarig (1989) all derive a positive correlation between leverage and value in a cross section of otherwise similar firms. Ross (1977) also predicts a positive correlation between leverage or value and bankruptcy probability, while Leland and Pyle (1977) predict a positive correlation between value and equity ownership of insiders.

### **III. Models Based on Product/Input Market Interactions**

Models of capital structure that use features of the theory of industrial organization have begun to appear in the literature. These models can be classified into two categories. One class of approaches exploits the relationship between a firm's capital structure and its *strategy* when competing in

the product market. A second class of approaches addresses the relationship between a firm's capital structure and the *characteristics* of its product or inputs. These two literatures are surveyed in the next two subsections.

### *A. Debt Influences Strategic Interaction Among Competitors*

Until recently, the industrial organization literature has assumed that in choosing its competitive strategy the firm's objective is to maximize total profits. The finance literature, on the other hand, has focused on maximization of equity value while generally ignoring product market strategy. The new literature linking capital structure and product market strategy adopts the finance view that managers generally have incentives to maximize equity value as opposed to profits or total value. In these papers, leverage changes the payoffs to equity and thus affects the equilibrium product market strategies.

One of the initial papers in this line of research was Brander and Lewis (1986).<sup>27</sup> They use the basic idea of Jensen and Meckling (1976) (see Section I) that increases in leverage induce equity holders to pursue riskier strategies. In the Brander and Lewis model, oligopolists increase risk by a more aggressive output policy. Thus, to commit to pursuing a more aggressive strategy in a subsequent Cournot game, firms choose positive debt levels.

To see how this process works in somewhat more detail, consider the following formal model based on Brander and Lewis. There are two firms,  $i = 1, 2$ . The two firms first commit simultaneously to a debt level  $D_i$ , then choose simultaneously an output level  $q_i$ . Profits to firm  $i$  are given by  $R^i(q_i, q_j, z_i)$  where  $z_1$  and  $z_2$  are independent and identically distributed shocks to the firms' profits. We assume that firm  $i$ 's profits are decreasing in the other firm's output and increasing in the random shock  $z_i$ . Also, firm  $i$ 's marginal profit ( $\partial R^i / \partial q_i$ ) is increasing in the random shock  $z_i$  and decreasing in the other firm's output.

These assumptions are fairly standard in Cournot-equilibrium models except for the assumption that marginal profit increases with the random component.<sup>28</sup> This assumption states that the marginal "product" (profit) of output is large in "good" states (when  $z$  is large). If the marginal product of output is high, the firm will optimally choose higher output than if it is low. But in this model the firm must choose output before its marginal product is known. Since levered equity holders receive payoffs only in good states (because of limited liability), however, they ignore the possibility that the marginal product of output is low. Consequently, leverage creates an incentive to increase output. Moreover, in Cournot oligopoly models, firms have an incentive to commit to producing large outputs since this causes their rivals

<sup>27</sup> Two other treatments that are contemporaneous with Brander and Lewis (1986) are Allen (1985) and Maksimovic (1986). For a similar treatment, see Maksimovic (1989).

<sup>28</sup> Brander and Lewis consider both this case and the case in which the marginal profit is decreasing with  $z$ . They consider the increasing case to be the most important empirically, since, in the other case, firms will be unlevered in equilibrium.

to produce less. Leverage thus provides a device that allows firms to commit to producing more in the Cournot oligopoly. Therefore, in equilibrium, both firms will choose a positive debt level. Notice that the firms are worse off in this equilibrium than they would be in an all-equity Cournot equilibrium since, with leverage, firms produce more than the Cournot output.<sup>29</sup>

When oligopolies persist over time, tacit collusion is possible through the use of punishment strategies triggered when a rival deviates from the collusive output level. It is well known (see Green and Porter (1984)) that the monopoly solution can be achieved in an infinitely repeated Cournot oligopoly by a subgame perfect equilibrium in which each firm reverts to the Cournot output forever in the period after any firm deviates from its share of the monopoly output. The condition that is required for this result is that the present value of monopoly profits exceeds the value of deviating for one period, then obtaining Cournot profits forever. If we denote monopoly profits per period by  $\pi_m$ , Cournot profits per period by  $\pi_c$ , the one-period profit from deviating by  $\pi_d$ , and the discount rate by  $r$ , the condition required for supporting the monopoly solution is

$$\pi_m + \pi_m/r > \pi_d + \pi_c/r.$$

Maksimovic (1988) points out that if managers are assumed to maximize the value of equity (as opposed to the value of the firm) this condition must be modified. In particular, suppose the firm has issued debt that promises to pay  $b$  per period forever, where  $b \geq \pi_c$  (otherwise, the debt has no effect since it will be paid even if the firm reverts to the Cournot equilibrium). Now, if the firm deviates, equity holders receive  $\pi_d - b$  for one period, then nothing thereafter since the assets will be transferred to bondholders (who will then follow the Cournot strategy forever). The condition for supporting the monopoly solution is therefore

$$\pi_m - b + (\pi_m - b)/r > \pi_d - b \quad \text{or} \quad b < \pi_m + (\pi_m - \pi_d)r.$$

Maksimovic interprets this as a debt capacity, i.e., the maximum amount of leverage that firms in such industries can support without destroying the possibility of tacit collusion.

By modeling profits explicitly in terms of demand and cost functions and number of firms, Maksimovic is able to derive comparative static results on debt capacity as a function of industry and firm characteristics. He shows that debt capacity increases with the elasticity of demand and decreases with the discount rate. Assuming some advantage for debt (e.g. taxes), so that the firm's actual debt will be at capacity, makes these implications potentially testable.<sup>30</sup>

<sup>29</sup> Glazer (1989) shows that when long run considerations are taken into account in a Brander and Lewis type model, firms have an incentive to issue long term debt which helps in enforcing a form of tacit collusion.

<sup>30</sup> Maksimovic (1990) extends this analysis to the case in which firms are privately informed about their own productivity.

*B. Debt Influences Interaction with Customers and/or Suppliers*

The second industrial-organization-based approach to capital structure determination is to identify product (input) or product market (input market) characteristics that interact in a significant way with the debt level. The examples included here are customers' need for a particular product or service, the need for workers to invest in firm-specific human capital, product quality, and the bargaining power of workers or other suppliers.

Titman (1984) observes that liquidation of a firm may impose costs on its customers (or suppliers) such as inability to obtain the product, parts, and/or service.<sup>31</sup> These costs are transferred to the stockholders in the form of lower prices for the firm's product. Consequently, the stockholders would like to commit to liquidate only in those states in which the net gains to liquidation exceed the costs imposed on customers. Unfortunately, when the firm's investors make the liquidation decision, they ignore these costs. Titman shows that capital structure can be used to commit the shareholders to an optimal liquidation policy. Specifically, capital structure is arranged so that stockholders never wish to liquidate, bondholders always wish to liquidate when the firm is in bankruptcy, and the firm will default only when the net gain to liquidation exceeds the cost to customers. It is shown that firms for which this effect is more important, e.g., computer and automobile companies, will have less debt, other things equal, than firms for which this effect is less important, e.g., hotels and restaurants. In general, for unique and/or durable products, the cost imposed on customers when a producer goes out of business is higher than for nondurable products or those made by more than one producer.

Maksimovic and Titman (Forthcoming) show that producers of nonunique and nondurable goods may also be subject to a similar effect. Consider a firm that can produce goods of high or low quality in any period, and suppose that consumers cannot distinguish quality until after consuming the good. Even though high quality costs more to produce, it may be worthwhile for the firm to produce high quality if it can establish a reputation for being a high quality producer. If, however, this reputation is lost (at least to stockholders) when the firm goes bankrupt, then the incentive to produce high quality is diminished by debt. Consequently, one would expect firms that can easily switch from high to low quality output but whose customers cannot distinguish quality without purchasing the good, to have less debt, other things equal.

Another advantage of debt is that debt strengthens the bargaining position of equity holders in dealing with input suppliers. Sarig (1988) argues that bondholders bear a large share of the costs of bargaining failure but get only a small share of the gains to successful bargaining. That is, bondholders insure stockholders to some extent against failure of negotiations with sup-

<sup>31</sup> Allen (1985) also focuses on bankruptcy costs emanating from the product market. He points out that firms in financial distress may postpone investments, thus giving an advantage to their competitors. See also John and Senbet (1988).

pliers. Increases in leverage increase the extent of this insurance and therefore increase the equity holders' threat point in negotiating with suppliers. As a result, debt can increase firm value. This implies that a firm should have more debt the greater is the bargaining power and/or the market alternatives of its suppliers. Thus, Sarig predicts that highly unionized firms and/or firms that employ workers with highly transferable skills will have more debt, *ceteris paribus*.

### C. Summary of Section III

Capital structure models based on product/input market interactions are in their infancy. These theories have explored the relationship between capital structure and either product market strategy or characteristics of products/inputs. The strategic variables considered are product price and quantity. These strategies are determined to affect the behavior of rivals, and capital structure in turn affects the equilibrium strategies and payoffs. Models involving product or input characteristics have focused on the effect of capital structure on the future availability of products, parts and service, product quality, and the bargaining game between management and input suppliers.

The models show that oligopolists will tend to have more debt than monopolists or firms in competitive industries (Brander and Lewis (1986)), and that the debt will tend to be long term (Glazer (1989)). If, however, tacit collusion is important, debt is limited, and debt capacity increases with the elasticity of demand (Maksimovic (1988)). Firms that produce products that are unique or require service and/or parts and firms for which a reputation for producing high quality products is important may be expected to have less debt, other things equal (Titman (1984) and Maksimovic and Titman (Forthcoming)). Finally, highly unionized firms and firms whose workers have easily transferable skills should have more debt (Sarig (1988)).

Models of capital structure based on industrial organization considerations have the potential to provide interesting results. For example, models similar to the ones surveyed above could delineate more specifically the relationship between capital structure and observable industry characteristics such as demand and supply conditions and extent of competition. In addition, it would be useful to explore the impact of capital structure on the choice of strategic variables other than price and quantity. These could include advertising, research and development expenditure, plant capacity, location, and product characteristics. Such research could help in explaining inter-industry variations in capital structure.

## IV. Theories Driven by Corporate Control Considerations

Following the growing importance of takeover activities in the 1980's, the finance literature began to examine the linkage between the market for corporate control and capital structure. These papers exploit the fact that

common stock carries voting rights while debt does not. In this section, we discuss three contributions. In Harris and Raviv (1988) and Stulz (1988), capital structure affects the outcome of takeover contests through its effect on the distribution of votes, especially the fraction owned by the manager. In Israel (Forthcoming), capital structure affects the distribution of cash flows between voting (equity) and nonvoting (debt) claimants.

