Interactions of Investment Opportunities and Financing Decisions

by

Atulya Sarin

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APPROVED:

Professor John M. Pinkerton, Chairman

Assistant Professor David J. Denis

Professor Robert S. Hansen

Professor Arthur J. Keown

Associate Professor Dilip Shome

Blacksburg, Virginia

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(ABSTRACT)

This study examines how the investment opportunity set of the firm affects financing choices the firm makes. In a two-period, one decision, no-tax model, we show that firms characterized by a high level of investment opportunities in future periods issue equity and convertible securities while firms with fewer investment opportunities in future periods issue straight debt. Our empirical design improves upon previous studies in two important ways. First, we treat convertible debt separately from straight debt. Second, in addition to examining the correlation between investment opportunity and debt-asset ratios, we examine the incremental financing decision using discrete choice analysis. We find that the level of investment opportunities of firms making public issues of equity and convertible debt are higher than those issuing straight debt. Also, there is a negative correlation between investment opportunities and debt-asset ratios. We interpret these results to mean that investment opportunities are an important determinant of the firm's financing policy. The direction of this relationship is the same as that predicted by the tax models of DeAngelo and Masulis (1980) and Dotan and Ravid (1985), and agency models of Myers (1977), Jensen (1986) and Stulz (1990).

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CHAPTER 1

INTRODUCTION

Until more than a decade ago, financial economists typically explored problems of capital structure under the assumption that investment decisions were exogenously determined. More current theories of corporate finance, however, recognize the interactive nature of these decisions. But still, there is a lack of consensus in the profession on the exact nature of these interactions.

Predictions of the several better known *investment opportunity set - financing choice* theories are inconsistent. For example, the tax models of Myers (1974) and Hite (1977) predict that the higher expected taxable income associated with positive NPV investment opportunities provides an incentive to obtain the tax shields associated with debt financing. On the other hand, Dotan and Ravid (1985), like DeAngelo and Masulis (1980), argue that positive NPV investments create non debt tax shields. Since debt-related and investment-related tax shields are perfect substitutes, the incentive for debt financing disappears as positive NPV investment opportunities increase.

The *Pecking Order* of financing, first introduced by Donaldson (1960) but today associated with the information asymmetry model of Myers and Majluf (1984), predicts that firms will finance new investment, first internally, then with debt, then with

convertible bonds and finally, as a last resort, with equity. Narayanan (1988) and Nachman and Noe (1989), also relying on information asymmetry, argue that the securities of high quality firms with positive NPV investment opportunities are typically undervalued. With debt less undervalued than equity, in the presence of asymmetric information, firms prefer to issue debt rather than equity.

Agency models predict that firms with an abundance of positive NPV investment opportunities will prefer to issue equity than debt to finance their new investment. For example, Myers (1977) points out that the stockholders of firms with a high chance of bankruptcy are unlikely to provide new capital, even to finance positive NPV (hence value increasing) projects. The stockholders' reluctance to invest more in the financially distressed firm stems from the reality that while they bear the entire cost of the investment, the existing debt holders capture most of the investment's return. Thus, a company's existing large debt level provides the firm's stockholders, when facing financial distress, an incentive to reject positive NPV projects. Myers concludes that firms not facing financial distress but expecting positive NPV investment opportunities will prefer to maintain low levels of debt and finance their current positive NPV projects with equity.

Jensen (1986) and Stulz (1990) both assume that managers have an incentive to invest all available funds even if it requires investing in some negative NPV projects. Debt service payments reduce the amount of funds managers have at their discretion for profitable investments. Thus, the managers of firms expecting to have future positive NPV investment opportunities prefer to finance those opportunities with equity. Only when positive NPV opportunities diminish and free cash flow increases will managers want to use debt.

The empirical evidence does not consistently verify theoretical predictions that the investment opportunity set influences the choice between debt and equity.