The first models to exploit the differential voting rights of debt and equity are those of Harris and Raviv (1988) and Stulz (1988). These two models generate a relationship between the fraction of the equity owned by a firm's manager and the value of outside equity (equity held by noncontestants). This relationship follows from the dependence of firm value on whether the firm is taken over and, if so, how much is paid by the successful bidder. The manager's equity ownership is determined in part by the firm's capital structure. Thus, capital structure affects the value of the firm, the probability of takeover, and the price effects of takeover. In what follows, we explain the models in more detail and compare their implications.

Harris and Raviv (1988) focus on the ability of an incumbent firm manager to manipulate the method and probability of success of a takeover attempt by changing the fraction of the equity he owns. Since the incumbent and the rival have different abilities to manage the firm, the value of the firm depends on the outcome of the takeover contest. The manager's ownership share determines one of three possible outcomes: the rival takes over for sure, the incumbent remains in control for sure, or the outcome is determined by the votes of passive investors, and this results in the election of the better candidate. The optimal ownership share is determined by the incumbent manager who trades off capital gains on his stake against the loss of any personal benefits derived from being in control. Since the manager's ownership share is determined indirectly by the firm's capital structure, this tradeoff results in a theory of capital structure.

The following is a simplified version of the Harris and Raviv model. An incumbent entrepreneur/manager  $I$  owns an initial fraction  $\alpha_0$  of an all-equity-financed firm. The remaining equity is held by passive investors who are not contenders for control. The incumbent obtains benefits of control of expected value  $B$  as long as he controls the firm. These benefits can be thought of as private control benefits or as the value of cash flows that he can expropriate from the firm if he is in control. The value of the cash flows (not including  $B$ ) generated by the firm depends on the ability of the manager. There are two possible ability levels, 1 and 2, and the corresponding values of the cash flows are denoted  $Y_1$  and  $Y_2$ , with  $Y_1 > Y_2$ .

In addition to the incumbent and passive investors, there is also a rival for control of the firm,  $R$ . If the rival takes over, he also obtains benefits of control. The abilities of the incumbent and rival are unobservable by all parties, but it is common knowledge that one is of higher ability than the other. That is, everyone knows that, with probability  $p$ , the incumbent has ability 1 and, with probability  $1 - p$ , the rival has ability 1. The other has ability 2. Thus the value of the firm's cash flows if the incumbent controls is

$Y_I$ , and if the rival controls it is  $Y_R$ , where

$$Y_I = pY_1 + (1 - p)Y_2 \text{ and } Y_R = (1 - p)Y_1 + pY_2.$$

When the rival appears, the incumbent first chooses a new fraction  $\alpha$  of the equity of the firm (this change in ownership is the result of a change in capital structure; see below). The rival then acquires equity from the passive investors. The takeover contest is decided by a simple majority vote (ties go to the incumbent) where the two contestants each vote for themselves, and the fraction  $\pi$  of the passive investors vote for the incumbent (the rest vote for the rival).<sup>32</sup>

Depending on the choices of equity ownership by the incumbent and rival, the takeover contest can have one of three possible outcomes. First, the incumbent's stake may be so small that, even if the rival is of lower ability, he still succeeds in taking over. Harris and Raviv (1988) refer to this case as that of a *successful* tender offer. The value of the cash flows in this case is  $Y_R$ . Second, the incumbent's stake may be so large that even if he is of lower ability, he still remains in control. This is referred to as the case of an *unsuccessful* tender offer, and the value of the cash flows in this case is  $Y_I$ . Finally, for intermediate values of  $\alpha$ , the incumbent will win if and only if he is of higher ability. This case is called a *proxy fight*, since the identity of the winner is uncertain until the vote is actually taken. Note, however, that in this case, the best candidate wins for sure, and hence the value of the cash flows is  $Y_1$ . The value of the firm's cash flows  $Y(\alpha)$  is determined by the incumbent's stake  $\alpha$  through its effect on which of the above three cases prevails. Since  $Y_1$  is larger than either  $Y_I$  or  $Y_R$  if the objective were to maximize the value of the cash flow to outside investors, then  $\alpha$  in the proxy fight range would be optimal. This would result in a model more similar to that of Stulz (1988) as will be seen below.

The objective in choosing the incumbent's share  $\alpha$  is to maximize his expected payoff. This payoff is the value of his equity stake plus the value of his control benefits if he remains in control. The value of the incumbent's equity stake is  $\alpha_0 Y(\alpha)$ , where  $\alpha_0$  is his *initial* equity stake, since any transactions in which he engages to change his stake have zero net present value. Therefore, the incumbent's payoff  $V(\alpha)$  is  $\alpha_0 Y_R$  if there is a successful tender offer (benefits of control are lost),  $\alpha_0 Y_I + B$  if there is an unsuccessful tender offer (benefits retained for sure), and  $\alpha_0 Y_1 + pB$  if there is a proxy fight (benefits retained with probability  $p$ ). The optimal ownership share for the incumbent maximizes  $V(\alpha)$ . The tradeoffs are apparent from the description of  $V$ . In particular, as  $\alpha$  is increased, the probability that the incumbent retains control and its benefits increases. On the other hand, if  $\alpha$  is increased too much, the value of the firm and the manager's stake are reduced.

In Harris and Raviv,  $\alpha$  is determined indirectly through the firm's capital structure. In particular, the incumbent is assumed to have a fixed amount of wealth represented by his initial stake  $\alpha_0$ . He can increase his stake by

<sup>32</sup> In the Harris and Raviv paper,  $\pi$  is derived from a model of passive investors' information.

having the firm repurchase equity from the passive investors, financing the repurchase by issuing debt. Debt decreases the value of the equity allowing him to purchase a larger fraction with his given wealth. Maximizing the manager's payoff is actually accomplished by choosing the debt level that determines the optimal share  $\alpha$ . Since Harris and Raviv assume that the expected benefits of control  $B$  decrease with the debt level, within any of the three cases described above, it is optimal to choose the lowest debt level consistent with that case.<sup>33</sup>

It follows from the above arguments that if the case of successful tender offer is optimal, the firm will have no debt. It is also shown that generally, proxy fights require some debt, and guaranteeing that the tender offer is unsuccessful requires even more debt. Thus, takeover targets will increase their debt levels on average and targets of unsuccessful tender offers will issue more debt on average than targets of successful tender offers or proxy fights. Also, firms that increase leverage either have unsuccessful tender offers or proxy fights. In the former case, firm value remains at  $Y_t$  on average, while in the latter it increases to  $Y_1$ . Thus, on average, debt issues are accompanied by stock price increases.

Finally, note that the fraction of passive investors who vote for the incumbent is determined by the information that these passive investors receive regarding the relative abilities of the two candidates. A larger fraction will vote for the incumbent if the passive investors' prior probability that he is more able,  $p$ , increases. Consequently, less debt is required to effect a proxy fight if the incumbent is more likely to be of higher ability. Since winning a proxy fight is positively related to the probability of being more able, the incumbent's winning is also associated with less debt. Therefore, in a sample of firms experiencing proxy fights, one would expect to observe less leverage among firms in which the incumbent remains in control.<sup>34</sup>

Stulz (1988) also focuses on the ability of shareholders to affect the nature of a takeover attempt by changing the incumbent's ownership share. In particular, as the incumbent's share  $\alpha$  increases, the premium offered in a tender offer increases, but the probability that the takeover occurs and the shareholders actually receive the premium is reduced. Stulz discusses how the ownership share of the incumbent is affected by capital structure (as well as other variables).

The basic idea of Stulz's model can be presented simply as follows. As in Harris and Raviv (1988), there is an incumbent manager of a firm, a potential rival, and a large number of passive investors. The incumbent owns the fraction  $\alpha$  of the shares and obtains private benefits of control. Stulz assumes the incumbent will not tender his shares in any takeover attempt.

<sup>33</sup> Expected benefits may decrease with the debt level because the benefits are lost in bankruptcy, higher debt results in more monitoring by creditors, and/or less free cash flow allows the manager less discretion.

<sup>34</sup> The model also has a number of other testable implications regarding stock price changes of takeover targets classified by the type of takeover attempt (proxy fight or tender offer) and the outcome (successful or unsuccessful).

The rival can obtain a random benefit of control  $B$  from taking over. Initially,  $B$  is unknown to all parties. The value of the benefit becomes known to the rival before he must decide what premium to offer shareholders. To acquire control, the rival must purchase 50% of the shares. These shares are purchased from the passive investors. This reflects the assumption that the passive investors vote for the incumbent in any takeover contest. The passive investors are assumed to have heterogeneous reservation prices for selling their shares. In particular, let  $s(P)$  be the fraction of passive investors who tender if the total premium paid by the rival (above the value under the incumbent) is  $P$ . The supply function  $s$  is assumed to be increasing in  $P$ . Then the minimum price that the rival must offer to purchase 50% of the votes,  $P^*(\alpha)$ , satisfies the condition

$$s(P^*(\alpha))(1 - \alpha) = 1/2.$$

Since  $s$  is increasing in  $P$ , this condition implies that the offer premium  $P^*$  is increasing in the incumbent's share  $\alpha$ . Intuitively, the larger the incumbent's stake, the larger the fraction of the passive investors' shares that must be acquired by the rival, hence the more he must pay. The rival will bid  $P^*$  if and only if his benefit  $B$  exceeds  $P^*$ . Therefore, the probability that the passive investors actually obtain the premium  $P^*$  is

$$Pr(B \geq P^*(\alpha)) \equiv \pi[P^*(\alpha)].$$

Since  $P^*$  increases with  $\alpha$  and  $\pi$  is a decreasing function, the probability of a takeover declines with  $\alpha$ . The expected gain to the passive investors is

$$Y(\alpha) = P^*(\alpha)\pi[P^*(\alpha)].$$

The incumbent's share  $\alpha$  is chosen to maximize  $Y$ . As mentioned above, increases in  $\alpha$  increase the takeover premium given success but decrease the probability of success.

As in Harris and Raviv,  $\alpha$  can be increased by increasing the firm's leverage.<sup>35</sup> Therefore, Stulz obtains the result that takeover targets have an optimal debt level that maximizes the value of outside investors' shares. Targets of hostile takeovers will have more debt than firms that are not targets. Since becoming a takeover target is good news, one would expect exchanges of debt for equity that accompany such an event to be associated with stock price increases. Moreover, the probability of a takeover is negatively related to the target's debt/equity ratio, and the takeover premium is positively related to this ratio.