Kim and Sorensen (1986), Titman and Wessels (1988), Smith and Watts (1990) and Chaplinsky & Niehaus (1990) all report that a lack of positive NPV investment opportunities corresponds with leverage increases (Titman & Wessels and Chaplinsky & Niehaus both reported a weak or statistically insignificant relationship). On the other hand Kester (1986) and Baskins (1989) found exactly the opposite.

More recently, Gaver and Gaver (1991) report that firms with positive NPV investment opportunities have low debt-equity ratios, but only if equity is measured at its market value. When calculated as a book (historical) value the existence of positive NPV investment opportunities fail to explain the cross-sectional variation in debt levels.

All empirical studies on interaction of investment opportunities and financing choices mentioned above assume a capital structure in equilibrium and test if the existing debt/asset ratio (or long term average debt/asset ratio) can be explained by a proxy for investment opportunities. MacKie-Mason (1990) alerts us to the dynamic nature of the capital structure decision. That is, firms capital structure are seldom at their optimal levels and the empirical prediction inconsistencies may be due to measurement errors associated with using either Debt/Total Assets or Debt/Equity ratios as indicators of the firm's equilibrium capital structure. Cross sectionally, such measurement errors may average out. But, systematic shocks may leave most firms in a sample, either above or below their optimal debt level, thus biasing the estimated regression coefficient for the investment opportunity set and limiting the reliability and statistical power of tests of significance.

Previous empirical studies have also combined straight debt with convertible debt. This approach has two limitations. First, it prevents us from analyzing the determinants of the convertible debt choice, and second, convertible debt has characteristics of equity, and combining it with straight debt reduces the power of tests of significance.

This study provides an empirically verified resolution to the conflicting predictions about how a firm's investment opportunity set influences the choice of straight debt, convertible debt, and equity in its capital structure.

I consider a two-period, one decision, no-tax model. Along similar lines as Jensen (1986) and Stulz (1990), I argue that the security choice reflects the firm's inter-temporal cash requirements. In case the cash flow is likely to exceed the positive NPV investment opportunities in future periods, firm value is maximized by issuing short term securities. This will force the managers to pay back the free cash and prevent them from investing in negative NPV projects. Alternatively, if investment opportunities exceed cash flows in future periods, firm value is maximized by issuing long term securities. This will ensure that sufficient capital is available (or less has to be raised) to take up all positive NPV projects. Equity has infinite maturity and convertible debt/preferred stock is often converted into equity. Thus,

> ***Hypothesis :*** Firms characterized by a high level of investment opportunities in future periods issue equity and convertible securities while firms with fewer investment opportunities in future periods issue straight debt.

As mentioned earlier, the empirical approach used in previous studies of assuming that the capital structure is in equilibrium and estimating if the current

debt/asset ratio (or long term debt/asset ratio) can be explained by a proxy for investment opportunities, limits the reliability and statistical power of the tests. I ameliorate this problem by using an incremental choice approach. I examine firms at the time they are raising capital to determine how differences in investment opportunities across firms lead them to choose among different security types. Furthermore, rather than measure the net changes in total liabilities, I restrict the analysis to the choice between publicly placed (1) equity, (2) straight debt and (3) convertible debt. Thus, my results explain the effects of investment opportunities on the choice between different securities conditional on going public. I do not consider private placements because of lack of data availability.

I use three different proxies for investment opportunities: Tobin's Q, the level of the firm's R&D capital, and analysts' expected 5 year growth rate in earnings per share. I find that the presence of positive NPV investment opportunities increases the likelihood that equity and convertible debt will be issued rather than debt.

A limitation to the incremental choice analysis is that I have not considered the entire range of financing choices available to the firm, and focus only on public issues of straight debt, convertible debt and equity. It is possible that firms with high levels of investment opportunities prefer to issue privately placed debt/bank debt and the firms with fewer such opportunities prefer privately placed equity/retentions. To account for all financing sources, I provide additional evidence by estimating cross sectional regressions relating the debt-asset ratio to the level of investment opportunities.