A similar approach was taken by Israel (Forthcoming). In his model, as in Stulz (1988), increases in debt also increase the gain to target shareholders if a takeover occurs but lower the probability of this event. The reason that increases in debt increase the gain to target shareholders is different from

<sup>35</sup> Stulz also considers a number of other methods for changing  $\alpha$  such as ESOP's, voting trusts, supermajority rules, and differential voting rights. Results derived from these considerations are not directly relevant to the topic at hand.

that in Stulz (1988), however. Israel observes that debt commands a contractually fixed share of any gains from takeover. Target and acquiring shareholders bargain only over that portion of the gains that is not previously committed to debtholders. The more debt, the less gain is left for target and acquiring shareholders to split and the smaller is the portion of the gain captured by acquiring shareholders. Moreover, target shareholders can capture the gains accruing to target debtholders when the debt is issued. Thus, they capture all of the gain not going to acquiring shareholders. Since debt reduces the gain captured by acquiring shareholders, the payoff to target shareholders, given that a takeover occurs, is increased by increased debt levels. The optimal debt level is determined by balancing this effect against the reduced probability of takeover resulting from the reduced share of the gain that accrues to acquiring stockholders.

The essence of Israel's (Forthcoming) model is the following. Suppose that a takeover can generate a random total gain  $G$  in firm value, but a takeover will cost  $T$ . Further, suppose the firm has issued risky debt of face value  $D$ , and, in the event of a takeover, this debt increases in value by  $\delta(D, G)$ . If the takeover occurs, the acquiring and target shareholders can then split the remaining net gain  $G - \delta - T$ . Assume that target shareholders obtain the fixed fraction  $1 - \gamma$  of this net gain and acquiring shareholders capture the remaining fraction  $\gamma$  ( $\gamma$  can be thought of as measuring the acquirer's bargaining power). Thus, a takeover will occur if and only if  $\gamma(G - \delta - T) > 0$  or  $G - \delta(D, G) \geq T$ , and the probability of a takeover is the probability of this event, denoted  $\pi(D, T)$ . In addition, when issuing the debt, target shareholders also capture the expected gain to debtholders. Consequently, target shareholders' total expected payoff is

$$\begin{aligned} Y(D) &= E[\{(1 - \gamma)[\tilde{G} - \delta(D, \tilde{G}) - T] \\ &\quad + \delta(D, \tilde{G})\} | \tilde{G} - \delta(D, \tilde{G}) > T] \pi(D, T) \\ &= E[\{(1 - \gamma)[\tilde{G} - T] + \gamma\delta(D, \tilde{G})\} | \tilde{G} - \delta(D, \tilde{G}) > T] \pi(D, T). \end{aligned}$$

As can be seen from this last expression, target shareholders capture the fraction  $1 - \gamma$  of the net total gains to takeover plus an additional fraction  $\gamma$  of the gain to target debtholders. The optimal debt level is obtained by maximizing  $Y(D)$ . This involves trading off the increase in amount extracted from the acquirer represented by the term in braces against the decrease in the probability that takeover occurs,  $\pi$ .<sup>36</sup>

Israel (Forthcoming) obtains several interesting comparative statics results. First, an increase in the costs of mounting a takeover contest  $T$  results in a decrease in leverage but an increase in the appreciation of target equity if a takeover occurs. Second, if the distribution of potential takeover gains

<sup>36</sup> In a related paper, Israel (1989) notes that increases in leverage reduce the capital loss suffered by an incumbent manager if he resists a value-increasing takeover. As a result, the manager can extract a larger share of the surplus for the firm's shareholders. Debt is limited by the amount of the surplus to be extracted.

shifts to the right, debt level increases. Such a shift could result from a *decrease* in the ability of the incumbent manager. Third, the optimal debt level increases, and the probability of takeover and the gain to target equity in the event of a takeover decrease with the rival's bargaining power  $\gamma$ .

#### *A. Summary of Section IV*

The papers discussed in this section provide a theory of capital structure related to takeover contests. The major results are as follows. First, all three papers conclude that takeover targets will increase their debt levels on average, and this will be accompanied by a positive stock price reaction. Second, all three show that leverage is negatively related on average to whether the tender offer succeeds. Third, Harris and Raviv (1988) also show that targets of unsuccessful tender offers will have more debt on average than targets of proxy fights. They also show that among firms involved in proxy fights, leverage is lower on average when the incumbent remains in control. Fourth, with regard to the relationship between fraction of the takeover premium captured by the target's equity and the amount of debt, Stulz (1988) and Israel (Forthcoming) obtain opposite results. In Stulz, the premium paid to target shareholders increases with increases in the target's debt level. In Israel, as the bargaining power of the target shareholders decreases, the target optimally issues more debt, and the fraction of the takeover premium captured by the target equity falls. Fifth, Israel shows that targets that are more costly to take over have less debt but capture a larger premium if a takeover occurs. Sixth, Israel predicts that firms that have greater potential takeover gains will have more debt.<sup>37</sup>

Two important observations should be noted here. First, the theories surveyed in this section should be viewed as theories of short-term changes in capital structure taken in response to imminent takeover threats, since the optimal capital structure derived in these models can be implemented in response to hostile takeover activity. As a result, theories based on corporate control considerations have nothing to say about the long run capital structure of firms. Second, these papers take as given the characteristics of the securities issued by firms. In particular, both the cash flow aspects and the assignment of voting rights and other control-related features are treated as exogenous.

### **V. Summary of Results**

The purpose of this section is to present the collected lessons of the literature surveyed. These lessons are presented in three subsections. In the first, we discuss the theoretical predictions of the models surveyed above. In the

<sup>37</sup> Similar results are undoubtedly available from Stulz's model although he does not derive them. One can view  $B$  in Stulz's model as takeover benefits net of takeover costs. Then any increase in potential benefits or decrease in costs is simply a rightward shift of the distribution of  $B$ .

second, we briefly summarize the available empirical evidence. In the third, we compare the theoretical predictions with the evidence. Much of the material in this section is synthesized in tables. These tables are as follows:

- Table II: Summary of Theoretical Results
- Table III: Industry Leverage Rankings
- Table IV: Determinants of Leverage
- Table V: Comparison of Theoretical and Empirical Results
- Table VI: Other Empirical Results
- Table VII: Summary of Results by Model Type

#### *A. Summary of Theoretical Results*

Those theoretical results that are potentially testable are summarized in Table II, consisting of four panels. Panel A contains implications regarding the relationship between leverage and exogenous factors that are not the result of decisions by agents in the model, e.g., profitability, characteristics of the product market, etc. Panel B contains implications regarding the relationship between leverage and endogenous factors that are the result of decisions by agents in the model. In this case, both leverage and the other factor are jointly determined by some third, exogenous factor. Typically, in these cases the endogenous factors are more readily observable than the exogenous driving factor. In Panel C, we list results relating the firm's stock price response to announcements of capital structure changes. Panel D contains other results that do not fit into the above three groups.<sup>38</sup> In each panel, the first column contains the theoretical prediction; the second column indicates the type(s) of model(s) from which the result was derived and corresponds to the various sections of the survey; the third column provides the specific references for the result.

The table makes it clear that the literature provides a substantial number of implications. The other striking feature is that there are very few cases in which two or more theories have opposite implications (these are indicated by a shaded background). Such conflicts can provide sharp tests capable of rejecting one or more theories in favor of another. The only instances of conflicting results are: i) Chang (1987) predicts a negative relationship of leverage and firm profitability while several studies predict a positive relationship (see Panel A); ii) Myers and Majluf (1984) predicts a negative relationship between leverage and free cash flow while Jensen (1986) and Stulz (1990) predict a positive relationship (see Panel A); iii) Stulz (1988) predicts a positive relationship between leverage and the takeover premium captured by a target while Israel (Forthcoming) predicts the opposite relationship (see Panel B); iv) Myers and Majluf (1984) and related papers predict the absence of a stock price reaction to a debt issue announcement while numerous papers predict a positive reaction (see Panel C); and v) several papers argue against the pecking order theory of Myers and Majluf (1984)

<sup>38</sup> Other theoretical results not directly relating to capital structure are not included in this summary even though they may be potentially testable.

Table II

## Summary of Theoretical Results

The table shows, for each theoretical result, the type of model from which the result was derived and the specific papers that obtain the result. Model types also refer to sections in the paper. The shaded cells (separated by dashed line) indicate results that are in conflict.

| Panel A. Association Between Leverage and Exogenous Factors                     |                        |                                                                                                                        |  |
|---------------------------------------------------------------------------------|------------------------|------------------------------------------------------------------------------------------------------------------------|--|
| Leverage increases with:                                                        | Model                  | References                                                                                                             |  |
| Extent of information asymmetry                                                 | Asymmetric Info.       | Myers & Majluf (1984)                                                                                                  |  |
| Increases in profitability                                                      | Asymmetric Info.       | Ross (1977), Leland & Pyle (1977), Heinkel (1982), Blazenko (1987), John (1987), Poitevin (1989), Ravid & Sarig (1989) |  |
| Decreases in profitability                                                      | Agency                 | Chang (1987)                                                                                                           |  |
| Extent of <i>strategic</i> interaction in the product market                    | Product/ Input Markets | Brander & Lewis (1986)                                                                                                 |  |
| Elasticity of demand for the product                                            | Product/ Input Markets | Maksimovic (1988)                                                                                                      |  |
| Extent to which product is not unique and does not require specialized service  | Product/ Input Markets | Titman (1984)                                                                                                          |  |
| Extent to which reputation for product quality is unimportant                   | Product/ Input Markets | Maksimovic & Titman (Forthcoming)                                                                                      |  |
| Extent to which workers are unionized or have transferable skills               | Product/ Input Markets | Sarig (1988)                                                                                                           |  |
| Extent to which the firm is a takeover target or lack of anti-takeover measures | Control                | Harris & Raviv (1988), Stulz (1988), Israel (Forthcoming)                                                              |  |
| Potential gains to takeover and reductions in their costs                       | Agency                 | Stulz (1990), Hirshleifer & Thakor (1989)                                                                              |  |
| Fraction of cash flow that is unobservable                                      | Control                | Israel (Forthcoming)                                                                                                   |  |
| Lack of growth opportunities, extent of regulation                              | Agency                 | Chang (1987)                                                                                                           |  |
|                                                                                 | Agency                 | Jensen & Meckling (1976), Stulz (1990)                                                                                 |  |