The cross sectional analysis of the amount of debt financing compliment the incremental choice findings. I interpret these results to mean that investment oppor-

tunities are an important determinant of a firm's financing policy. The direction of this relationship is the same as that predicted by the tax models of DeAngelo and Masulis (1980) and Dotan and Ravid (1985), and agency models of Myers (1977), Jensen (1986) and Stulz (1990). Our results do not support the tax models of Myers (1974) and Hite (1977), and the information asymmetry models of Narayanan (1988) and Nachman and Noe (1988).

The remainder of this study is organized as follows. In chapter 2, the extant literature is discussed. Chapter 3 presents a simple model of financing choice under asymmetric information and agency conflicts between managers and shareholders. The model is then used to develop testable implications of the financing choice. Chapter 4 presents the empirical testing procedure. Data sources are explained and proxy variables for measuring investment opportunities are suggested. In addition, other variables known to affect the capital structure decision are identified and discussed. Chapter 5 presents the major empirical results of the paper, which are consistent with the predictions of the agency models of Myers (1977), Jensen (1986) and Stulz (1990). The presence of positive NPV investment opportunities increases the likelihood that equity and convertible debt will be issued rather than debt. Chapter 6 offers concluding remarks.

CHAPTER 2

LITERATURE REVIEW

2.1 Theory

Until more than a decade ago, financial economists typically explored problems of capital structure under the assumption that operating cash flows or investment decisions were exogenously determined, either with certainty or with an endowed known distribution. It is now the consensus, I believe, that excluding the interactions of investment and capital structure decisions, may obscure some of the more important activities that take place in the firm. While a rigorous derivation of the interactions model is a fairly recent development, an intuitive notion of interactions can be traced back to the initial cost of capital computation as performed by Modigliani and Miller in 1963, and even earlier in the 'traditional' use of the "U"-shaped curve in characterizing optimal capital structure. However, the issue first became a focus of attention in the 1974 contribution by Myers. Myers prefaces his work by saying: 'The purpose of this paper is to present a general approach for analysis of the interactions of corporate financing and investment decisions." However, his discussion boils down to the assertion that in computing the present value of investments, one must also take into account the impact of the additional investment on the firm's debt

capacity-which in turn, will change the firm's tax liability. He concludes that as proposed by M&M, additional leverage increases firm value.

In a companion paper, Myers and Pogue (1974) show that in a framework as presented above, the firm may optimally invest in negative net present value projects only because they increase the firm's debt capacity, and thus generate tax-savings associated with debt. This notion is illustrated with a numerical example solved via a linear programming technique. Myers' basic insight is supported by numerous transactions performed by firms for the sole purpose of tax sheltering. Myers' stimulating contribution must be considered the basis for those later studies which can be broadly grouped into three categories: tax approach, agency approach and the information asymmetry approach.

2.1.1 Tax Approach:

The tax models essentially argue that interest payments on debt provide a tax shield. Since tax-deductibility is not unique to debt, but affects all inputs purchased by the firm, taxes might offer a link between production and financial decisions. Hite (1977) first formalized that notion by suggesting that, since capital rather than labor expenses are financed by debt, costs attributed to capital may become twice deductible, and thus a firm that carries a large amount of debt may want to use more cheap capital in its production mix. The two problems with the Hite (1977) approach are the automatic link between investment and capital structure (that is, the factor cost of investment capital is an explicit function of leverage) and the fact that there is no bankruptcy in his model. In fact, the optimal capital structure in his model is all debt. In a later paper, Albert and Hite (1983), use the same framework to derive industry

equilibrium. Here it is shown that the firm's supply curve is shifted downward as the use of leverage increases since capital is partially financed by debt. The equilibrium is obtained at the point where profits, including the operating loss and tax shelter benefits combined, reach zero.