Table II—(Continued)

| Panel A. Association Between Leverage and Exogenous Factors                      |                  |                                                                   |  |
|----------------------------------------------------------------------------------|------------------|-------------------------------------------------------------------|--|
| Leverage Increases with:                                                         | Model            | References                                                        |  |
| Increases in free cash flow                                                      | Agency           | Jensen (1986), Stulz (1990)                                       |  |
| Decreases in free cash flow                                                      | Asymmetric Info. | Myers & Majluf (1984)                                             |  |
| Increases in liquidation value                                                   | Agency           | Williamson (1988), Harris & Raviv (1990a)                         |  |
| Decreases in investigation costs                                                 | Agency           | Harris & Raviv (1990a)                                            |  |
| Increases in the importance of managerial reputation                             | Agency           | Hirshleifer & Thakor (1989)                                       |  |
| Panel B. Association Between Leverage and Endogenous Factors                     |                  |                                                                   |  |
| Result                                                                           | Model            | References                                                        |  |
| Leverage is positively correlated with firm value                                | Agency           | Harris & Raviv (1990a), Stulz (1990), Hirshleifer & Thakor (1989) |  |
|                                                                                  | Asymmetric Info. | Ross (1977), Noe (1988), Narayanan (1988), Poitevin (1989)        |  |
|                                                                                  | Control          | Harris & Raviv (1988), Stulz (1988), Israel (Forthcoming)         |  |
| Leverage is positively correlated with default probability                       | Agency           | Harris & Raviv (1990c;)                                           |  |
|                                                                                  | Asymmetric Info. | Ross (1977)                                                       |  |
| Leverage is positively correlated with the extent of managerial equity ownership | Asymmetric Info. | Leland & Pyle (1977)                                              |  |
|                                                                                  | Control          | Harris & Raviv (1988), Stulz (1988)                               |  |
| Leverage is positively correlated with target premium                            | Control          | Stulz (1988)                                                      |  |
| Leverage is negatively correlated with target premium                            | Control          | Israel (Forthcoming)                                              |  |
| Leverage is negatively correlated with probability of successful takeover        | Control          | Stulz (1988)                                                      |  |

Table II—(Continued)

| Panel B. Association Between Leverage and Endogenous Factors                                                               |                  |                                                                                                                                                       |  |
|----------------------------------------------------------------------------------------------------------------------------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Results                                                                                                                    | Model            | References                                                                                                                                            |  |
| Leverage is negatively correlated with the interest coverage ratio and the probability of reorganization following default | Agency           | Harris & Raviv (1990a)                                                                                                                                |  |
| Targets of an unsuccessful tender offer have more debt than targets of proxy fights or successful tender offer             | Control          | Harris & Raviv (1988)                                                                                                                                 |  |
| Targets of successful proxy fights have more debt than targets of unsuccessful proxy fights                                | Control          | Harris & Raviv (1988)                                                                                                                                 |  |
| Targets of proxy fights have more debt than targets of successful tender offers                                            | Control          | Harris & Raviv (1988)                                                                                                                                 |  |
| Panel C. Announcement of Security Issues                                                                                   |                  |                                                                                                                                                       |  |
| Stock Price                                                                                                                | Model            | References                                                                                                                                            |  |
| Increases on announcement of debt issues, debt-for-equity exchanges or stock repurchases                                   | Agency           | Harris & Raviv (1990a), Stulz (1990), Hirshleifer & Thakor (1989)                                                                                     |  |
|                                                                                                                            | Asymmetric Info. | Ross (1977), Noe (1988), Narayanan (1988), Poitevin (1989)                                                                                            |  |
|                                                                                                                            | Control          | Harris & Raviv (1988), Stulz (1988), Israel (Forthcoming)                                                                                             |  |
| Isn't affected by announcement of debt issue                                                                               | Asymmetric Info. | Myers & Majluf (1984), Krasker (1986), Korajczyk, et al. (1990c)                                                                                      |  |
| Decreases on announcement of equity issue                                                                                  | Agency           | Harris & Raviv (1990a), Stulz (1990), Hirshleifer & Thakor (1989)                                                                                     |  |
|                                                                                                                            | Asymmetric Info. | Ross (1977), Myers & Majluf (1984), Krasker (1986), Korajczyk, et al. (1990c), Noe (1988), Narayanan (1988), Poitevin (1989), Lucas & McDonald (1990) |  |
|                                                                                                                            | Control          | Harris & Raviv (1988), Stulz (1988), Israel (Forthcoming)                                                                                             |  |

Table II — (Continued)

| Panel C. Announcement of Security Issues                                                                                                |                  |                                                                    |  |
|-----------------------------------------------------------------------------------------------------------------------------------------|------------------|--------------------------------------------------------------------|--|
| Stock Price                                                                                                                             | Model            | References                                                         |  |
| Decreases more the larger is the informational asymmetry                                                                                | Asymmetric Info. | Myers & Majluf (1984), Krasker (1986), Korajczyk, et al. (1990c)   |  |
| Decreases more the larger is the size of the issue                                                                                      | Asymmetric Info. | Krasker (1986)                                                     |  |
| Increases if some proceeds of equity issue used to repurchase debt                                                                      | Asymmetric Info. | Brennan & Kraus (1987)                                             |  |
| Increases on announcement of issue of convertible debt in exchange for equity                                                           | Asymmetric Info. | Constantinides & Grundy (1989)                                     |  |
| Panel D. Other Results                                                                                                                  |                  |                                                                    |  |
| Result                                                                                                                                  | Model            | References                                                         |  |
| There is a pecking order: firms prefer internal finance, then issuing securities in order of increasing sensitivity to firm performance | Asymmetric Info. | Myers & Majluf (1984), Krasker (1986), Narayanan (1988)            |  |
| There is no pecking order                                                                                                               | Asymmetric Info. | Brennan & Kraus (1987), Noe (1988), Constantinides & Grundy (1989) |  |
| Firms tend to issue equity following abnormal price appreciation                                                                        | Asymmetric Info. | Lucas & McDonald (1990)                                            |  |
| Firms tend to issue equity when information asymmetry is smallest                                                                       | Asymmetric Info. | Myers & Majluf (1984), Korajczyk, et al. (1990c)                   |  |
| Bonds can be expected to have covenants prohibiting "asset substitution"                                                                | Agency           | Jensen & Meckling (1976)                                           |  |
| Firms with longer track records have lower default probabilities                                                                        | Agency           | Diamond (1989)                                                     |  |

and others (see Panel D). Since conflicting implications are rare, the large majority of the studies surveyed must therefore be considered as complements, i.e., any or all of the effects traced by these theories could be present simultaneously. The relative significance of these effects is an empirical issue.

### *B. Summary of Empirical Evidence*

The evidence fits into four categories. The first group contains evidence of general capital structure trends. The second group, event studies, generally measures the impact on stock value of an announcement of a capital structure change. The third group relates firm/industry characteristics to financial structure. The fourth group measures the relationship between capital structure and factors associated with corporate control. We discuss these four classes of empirical studies in the next subsections.

Before turning to this discussion, a word of caution is in order. The interpretation of the results must be tempered by an awareness of the difficulties involved in measuring both leverage and the explanatory variables of interest. In measuring leverage, one can include or exclude accounts payable, accounts receivable, cash, and other short-term debt. Some studies measure leverage as a ratio of book value of debt to book value of equity, others as book value of debt to market value of equity, still others as debt to market value of equity plus book value of debt. With regard to the explanatory variables, proxies are often difficult to interpret. For example, several studies measure growth opportunities as the ratio of market value of the firm to book value of assets. While firms with large growth opportunities should have large values of this ratio, other firms whose assets have appreciated significantly since purchase but which do not have large growth opportunities will also have large values of this ratio. In addition to measurement problems, there are the usual problems with interpreting statistical results. In what follows, we take the results reported at face value and compare results of various studies largely ignoring differences in measurement technique.

#### *B.1. General Trends*

Firms raise funds for new investment both externally, through security issues, and internally from retained earnings. Internal sources, which add to total firm equity, have historically constituted a large but fairly steadily declining fraction of these funds. For example, undistributed profits accounts for about 22% of total sources of funds for nonfarm, nonfinancial corporate business in 1986. By comparison, the same figure averaged about 49% over the period 1946–1966 (see Masulis (1988, Table 1-1, p. 3)).

The second major trend in financial structure has been the secular increase in leverage. Taggart (1985) reports secular trends in leverage using a variety of different measurements. He concludes that leverage has increased steadily since World War II but that current debt levels may not be high relative to those of the prewar period.

*B.2. Event Studies*

Event studies have documented the stock price reaction to announcements of security offerings, exchanges and repurchases.<sup>39</sup> In some cases, the studies also document the reaction of earnings or earnings forecasts to the events. Generally, equity-increasing transactions result in stock price decreases while leverage-increasing transactions result in stock price increases. Earnings and earnings forecasts react consistently with the stock price reactions.

With regard to security issues,<sup>40</sup>

- abnormal returns associated with announcements of common stocks are the most negative (about  $-3\%$  according to Smith (1986)),
- abnormal returns associated with convertible bonds or convertible preferred stock are more negative than those associated with the respective nonconvertible security,
- abnormal returns associated with straight debt or preferred stock are not statistically significantly different from zero,<sup>41</sup>
- abnormal returns associated with securities issued by utilities are less negative than those associated with the same securities issued by industrial firms.

Marsh (1982) finds that firms are more likely to issue long-term debt to the extent that their current long-term debt is below their target as measured by the average debt level of the previous 10 years. He also finds that market conditions play a highly significant role in determining the probability that a firm will issue debt. Specifically, firms are more likely to issue debt (equity) when they expect other firms to issue debt (equity) and are more likely to issue equity to the extent that the previous year's share return exceeds that of the market portfolio. Korajczyk, et al. (1990a) also document that a firm's stock price experiences significant abnormal rises on average prior to its issuing equity. In addition, Korajczyk, et al. (1990b) find that equity issues are clustered after earnings announcements and the extent of the price drop at the announcement increases insignificantly with time since the last earnings announcement. Korajczyk, et al. (1990a) examine the cross-sectional properties of the price rise and track debt ratios and Tobin's  $q$  around the time of equity issues. They find that debt ratios do not increase prior to equity issues, "suggesting that strained debt capacity is not the main reason for equity issues." Tobin's  $q$  (the ratio of market to book value of assets) is observed to rise prior to an equity issue and fall following the issue. This suggests that equity is issued to finance new investments.

<sup>39</sup> Much of the literature is surveyed in Smith (1986). Masulis (1988) provides a more recent and comprehensive survey.

<sup>40</sup> See Asquith and Mullins (1986), Dann and Mikkelsen (1984), Eckbo (1986), Linn and Pinegar (1988), Masulis and Korwar (1986), Mikkelsen and Partch (1986), and Schipper and Smith (1986).

<sup>41</sup> Kim and Stulz (1988), however, found a significantly positive effect associated with Eurobond issues.

With regard to exchange offers, Masulis (1983) reports:<sup>42</sup>

- debt issued in exchange for common stock results in a 14% abnormal stock return.
- preferred stock issued in exchange for common stock results in a 8.3% abnormal stock return,
- debt issued in exchange for preferred stock results in a 2.2% abnormal stock return,
- common stock issued in exchange for preferred stock results in a -2.6% abnormal stock return,
- common stock issued in exchange for debt results in a -9.9% abnormal stock return,
- preferred stock issued in exchange for debt results in a -7.7% abnormal stock return.

Further evidence on exchanges is offered by Lys and Sivaramakrishnan (1988), Cornett and Travlos (1989), and Israel, et al. (Forthcoming). Cornett and Travlos confirm Masulis' (1980, 1983) results that leverage increasing (decreasing) exchanges of securities are accompanied by positive (negative) abnormal common stock returns. They further document that abnormal price drops following leverage decreasing capital structure exchanges are positively related to unexpected earnings decreases. Finally, they observe that abnormal price increases following leverage increasing capital structure exchanges are positively related to changes in managerial stock holdings. Lys and Sivaramakrishnan (1988) and Israel, et al. (Forthcoming) consider the effect of capital structure exchanges on the revisions of financial analysts' forecasts. In a study of leverage decreasing exchanges, they find that analysts revise their forecasts of net operating income downward and that these revisions are positively correlated with the size of the stock price reaction to the exchange announcement.

Stock repurchases via tender offers result in sharp stock price increases. Masulis (1980) reports a 21% abnormal stock return, Dann (1981) finds a 15.4% abnormal stock return, and Vermaelen (1981) documents a 13.3% abnormal stock return. Consistent with this evidence, Dann, et al. (1989) document positive earnings surprises subsequent to tender offer stock repurchases (but not before).

### *B.3. Firm and Industry Characteristics*

The most basic stylized facts concerning industry characteristics and capital structure are that firms within an industry are more similar than those in different industries and that industries tend to retain their relative leverage ratio rankings over time (Bowen, et al. (1982), Bradley et al. (1984)). Leverage ratios of specific industries have been documented by Bowen, et al. (1982), Bradley, et al. (1984), Long and Malitz (1985), and Kester (1986). Their results are in broad agreement and show that Drugs, Instruments,

<sup>42</sup> See also Masulis (1980), Eckbo (1986), Mikkelsen and Partch (1986), Pinegar and Lease (1986), and Cornett and Travlos (1989).

Electronics, and Food have consistently low leverage while Paper, Textile Mill Products, Steel, Airlines, and Cement have consistently high leverage. Moreover, regulated industries (Telephone, Electric and Gas Utilities and Airlines) are among the most highly levered firms according to the study by Bradley, et al. (1984). The evidence on industry leverage ratios is summarized in Table III.

Several studies shed light on the specific characteristics of firms and industries that determine leverage ratios (Bradley, et al. (1984), Castanias (1983), Long and Malitz (1985), Kester (1986), Marsh (1982), and Titman and Wessels (1988)). These studies generally agree that leverage increases with fixed assets, nondebt tax shields, growth opportunities, and firm size and decreases with volatility, advertising expenditures, research and development expenditures, bankruptcy probability, profitability and uniqueness of the product. These results are summarized in Table IV. In addition to the evidence cited in Table IV, Castanias (1983) also finds a negative correlation between leverage and default probability.

#### *B.4. Corporate Control Considerations*

Finally, since capital structure is used as an antitakeover device (DeAngelo and DeAngelo (1985), Dann and DeAngelo (1988), and Amihud, et al. (1990)),

**Table III**  
**Industry Leverage Rankings**

Rankings of industries by leverage ratio are reported based on four studies: Bradley, et al. (1984, Table 1) [denoted BJK], Bowen, et al. (1982, Exhibit 1) (BDH), Long and Malitz (1985, Table 3) [LM], and Kester (1986, Exhibit 2). We have listed industries from lowest to highest based on average debt-to-value ratio over the period 1962–1981 using Bradley, et al. The classification into “Low,” “Medium,” and “High,” is our own and is somewhat arbitrary. The rankings in Bowen, et al. are an average of rankings over the period 1951–1969 based on long-term plus short-term debt divided by total assets. For Long and Malitz, “Low” (“High”) means that the industry was one of the five lowest (highest) in leverage ratio (book value of long-term funded debt divided by total funded capital) out of a sample of 39 firms. The rankings for Kester are based on the average of net debt divided by market value of equity for a sample of 344 Japanese and 452 U.S. companies in 27 industries over the period April, 1982 through March, 1983.

| Industry              | BJK              | BDH              | LM               | Kester              |
|-----------------------|------------------|------------------|------------------|---------------------|
| Drugs                 | Low <sup>a</sup> |                  | Low              | Low                 |
| Cosmetics             | Low              |                  | Low              | Medium <sup>b</sup> |
| Instruments           | Low              |                  | Low <sup>c</sup> | Low <sup>d</sup>    |
| Metal Mining          | Low              |                  |                  |                     |
| Publishing            | Low              |                  |                  |                     |
| Electronics           | Low              |                  | Low <sup>e</sup> | Low                 |
| Machinery             | Low              |                  |                  | Medium <sup>f</sup> |
| Food                  | Low              |                  |                  | Low <sup>g</sup>    |
| Petroleum Exploration | Medium           |                  |                  |                     |
| Construction          | Medium           |                  |                  |                     |
| Petroleum Refining    | Medium           | Low <sup>h</sup> | High             | High                |
| Metal Working         | Medium           |                  |                  |                     |
| Chemicals             | Medium           | Medium           |                  | High                |

Table III—(Continued)

| Industry                   | BJK    | BDH                 | LM               | Kester |
|----------------------------|--------|---------------------|------------------|--------|
| Apparel                    | Medium |                     |                  | Medium |
| Lumber                     | Medium |                     |                  |        |
| Motor Vehicle Parts        | Medium | Medium <sup>i</sup> | Low <sup>j</sup> | Medium |
| Paper                      | Medium |                     | High             | High   |
| Textile Mill Products      | High   | Medium              | High             | High   |
| Rubber                     | High   |                     |                  | Medium |
| Retail Department Stores   | High   | Medium              |                  |        |
| Retail Grocery Stores      | High   | Medium              |                  |        |
| Trucking                   | High   |                     |                  |        |
| Steel                      | High   | Low                 | High             | High   |
| Telephone                  | High   |                     |                  |        |
| Electric and Gas Utilities | High   |                     |                  |        |
| Airlines                   | High   | High                |                  |        |
| Cement                     |        |                     | High             | High   |
| Glass                      |        |                     |                  | High   |

<sup>a</sup> Drugs (SIC code 2830) and Cosmetics (SIC code 2840) are combined.

<sup>b</sup> Soaps and Detergents (SIC code 2841) part of Cosmetics (SIC code 2840) only.

<sup>c</sup> Photographic Equipment (SIC code 3861) part of Instruments (SIC code 3800) only.

<sup>d</sup> Photographic Equipment (SIC code 3861) part of Instruments (SIC code 3800) only.

<sup>e</sup> Radio and TV Receiving (SIC code 3651) part of Electronics (SIC code 3600) only.

<sup>f</sup> Construction Machinery, Agricultural Machinery, and Machine Tools (SIC codes 3530, 3520, 3540).

<sup>g</sup> Confectionery and Alcoholic Beverages (SIC codes 2065, 2082, 2085) part of Food (SIC code 2000) only.

<sup>h</sup> Oil-Integrated Domestic (SIC code 2912) part of Petroleum Refining (SIC code 2900) only.

<sup>i</sup> BDH split Motor Vehicle Parts (SIC code 3700) into Auto Parts and Accessories (SIC code 3714) and Aerospace (SIC code 3721). In their study, the former ranks consistently at or near the lowest leverage ratio while the latter ranks near the highest.

<sup>j</sup> Aircraft (SIC code 3721) part of Motor Vehicle Parts (SIC code 3700) only.

several studies of the market for corporate control have produced evidence about capital structure. First, leverage is positively correlated with the extent of managerial equity ownership (Kim and Sorensen (1986), Agrawal and Mandelker (1987), Amihud et al. (1990)).<sup>43</sup> Second, Dann and DeAngelo (1988) find that hostile bidders rarely prevail in the face of capital restructuring. Indeed, Palepu (1986) finds that leverage is negatively correlated with the probability of being successfully taken over. Third, stock price decreases following dual class recapitalization and other defensive strategies (Partch (1987), Dann and DeAngelo (1988), and Jarrell and Poulsen (1988)). Fourth, claims with superior voting power command higher prices than similar claims with inferior voting power (Levy (1983), Lease, et al. (1984), DeAngelo and DeAngelo (1985)). Fifth, high free cash flow is associated with higher probability of going private and larger premiums paid to stockholders upon going private (Lehn and Poulsen (1989)). Sixth, the distribution of equity

<sup>43</sup> Friend and Hasbrouck (1988) and Friend and Lang (1988) find evidence to the contrary, although in the former the sign is insignificant.