DeAngelo and Masulis (1980) introduced the opposite notion, i.e. that depreciation resulting from investment and interest tax shelters may be substitutes rather than complements. The crucial difference between Hite (1974) and DeAngelo and Masulis (1980) is that Hite essentially assumed that debt-related tax shields were never lost whereas DeAngelo and Masulis relaxed this assumption. In the DeAngelo and Masulis (1980) state preference model, non-debt-related tax shields are introduced. The amount of these tax shields varies across firms. Thus, if income does not always exceed all tax shelters, some interest in some states of nature may not be deductible.

This issue was further explored in the Dotan and Ravid (1985) analysis. They extended the DeAngelo-Masulis (1980) and Hite (1974) work by explicitly posing the question: where do the non-debt-related tax shields come from? The immediate answer is that they usually are depreciation-related tax shields, which originate in investments made by the firm. The model proposed, then, is of a firm which must decide on productive capacity and on debt simultaneously. Both decisions give rise to tax shelters. Dotan and Ravid's accounting environment is similar to DeAngelo and Masulis - if there is not enough income, the firm loses its tax shields. Since debt-related and capacity-related tax shields are substitutes, this one period model reaches the conclusion that, at the margin, higher productive capacity should be financed by less debt. Also, Dotan and Ravid show that higher taxes lead to more debt, but lower productive capacity. Thus the introduction of costly bankruptcy and

non-tax-paying states leads to results diametrically opposed to Hite's conclusions, and the question remains whether increased productive capacity should be financed by debt or equity.

2.1.2 Agency Approach

Until recently, firms were viewed by economists as profit-maximizing entities. While this view obviously has its merits, it was treated with much suspicion by people who are familiar with the day-to-day intricacies of firm operation. The agency approach, which focuses on the organization of the firm, goes a long way towards reconciling theory with reality in explaining how conflicts between various groups within the firm affect observed corporate behavior. Amongst other things, the agency approach contributes to our understanding how financing decisions could affect a firm's investment incentives.

Jensen and Meckling (1976) offered an insight which has altered the way the the finance profession views the business firm. This simple application of a fairly complex concept of the theory of information provided an alternative view of the firm, not as a value maximizing entity but as a nexus of contracts, where each claimant to the economic value of the enterprise is vying to get a piece of the pie. Agency costs are created because of potential conflicts of interest between shareholders, who are presumably interested in value maximization, and their agent, the manager. Similarly, bondholders and shareholders have divergent interests.

This idea in itself has lead to a theory of optimal capital structure, where the marginal agency costs of leverage balance the marginal agency costs of equity at the optimal

level of debt. It has also led to a reconsideration of the way the capital structure decision is actually made. While it must have always been clear that firms usually make a capital structure choice with some investment in mind, the agency approach provided an analytical tool with which one could probe the issue.

Jensen and Meckling (1976) made the point that agency costs vary with the scale of production, creating a link between production and financing. However, Myers (1977) was the first to offer an explicit agency interaction model. He suggests that the existence of debt may lead to non-optimal investment decisions on the part of shareholders. Whereas shareholders of an all equity firm should be interested in value maximization, and thus undertake all positive NPV projects, shareholders of levered firm are interested in cash flows over and above the repayment of debt, and thus may forgo positive NPV investment opportunities.

Jensen (1986) and Stulz (1990) reached the same conclusion that leverage is inversely related to the level of investment opportunities by looking at the agency conflicts between managers and shareholders. They argue that managers maximize investments and will prefer to invest in negative NPV projects over paying out dividends. Contractual debt repayment may prevent them from doing that. Thus, shareholders will prefer high debt levels if the company is expected to have a high level of profitability and a shortage of good investment projects in the future.

Brender and Spencer (1987) extend the literature, and explore the agency incentive link between debt and investment on the one hand and manager's effort on the other. They conclude that the existence of debt will reduce the manager's level of unobservable effort, creating additional agency costs. The reason for this result is that the owner-manager is interested only in the non-bankrupt states. As the amount of debt

increases, there are fewer such states, and hence, the effort exerted by the manager will decline.