**Table IV**  
**Determinants of Leverage**

The sign of the change in leverage as a result of an increase in the given characteristic is shown for each of six studies. Blank entry indicates that the specific study did not include the given characteristic. The studies are Bradley, et al. (1984) [denoted BJK], Chaplinsky and Niehaus (1990) [CN], Friend and Hasbrouck (1988), and Friend and Lang (1988) [FH/L], Gonedes, et al. (1988) [GLC], Long and Malitz (1985) [LM], Kester (1986) [Kest.], Kim and Sorensen (1986) [KS], Marsh (1982) [Mar.], and Titman and Wessels (1988) [TW]. Comparisons suffer from the fact that these studies used different measures of the firm characteristics, different time periods, different leverage measures, and different methodologies.

| Characteristic            | BJK            | CN | FH/L | GLC | LM | Kest. | KS | Mar. <sup>a</sup> | TW |
|---------------------------|----------------|----|------|-----|----|-------|----|-------------------|----|
| Volatility                | —              |    | —    |     |    | —*    | +  |                   | —* |
| Bankruptcy<br>Probability |                |    |      |     |    |       |    | —                 |    |
| Fixed Assets              |                |    | +    | +   | +  |       |    | +                 | +* |
| Non-Debt Tax<br>Shields   | +              | +  |      |     |    |       | —  |                   | —* |
| Advertising               | — <sup>b</sup> |    |      |     | —  |       |    |                   |    |
| R & D<br>Expenditures     | —              |    |      |     | —  |       |    |                   |    |
| Profitability             |                |    | —    | —*  | +* | —     |    |                   | —  |
| Growth                    |                | —* |      |     |    | +     | —  |                   | —* |
| Opportunities             |                |    |      |     |    |       |    |                   |    |
| Size                      |                | —* | +*   |     |    | —*    | —* | +                 | —* |
| Free Cash Flow            |                | —  |      |     |    |       |    |                   |    |
| Uniqueness <sup>c</sup>   |                |    |      |     |    |       |    |                   | —  |

<sup>a</sup> Marsh measures the probability of issuing debt conditional on issuing securities and on firm characteristics. The sign indicates the direction of change of this probability given a change in the indicated characteristic.

<sup>b</sup> Advertising and R & D expenditures are combined.

<sup>c</sup> This refers to the uniqueness of the product and is included specifically to test the model of Titman (1984).

\* Indicates that the result was either not statistically significantly different from zero at conventional significance levels or that the result was weak in a nonstatistical sense.

ownership seems to play a role in both managerial behavior and capital structure. In particular, Agrawal and Mandelker (1987) find that when managers own a larger share of the equity they tend to choose higher variance targets. Also, Friend and Lang (1988) and Gonedes, et al. (1988) find that leverage is lower in firms with dispersed outside ownership.

### *C. Comparison of Theoretical Predictions and Empirical Evidence*

This subsection integrates the information described in the previous two subsections. Table V matches the empirical evidence with the theoretical results in Table II. Table V is organized exactly as Table II except that columns two and three of Table II are replaced by the evidence. Specifically, for each theoretical result we list the relevant empirical studies divided into two groups: those consistent with the prediction (indicated by “Yes”) and those inconsistent with it (indicated by “No”).

Table V

**Comparison of Theoretical and Empirical Results**

The table lists, for each theoretical result in Table II, those empirical studies whose findings are either consistent (after the word "Yes:") or inconsistent (after "No:") with the theoretical result. Blank cells indicate the lack of empirical evidence.

| Panel A. Association Between Leverage and Exogenous Factors                     |                                                                                                                                                   |
|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Leverage increases with:                                                        | Empirical Evidence                                                                                                                                |
| Extent of information asymmetry                                                 |                                                                                                                                                   |
| Increases in profitability                                                      | Yes: Long & Malitz (1985)*<br>No: Kester (1986), Friend & Hasbrouck (1988), Friend & Lang (1988), Gonedes, et al. (1988), Titman & Wessels (1988) |
| Extent of <i>strategic</i> interaction in the product market                    |                                                                                                                                                   |
| Elasticity of demand for the product                                            |                                                                                                                                                   |
| Extent to which product is not unique and does not require specialized service  | Yes: Titman & Wessels (1988)                                                                                                                      |
| Extent to which reputation for product quality is unimportant                   |                                                                                                                                                   |
| Extent to which workers are unionized or have transferrable skills              |                                                                                                                                                   |
| Extent to which the firm is a takeover target or lack of anti-takeover measures |                                                                                                                                                   |
| Potential gains to takeover and reductions in their costs                       |                                                                                                                                                   |
| Fraction of cash flow that is unobservable                                      |                                                                                                                                                   |
| Lack of growth opportunities                                                    | Yes: Kim & Sorensen (1986), Titman & Wessels (1988),*<br>Chaplinsky & Niehaus (1990)*<br>No: Kester (1986)                                        |
| Extent of regulation                                                            | Yes: Bowen, et al. (1982), Bradley, et al. (1984)                                                                                                 |
| Increases in free cash flow                                                     | No: Chaplinsky & Niehaus (1990)                                                                                                                   |

Table V—(Continued)

| Panel A. Association Between Leverage and Exogenous Factors                                                                |                                                                                                                                                                                                                                           |  |
|----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Leverage increases with:                                                                                                   | Empirical Evidence                                                                                                                                                                                                                        |  |
| Increases in liquidation value                                                                                             | Yes: Bradley, et al. (1984), Long & Malitz (1985), Friend & Hasbrouck (1988), Friend & Lang (1988), Gonedes, et al. (1988), Titman & Wessels (1988), * Chaplinsky & Niehaus (1990)<br>No: Kim & Sorensen (1986), Titman & Wessels (1988)* |  |
| Decreases in investigation costs                                                                                           |                                                                                                                                                                                                                                           |  |
| Increases in the importance of managerial reputation                                                                       |                                                                                                                                                                                                                                           |  |
| Panel B. Association Between Leverage and Endogenous Factors                                                               |                                                                                                                                                                                                                                           |  |
| Result                                                                                                                     | Empirical Evidence                                                                                                                                                                                                                        |  |
| Leverage is positively correlated with firm value                                                                          | Yes: Lys & Sivaramakrishnan (1988), Cornett & Travlos (1989), Dann, et al. (1989), Israel, et al. (Forthcoming)<br>No: Castanias (1983)                                                                                                   |  |
| Leverage is positively correlated with default probability                                                                 |                                                                                                                                                                                                                                           |  |
| Leverage is positively correlated with the extent of managerial equity ownership                                           | Yes: Kim & Sorensen (1986), Agrawal & Mandelker (1987), Amihud, et al. (1990)<br>No: Friend & Hasbrouck (1988), * Friend & Lang (1988)                                                                                                    |  |
| Leverage is positively correlated with target premium                                                                      |                                                                                                                                                                                                                                           |  |
| Leverage is negatively correlated with probability of successful takeover                                                  | Yes: Palepu (1986)                                                                                                                                                                                                                        |  |
| Leverage is negatively correlated with the interest coverage ratio and the probability of reorganization following default |                                                                                                                                                                                                                                           |  |

Table V—(Continued)

| Panel B. Association Between Leverage and Endogenous Factors                                                    |                                                                                                              |
|-----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| Result                                                                                                          | Empirical Evidence                                                                                           |
| Targets of an unsuccessful tender offer have more debt than targets of proxy fights or successful tender offers |                                                                                                              |
| Targets of successful proxy fights have more debt than targets of unsuccessful proxy fights                     |                                                                                                              |
| Targets of proxy fights have more debt than targets of successful tender offers                                 |                                                                                                              |
| Panel C. Announcement of Security Issues                                                                        |                                                                                                              |
| Stock price:                                                                                                    | Empirical Evidence                                                                                           |
| Increases on announcement of debt issue                                                                         | Yes: Kim & Stulz (1988)<br>No: Dann & Mikkelsen (1984), * Eckbo (1986), * Mikkelsen & Partch (1986)*         |
| Increases on announcement of debt for equity exchange                                                           | Yes: Masulis (1980, 1983), Cornett & Travlos (1989)                                                          |
| Increases on announcement of stock repurchase                                                                   | Yes: Masulis (1980), Dann (1981), Vermaelen (1981), Dann, et al. (1989)                                      |
| Decreases on announcement of equity issue                                                                       | Yes: Asquith & Mullins (1986), Masulis & Korwar (1986), Mikkelsen & Partch (1986), Schipper and Smith (1986) |
| Decreases on announcement of equity for debt exchange                                                           | Yes: Masulis (1980, 1983), Eckbo (1986), Mikkelsen & Partch (1986), Cornett & Travlos (1989)                 |
| Decreases more the larger is the informational asymmetry                                                        | Yes: Korajczyk, et al. (1990b)*                                                                              |
| Decreases more the larger is the size of the issue                                                              | Yes: Asquith & Mullins (1986)                                                                                |

Table V—(Continued)

| Panel C. Announcement of Security Issues                                                                                                |                                                                                          |  |
|-----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|--|
| Increases if some proceeds of equity issue used to repurchase debt                                                                      |                                                                                          |  |
| Increases on announcement of issue of convertible debt in exchange for equity                                                           |                                                                                          |  |
| Panel D. Other Results                                                                                                                  |                                                                                          |  |
| Result                                                                                                                                  | Empirical Evidence                                                                       |  |
| There is a pecking order: firms prefer internal finance, then issuing securities in order of increasing sensitivity to firm performance | Yes: Chaplinsky & Niehaus (1990), Amihud, et al. (1990)<br>No: Korajczyk, et al. (1990a) |  |
| Firms tend to issue equity following abnormal price appreciation                                                                        | Yes: Marsh (1982), Korajczyk, et al. (1990a)                                             |  |
| Firms tend to issue equity when information asymmetry is smallest                                                                       | Yes: Korajczyk, et al. (1990b)                                                           |  |
| Low returns optimally entail change of control or ownership                                                                             |                                                                                          |  |
| Bonds can be expected to have covenants prohibiting “asset substitution”                                                                | Yes: Smith & Warner (1979)                                                               |  |
| Firms with longer track records have lower default probabilities                                                                        |                                                                                          |  |

\* = weak or statistically insignificant relationship.

The evidence cited in Table V is either direct evidence about the particular result or, in some cases, represents an interpretation of the actual independent variable used in the study. In particular, the following interpretations are embedded in Table V.

- Extent of regulation: telephone, electric and gas utilities, and airlines are both highly regulated and highly levered as indicated in Table III.
- Liquidation value: fixed assets and nondebt tax shields are generally regarded as proxies for the tangibility or liquidation value of assets. On the other hand, research and development and advertising expenditures can be interpreted as measuring the extent to which assets are intangible. See Table IV.
- Firm value: in Panel B, the studies cited document increases in earnings or earnings forecasts following leverage increases.
- Pecking order: the fact that leverage decreases with internal funds is interpreted as evidence that firms prefer to use internal financing before issuing debt (Chaplinsky and Niehaus (1990)). Also, Amihud, et al. (1990) find that, in acquisitions, managers prefer to finance with cash or debt rather than equity, at least when they have a large equity stake. Finally, Korajczyk, et al. (1990a) interpret the fact that debt ratios do not increase prior to equity issues used to finance investment as evidence that “strained debt capacity is not the main reason for equity issues.”