Myers (1977), Jensen (1986), Brender and Spencer (1987), and Stulz (1990) all argue that leverage is inversely related to the level of investment opportunities. All of them claim that debt will reduce the level of inputs - investment or effort. However, whereas Jensen refers to the states of nature (free cash flow) where such reductions will increase the NPV of the firm by eliminating bad projects, the other authors, who abstract from the agency problem between managers and shareholders, refer to a situation where the reduction in inputs eliminates 'good', i.e. positive NPV projects.

2.1.3 Information Asymmetry Approach

Most of the studies mentioned in the previous section focused on the choice between debt and equity and its impact on the investment decision. In practice most firms choose to finance a surprising percentage of new operations with retained earnings (Masulis (1982)). This curious fact was the driving force behind papers by Myers (1985) and Myers and Majluf (1984) which focused on the asymmetry of information between the manager and shareholders. The general idea is that managers may have superior information about the projects available to the firm. If they can resort to internal financing, optimal investment decisions will take place. However, if they need to sell new securities in the market, it may be (if the firm's equity is sufficiently undervalued) that the firm will forgoe good investment projects, since their acceptance will lower the value of the existing equity. Thus, even though with full information there seems to be very few compelling reasons to resort to internal financing (transactions costs can not account for the prevalence of this form of financing),

asymmetric information justifies the 'pecking order' of financing- internal financing, then safe debt, and only as a last resort, risky debt or equity.

Narayanan (1988) and Heinkel and Zechner (1990) obtain similar results to Myers and Majluf (1984) 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 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 the projects are financed by debt. He further shows that when firms are allowed to issue either debt or equity, all firms either issue debt or reject the project.

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 modelled by Myers and Majluf (1984). 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 a richer set of financing options.

2.2 Empirical Evidence

The empirical evidence does not consistently verify theoretical predictions that the investment opportunity set influences the choice between debt and equity.

Kim and Sorensen (1986), Titman and Wessels (1988), Smith and Watts (1990) and Chaplinsky and Niehaus (1990) all report that a lack of positive NPV investment opportunities corresponds with leverage increases (Titman & Wessels and Chaplinsky & Niehaus both reported a weak or statistically insignificant relationship). On the other hand Kester(1986) and Baskins(1989) found exactly the opposite.

More recently, Gaver and Gaver(1991) report that firms with positive NPV investment opportunities have low debt-equity ratios, but only if equity is measured at its market value. When calculated as a book (historical) value the existence of positive NPV investment opportunities fail to explain the cross-sectional variation in debt levels. All these studies have the following two limitations, which I address in my study.

2.2.1 Analyze Debt-Equity Ratios

The common approach in previous studies has been to assume that the capital structure is in equilibrium and test if the current debt/asset ratio can be explained by a proxy of investment opportunities. The problem with this approach is that it ignores the dynamic nature of the capital structure decision.[1] Due to adjustment costs, firms

[1] This problem has been pointed out by MacKie-Mason(1990). My empirical modeling, which takes care of this problem, closely parallels his approach.

will not typically adjust their capital structure continuously to optimal levels. This is apparent from casual observation. If, for instance, the change in the market value of debt/asset ratio is the appropriate control variable, then adjustment should be made virtually everyday, as stock price changes, inflation, and other unexpected economic events change the value of this ratio. In fact, capital structure changes are lumpy and relatively infrequent. Thus measuring debt/asset ratio at any given moment, and using that to test for the relationship between investment opportunities and debt levels, may lead to erroneous conclusions. Although, in cross section, the measurement errors may tend to average out, this will not be true if firms sometimes face credit constraints. If credit was rationed when firms wanted to raise new debt financing, then observed debt/asset ratios will be systematically below optimal, thus limiting the reliability and statistical power of tests of significance.