Other evidence from Table III (industry leverage ratio rankings) may conceivably bear on the predictions of the theory. For example, one might argue that the airline industry is marked by a high degree of strategic interaction across firms. If so, the fact that airlines are highly levered is consistent with the results of Brander and Lewis (1986). Similarly, if reputation for product quality is especially important in the drug industry, the fact that drug firms have low leverage is consistent with the results of Maksimovic and Titman (Forthcoming). Also, to the extent that trucking is highly unionized, the high leverage found in this industry supports the model of Sarig (1988). Obviously, such inferences depend on detailed knowledge of the industries involved—knowledge we do not possess.

In addition to Table V, which matches the empirical evidence with the theoretical results, we also present, in Table VI, those empirical findings that do not bear on any specific theoretical prediction. Some of these lend support to the assumptions of certain models. Others provide evidence to be explained.

Finally, in Table VII, we organize the information in Table V to present the theoretical results and the evidence by model type. In Panels A through D we list, in turn, the implications of agency models (Panel A), asymmetric information models (Panel B), product/input market models (Panel C), and corporate control models (Panel D). The results are ordered, in each panel, so that those with evidence are listed first, followed by those for which there is no available evidence. Table VII is useful for determining whether any model or class of models has been rejected by the evidence and what additional evidence would be useful for testing the models.

**Table VI**  
**Other Empirical Results**

This table lists empirical evidence not directly related to any theoretical result.

| Empirical Result                                                                               | Source                                                                                                                         |
|------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| The extent of external financing has increased over time                                       | Masulis (1988)                                                                                                                 |
| Total leverage has increased steadily since World War II                                       | Taggart (1985)                                                                                                                 |
| Capital structure is used to protect control                                                   | DeAngelo & DeAngelo (1985), Dann & DeAngelo (1988), Amihud, et al. (1990)                                                      |
| Hostile bidders rarely prevail in face of capital restructuring                                | Dann & DeAngelo (1988)                                                                                                         |
| Dual class recapitalization and other defensive strategies result in stock price decrease      | Partch (1987),* Dann & DeAngelo (1988), Jarrell & Poulsen (1988)                                                               |
| Stock price increases with voting power                                                        | Levy (1983), Lease, et al. (1984), DeAngelo & DeAngelo (1985)                                                                  |
| High free cash flow is associated with higher probability of going private and higher premiums | Lehn & Poulsen (1989)                                                                                                          |
| Firms more likely to issue debt if current debt level is below target                          | Marsh (1982)                                                                                                                   |
| Leverage decreases with return volatility                                                      | Bradley, et al. (1984), Kester (1986),* Friend & Hasbrouck (1988), Friend & Lang (1988), Titman & Wessels (1988)*              |
| Leverage increases with increases in operating risk                                            | Kim & Sorensen (1986)                                                                                                          |
| Leverage decreases with increases in firm size                                                 | Yes: Kester (1986),* Kim & Sorensen (1986),* Titman & Wessels (1988)*<br>No: Friend & Hasbrouck (1988),* Friend & Lang (1988)* |
| High inside ownership is associated with return variance increasing investments                | Agrawal & Mandelker (1987)                                                                                                     |
| Leverage decreases with increases in dispersion outside ownership                              | Friend & Lang (1988), of Gonedes, et al. (1988)                                                                                |

\* = weak or statistically insignificant relationship.

## VI. Conclusions

The theories surveyed here have identified a great many *potential* determinants of capital structure (in addition to taxes). These can be most easily seen in Table II, Panels A and D. Since the theories are, for the most part, complementary, which of these factors is important in various contexts remains a largely unanswered empirical question.

Although many potential factors emerge from the theory, a fairly small number of "general principles" is evident. The literature that takes debt and

Table VII

**Summary of Results by Model Type**

The table shows, for each model type, the main results [with sources in brackets] and the empirical studies whose findings are either consistent (after the word "Yes:") or inconsistent (after "No:") with the theoretical result.

| Panel A. Agency Models                                                                                                                                                                                                                                |                                                                                                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Theoretical Result [source]                                                                                                                                                                                                                           | Empirical Evidence                                                                                                            |
| Stock price increases on announcement of debt issues, debt-for-equity exchanges, or stock repurchases and decreases on announcement of equity issues or equity-for-debt exchanges [Harris & Raviv (1990a), Stulz (1990), Hirshleifer & Thakor (1989)] | Debt Issues<br>Yes: Kim & Stulz (1988)<br>No: Dann & Mikkelsen (1984),* Eckbo (1986),* Mikkelsen & Partch (1986)*             |
|                                                                                                                                                                                                                                                       | Debt-for-Equity Exchanges<br>Yes: Masulis (1980, 1983), Cornett & Travlos (1989)                                              |
|                                                                                                                                                                                                                                                       | Stock Repurchases<br>Yes: Masulis (1980), Dann (1981), Vermaelen (1981), Dann, et al. (1989)                                  |
|                                                                                                                                                                                                                                                       | Equity Issues<br>Yes: Asquith & Mullins (1986), Masulis & Korwar (1986), Mikkelsen & Partch (1986), Schipper and Smith (1986) |
|                                                                                                                                                                                                                                                       | Equity-for-Debt Exchanges<br>Yes: Masulis (1980, 1983), Eckbo (1986), Mikkelsen & Partch (1986), Cornett & Travlos (1989)     |
| Leverage is positively correlated with firm value [Harris & Raviv (1990a), Stulz (1990), Hirshleifer & Thakor (1989)]                                                                                                                                 | Yes: Lys & Sivaramakrishnan (1988), Cornett & Travlos (1989), Dann, et al. (1989), Israel, et al. (1990)                      |
| Leverage is positively correlated with default probability [Harris & Raviv (1990a)]                                                                                                                                                                   | No: Castanias (1983)                                                                                                          |
| Leverage increases with lack of growth opportunities [Jensen & Meckling (1976), Stulz (1990)]                                                                                                                                                         | Yes: Kim & Sorensen (1986), Titman & Wessels (1988),* Chaplinsky & Niehaus (1990)*<br>No: Kester (1986)                       |

Table VII—(Continued)

| Panel A. Agency Models                                                                                                                              |                                                                                                                                                                                                                                           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Theoretical Result [source]                                                                                                                         | Empirical Evidence                                                                                                                                                                                                                        |
| Leverage increases with decreases in profitability [Chang (1987)]                                                                                   | Yes: Kester (1986), Friend & Hasbrouck (1988), Friend & Lang (1988), Gonedes, et al. (1988), * Titman & Wessels (1988)<br>No: Long & Malitz (1985)*                                                                                       |
| Leverage increases with extent of regulation [Jensen & Meckling (1976), Stulz (1990)]                                                               | Yes: Bowen, et al. (1982), Bradley, et al. (1984)                                                                                                                                                                                         |
| Leverage increases with increases in free cash flow [Jensen (1986), Stulz (1990)]                                                                   | No: Chaplinsky & Niehaus (1990)                                                                                                                                                                                                           |
| Leverage increases with increases in liquidation value [Williamson (1988), Harris & Raviv (1990a)]                                                  | Yes: Bradley, et al. (1984), Long & Malitz (1985), Friend & Hasbrouck (1988), Friend & Lang (1988), Gonedes, et al. (1988), Titman & Wessels (1988), * Chaplinsky & Niehaus (1990)<br>No: Kim & Sorensen (1986), Titman & Wessels (1988)* |
| Bonds can be expected to have covenants prohibiting “asset substitution” [Jensen & Meckling (1976)]                                                 | Yes: Smith & Warner (1979)                                                                                                                                                                                                                |
| Leverage is negatively correlated with the interest coverage ratio and the probability of reorganization following default [Harris & Raviv (1990a)] |                                                                                                                                                                                                                                           |
| Leverage increases with fraction of cash flow that is unobservable [Chang (1987)]                                                                   |                                                                                                                                                                                                                                           |
| Leverage increases with extent to which the firm is a takeover target or lack of anti-takeover measures [Stulz (1990), Hirshleifer & Thakor (1989)] |                                                                                                                                                                                                                                           |
| Firms with longer track records have lower default probabilities [Diamond (1989)]                                                                   |                                                                                                                                                                                                                                           |
| Leverage increases with decreases in investigation costs [Harris & Raviv (1990a)]                                                                   |                                                                                                                                                                                                                                           |

Table VII—(Continued)

| Panel A. Agency Models                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Theoretical Result [source]                                                                                                                                                                                                   | Empirical Evidence                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Leverage increases with increases in the importance of managerial reputation [Hirshleifer & Thakor (1989)]                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Panel B. Asymmetric Information Models                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Theoretical result [source]                                                                                                                                                                                                   | Empirical Evidence                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Stock price increases on announcement of debt issues, debt-for-equity exchanges, or stock repurchases and decreases on announcement of equity-for-debt exchanges [Ross (1977), Noe (1988), Narayanan (1988), Poitevin (1989)] | <p>Debt Issues</p> <p>Yes: Kim &amp; Stulz (1988)</p> <p>No: Dann &amp; Mikkelsen (1984), * Eckbo (1986), * Mikkelsen &amp; Partch (1986)*</p> <p>Debt-for-Equity Exchanges</p> <p>Yes: Masulis (1980, 1983), Cornett &amp; Travlos (1989)</p> <p>Equity-for-Debt Exchanges</p> <p>Yes: Masulis (1980, 1983), Eckbo (1986), Mikkelsen &amp; Partch 91986), Cornett &amp; Travlos (1989)</p> <p>Stock Repurchases</p> <p>Yes: Masulis (1980), Dann (1981), Vermaelen (1981), Dann, et al. (1989)</p> |
| Stock price is unaffected by debt issues [Myers & Majluf (1984), Krasker (1986), Korajczyk, et al. (1990c)]                                                                                                                   | See previous cell                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Leverage increases with increases in profitability [Ross (1977), Leland & Pyle (1977), Heinkel (1982), Blazenko (1987), John (1987), Poitevin (1989)]                                                                         | <p>Yes: Long &amp; Malitz (1985)*</p> <p>No: Kester (1986), Friend &amp; Hasbrouck (1988), Friend &amp; Lang (1988), Gonedes, et al. (1988), * Titman &amp; Wessels (1988)</p>                                                                                                                                                                                                                                                                                                                      |
| Leverage increases with decreases in free cash flow [Myers & Majluf (1984)]                                                                                                                                                   | Yes: Chaplinsky & Niehaus (1990)                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