An alternative approach has been to see if investment opportunities affect long-run debt levels, measured as several year averages. This ignores the nonstationarity of the investment opportunities and optimal debt ratios. Specifically, two firms may have had different investment opportunities in previous periods and that may account for differences in long-run debt/asset ratios. However, if these two firms no longer have differences in their investment opportunities, no test will be able to establish a relationship between present period investment opportunities and long-run debt/asset ratios.[2]

Thus, dynamic structure of the firm's optimization problem and nonstationarity of investment opportunities limit the reliability and statistical power of the tests using

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[2] Note that one way to address this problem is to measure all explanatory variables over the same time as the debt levels.

debt/asset ratio to establish investment opportunities as a determinant of the financing choice.

2.2.2 Ignore Security Types other than Straight Debt and Equity

As far as I am aware, all previous studies only attempt to explain the choice between equity and total debt. My model and some of the other theories have different empirical implications with regard to different types of debt instruments. Thus, straight debt and convertible debt should be analyzed separately rather than treating them together as an aggregate measure of total debt.

CHAPTER 3

AGENCY COSTS, UNCERTAINTY RESOLUTION AND THE FINANCING DECISION

3.1 Introduction

The capital structure decision and the stock price behavior around security issues has received a great deal of attention in the finance literature.[3] The two frameworks dominating this research in the last decade are agency cost models and information theoretic models. Extensive empirical support for both models exists. Yet with the exception of John(1987), little has been done to investigate how the agency models and the information theoretic models jointly explain the financing decision and share price behavior around security issues. My theoretical analysis provides a unified framework of some information theoretic models and the agency cost models.

I consider a two period world in which the firm raises external capital since the cash inflows are not sufficient to finance all positive NPV projects. It has to choose between issuing debt and equity. The agency problem exists because the managers maximize investments and prefer to invest in negative NPV projects over paying out

[3] For a detailed survey see Harris and Raviv(1991).

the cash flow in excess of the amount which can be invested in positive NPV projects. Thus, they always prefer to raise the maximum amount of capital and always issue equity. However, their financing decisions are constrained by an investment banker. The investment banker has access to the manager's private information set and monitors them in the collective interest of all shareholders to ensure that the size and type of the security issued maximizes firm value. I show that the firm issues debt in the case where positive NPV investment opportunities are less than the cash inflow in the next period. The debt issue contracts the managers to pay back the face value of debt and reduces investments in negative NPV projects. On the other hand, if positive NPV investment opportunities exceed the cash flow in the next period, the firm issues equity. This is because issuing debt in this case would reduce the amount of positive NPV projects which can be taken up or increase the amount of new funds which will have to be raised (which is costly). So firms with valuable investment opportunities prefer to issue equity and firms with fewer investment opportunities prefer to issue debt.

Investors are presumed to know the constrained objective function used by the firm to decide upon the size and type of the financing instrument. The firm's financing decision therefore helps them revise their expectations of future cash flows and investment opportunities. The price adjusts to reflect the investors' new expectations.

The investors know that external financing is more likely when the earnings are lower than expected or when the amount of positive NPV projects are higher than expected, or both. But they have no expectation of the uses of the unanticipated financing for specific firms. However, based on historical information and prevalent economic conditions, they make rational estimates (same estimates for all firms) of the average

increase in investments and decrease in earnings per dollar of unanticipated financing. For firms expected to earn high economic rents, an increase in investments results in a greater increase in firm value than the same increase in investments for firms expected to earn low economic rents. Thus, the price reaction to unanticipated financing which is the net of the increase in value due to an unanticipated increase in investments and decrease in value due to an unanticipated decrease in earnings will be directly related to the expected return on the firm's new investment opportunities.

3.2 The Environment

This section describes the environment in which firm and investors operate.