Table VII—(Continued)

| Panel B. Asymmetric Information Models                                                                                                                                                                        |                                                                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Theoretical Result [source]                                                                                                                                                                                   | Empirical Evidence                                                                                                                     |
| Stock price decreases on announcement of equity issue [Ross (1977), Myers & Majluf (1984), Krasker (1986), Korajczyk, et al. (1990c), Noe (1988), Narayanan (1988), Poitevin (1989), Lucas & McDonald (1990)] | Yes: Asquith & Mullins (1986), Masulis & Korwar (1986), Mikkelsen & Partch (1986), Schipper and Smith (1986)                           |
| There is a pecking order: firms prefer internal finance, then issuing securities in order of increasing sensitivity to firm performance [Myers & Majluf (1984), Krasker (1986), Narayanan (1988)]             | Yes: Chaplinsky & Niehaus (1990), Amihud, et al. (1990)<br>No: Korajczyk, et al. (1990a)                                               |
| Leverage is positively correlated with firm value [Ross (1977), Noe (1988), Narayanan (1988), Poitevin (1989)]                                                                                                | Yes: Lys & Sivaramakrishnan (1988), Cornett & Travlos (1989), Dann, et al. (1989), Israel, et al. (Forthcoming)                        |
| Leverage is positively correlated with default probability [Ross (1977)]                                                                                                                                      | No: Castanias (1983)                                                                                                                   |
| Leverage is positively correlated with the extent of managerial equity ownership [Leland & Pyle (1977)]                                                                                                       | Yes: Kim & Sorensen (1986), Agrawal & Mandelker (1987), Amihud, et al. (1990)<br>No: Friend & Hasbrouck (1988), * Friend & Lang (1988) |
| Firms tend to issue equity following abnormal price appreciation [Lucas & McDonald (1990)]                                                                                                                    | Yes: Marsh (1982), Korajczyk, et al. (1990a)                                                                                           |
| Firms tend to issue equity when information asymmetry is smallest [Myers & Majluf (1984), Korajczyk, et al. (1990c)]                                                                                          | Yes: Korajczyk, et al. (1990a)                                                                                                         |
| Stock price decreases more the larger is the informational asymmetry [Myers & Majluf (1984), Krasker (1986), Korajczyk, et al. (1990c)]                                                                       | Yes: Korajczyk, et al. (1990b)*                                                                                                        |
| Leverage increases with extent of information asymmetry [Myers & Majluf (1984)]                                                                                                                               |                                                                                                                                        |

Table VII — (Continued)

| Panel B. Asymmetric Information Models                                                                                     |  |                               |
|----------------------------------------------------------------------------------------------------------------------------|--|-------------------------------|
| Theoretical result [source]                                                                                                |  | Empirical Evidence            |
| Stock price decreases more the larger is the size of the issue [Krasker (1986)]                                            |  | Yes: Asquith & Mullins (1986) |
| Stock price increases if some proceeds of equity issue used to repurchase debt [Brennan & Kraus (1987)]                    |  |                               |
| Stock price increases on announcement of issue of convertible debt in exchange for equity [Constantinides & Grundy (1989)] |  |                               |
| Panel C. Product/Input Market Models                                                                                       |  |                               |
| Theoretical Result [source]                                                                                                |  | Empirical Evidence            |
| Leverage increases with extent to which product is not unique and does not require specialized service [Titman (1984)]     |  | Yes: Titman & Wessels (1988)  |
| Leverage increases with extent of <i>strategic</i> interaction in the product market [Brander & Lewis (1986)]              |  |                               |
| Leverage increases with elasticity of demand for the product [Maksimovic (1988)]                                           |  |                               |
| Leverage increases with extent to which reputation for product quality is unimportant [Maksimovic & Titman (Forthcoming)]  |  |                               |
| Leverage increases with extent to which workers are unionized or have transferable skills [Sarig (1988)]                   |  |                               |

Table VII—(Continued)

| Panel D. Corporate Control Models                                                                                                                                                                                                             |                                                                                                                                                                                                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Theoretical Result [source]                                                                                                                                                                                                                   | Empirical Evidence                                                                                                                                                                                      |
| Stock price increases on announcement of debt issues, debt-for-equity exchanges, or stock repurchases and decreases on announcement of equity issues or equity-for-debt exchanges [Harris & Raviv (1988), Stulz (1988), Israel (Forthcoming)] | Debt Issues<br>Yes: Kim & Stulz (1988)<br>No: Dann & Mikkelsen (1984), * Eckbo (1986), * Mikkelsen & Partch (1986)*<br>Debt-for-Equity Exchanges<br>Yes: Masulis (1980, 1983), Cornett & Travlos (1989) |
|                                                                                                                                                                                                                                               | Stock Repurchases<br>Yes: Masulis (1980), Dann (1981), Vermaelen (1981), Dann, et al. (1989)                                                                                                            |
|                                                                                                                                                                                                                                               | Equity Issues<br>Yes: Asquith & Mullins (1986), Masulis & Korwar (1986), Mikkelsen & Partch (1986), Schipper and Smith (1986)                                                                           |
|                                                                                                                                                                                                                                               | Equity-for-Debt Exchanges<br>Yes: Masulis (1980, 1983), Eckbo (1986), Mikkelsen & Partch (1986), Cornett & Travlos (1989)                                                                               |
|                                                                                                                                                                                                                                               | Yes: Lys & Sivaramakrishnan (1988), Cornett & Travlos (1989), Dann, et al. (1989), Israel, et al. (Forthcoming)                                                                                         |
| Leverage is positively correlated with firm value [Harris & Raviv (1988), Stulz (1988), Israel (Forthcoming)]                                                                                                                                 | Yes: Kim & Sorensen (1986), Agrawal & Mandelker (1987), Amihud, et al. (1990)<br>No: Friend & Hasbrouck (1988), * Friend & Lang (1988)                                                                  |
| Leverage is positively correlated with the extent of managerial equity ownership [Harris & Raviv (1988), Stulz (1988)]                                                                                                                        | Yes: Palepu (1986)                                                                                                                                                                                      |
| Leverage is negatively correlated with probability of successful takeover [Stulz (1988)]                                                                                                                                                      |                                                                                                                                                                                                         |

Table VII—(Continued)

| Panel D. Corporate Control Models                                                                                                                                   |                    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| Theoretical Result [source]                                                                                                                                         | Empirical Evidence |
| Leverage increases with potential gains to takeover and reductions in their costs [Israel (Forthcoming)]                                                            |                    |
| Leverage is positively correlated with target premium [Stulz (1988)]                                                                                                |                    |
| Leverage increases with extent to which the firm is a takeover target or lack of anti-takeover measures [Harris & Raviv (1988), Stulz (1988), Israel (Forthcoming)] |                    |
| Leverage is negatively correlated with target premium [Israel (Forthcoming)]                                                                                        |                    |
| Targets of an unsuccessful tender offer have more debt than targets of proxy fights or successful tender offers [Harris & Raviv (1988)]                             |                    |
| Targets of successful proxy fights have more debt than targets of unsuccessful proxy fights [Harris & Raviv (1988)]                                                 |                    |
| Targets of proxy fights have more debt than targets of successful tender offers [Harris & Raviv (1988)]                                                             |                    |

\* = weak or statistically insignificant relationship.

equity as given is based on four important properties of the debt contract:

- Bankruptcy, i.e., debt provides for a costly takeover of the firm by debtholders under certain conditions. This fact is exploited in Ross (1977), Grossman and Hart (1982), Titman (1984), Jensen (1986), Harris and Raviv (1988, 1990a), Maksimovic and Titman (Forthcoming), Poitevin (1989), Stulz (1990), and others.
- Cash flow to levered equity is a convex function of returns to the firm. This fact leads to the asset substitution effect which is central in Jensen and Meckling (1976), Brander and Lewis (1986), Sarig (1988), Diamond (1989), and others.
- Leverage increases the manager's equity ownership share. This effect works in two ways: it forces manager's payoffs to be more sensitive to firm performance, and, since debt is nonvoting, it concentrates voting power. These properties are exploited in Jensen and Meckling (1976), Leland and Pyle (1977), Harris and Raviv (1988), Stulz (1988), and others.
- The value of debt is relatively insensitive to firm performance. Thus, debt is priced more accurately than equity in situations involving asymmetric information. This fact is used by Myers and Majluf (1984) among others.

Since the survey shows that theory has identified numerous potential determinants, it is not surprising that the models have a wealth of different implications (very few opposing, however) (see Table II). Models within a given type (e.g., agency), however, have many common predictions (see Table VII). Moreover, models of almost all types share the prediction that stock price will increase on announcement of leverage-increasing capital structure changes (see Table II, Panel B). This is probably because the models were designed to produce this prediction, since this effect is so well documented by event studies. Although the event studies have generally been interpreted as evidence that announcements of security offerings, exchanges, and repurchases contain new information about the firm's future cash flows, i.e., as evidence for signaling models, in fact they support at least three of the four types of models.

From Tables V and VII it is clear that the empirical evidence thus far accumulated is broadly consistent with the theory. It is perhaps unfortunate that there seem to be no significant empirical anomalies to guide further theoretical work. Indeed, it would be difficult to reject any models based on the available evidence.<sup>44</sup> Note, however, that many of the theoretical impli-

<sup>44</sup> Inspection of Table VII produces only the following candidates: the signaling models listed in Panel B, line 3 (see also line 8); the free cash flow models listed in Panel A, line 7 and Harris and Raviv (1990a) (Panel A, line 3). In each case, the empirical studies were not designed specifically to test the model and hence generally do not meet the *ceteris paribus* conditions demanded by the theory.

cations have not yet been tested (as evidenced by the empty cells in Tables V and VII).

While recommendations for further work are always tentative, it seems clear that certain areas are underexplored. In our view, models which relate capital structure to products and inputs are the most promising.<sup>45</sup> This area is still in its infancy and is short on implications relating capital structure to industrial organization variables such as demand and cost parameters, strategic variables, etc. On the other hand, it seems to us that models exploiting asymmetric information have been investigated to the point where diminishing returns have set in. It is unlikely that further effort in this area will lead to significant new insights. With regard to empirical work, Table V (or VII) provides a list of theoretical predictions that have not been tested. Of course, testing these results (or any of the others) is complicated by the wealth of *ceteris paribus* conditions each requires. Nevertheless, it is essential that empirical work be directed specifically at sorting out which effects are important in various contexts.

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<sup>45</sup> Most promising of those areas surveyed here; we also believe that security design is an important underexplored topic — see our companion survey Harris and Raviv (1990b).

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