3.2.1 Preferences

Investors: Investors are risk-neutral. Without any loss of generality, I assume that the riskless rate of interest is zero.

Managers: Managers value investments and prefer to invest in negative NPV projects rather than pay cash flow to shareholders. The managers may prefer to maximize investments rather than the value of the firm for several reasons. For instance, the managers of larger firms have more visibility, have more perks to dispense to their employees and are better able to promote employees within the firm [Stulz(1990)]. Rather than model the reason managers prefer to maximize investments, I [along the same lines as Stulz(1990)] assume that manager's utility increases with the con-

sumption of perquisites and that this consumption is a function of investment only. Each unit of investment produces a nonstochastic positive amount of perquisites that is an increasing function of the investment's NPV. This assumption insures that management invests in positive NPV projects first. The reason is as follows: negative NPV projects consume corporate resources in the future, whereas, positive NPV projects increases these resources. So, managers that value investment would invest in projects that enable them to increase future investments.

My results [and those of Myers (1977), for example] of the financing choice depend on the assumption that a compensation contract which forces the managers to maximize firm value is not possible. I assume that managers receive a fixed wage and have no stake in the firm; implicitly, I assume that no monetary rewards can dominate management's benefits from increasing investments.[4]

Investment Banker: Based on the findings of Hansen and Torregrosa(1991), I assume that the lead investment bank of the underwriting syndicate monitors the financing activity of the managers. They argue that the investment banker provides monitoring of the manager stockholder conflict in the capital raising process. The investment banker acting in the collective interests of the shareholders, ensures that the size and type of security issued maximizes firm value.

Also since external financing can lower the share price, shareholders may disagree on the desired financial policy. Specifically, shareholders who are about to sell shares may prefer to delay or forego a project if issuing securities to finance the

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[4] Jensen and Murphy(1990) provide evidence that managerial compensation is weakly related to managerial performance, suggesting that it is unlikely that compensation contracts are used to attenuate the agency costs of managerial discretion (Stulz(1990), footnote 4).

project lowers the current stock price. I assume, as do Lucas and McDonald(1990), that the firm has enough long-term shareholders, and the financing decision is in their interests.

3.2.2 Investment Opportunities

The specification of the return to investment is chosen to reflect declining marginal returns on investment. Furthermore, for tractability I assume the marginal product of investment is given by a step function. Thus firm i can invest I_t^{iA} in positive NPV projects at date t and have cash inflow of $1 + \rho^{iA}_{(t+1)g}$ per dollar of investment at date t+1. Any further investment at date t leads to cash inflow of $1 - \rho^{iA}_{(t+1)b}$ (negative returns) per dollar of investment at date t+1.

3.2.3 Terminology

I employ a model with three dates: 0,1 and 2. Capital markets are open at all dates. The total cash inflow at date 2 is distributed among shareholders and the firm is disbanded. I abstract from taxes and the possibility of storing investment opportunities. Define (for firm i):

I^{iA}_{tg} = Amount which is invested in positive NPV opportunities at date t.

I^{r}_{tg} = Amount which can be invested in positive NPV opportunities at date t.

I_{tg}^{iE}	=	Investor's expectations of the amount which can be invested in positive NPV opportunities at date t.
$\gamma_t^i = I_{tg}^{iA} - I_{tg}^{iE}$	=	Unanticipated positive NPV investments at date t. Conditional on no unanticipated financing announcement, $E(\gamma_t^i) = 0$.
$1 + \rho_{tg}^{iA}$	=	Actual cash inflow at date t+1 from investment of one dollar made at date t in positive NPV project.
$1 + \rho_{tg}^{iE}$	=	Investors' expectation of the cash inflow at date t+1 from investment of one dollar made at date t in positive NPV project.
$\varepsilon_t^i = \rho_{tg}^{iA} - \rho_{tg}^{iE}$	=	Unanticipated cash inflow at date t+1 from investment of one dollar at date t. Conditional on no unanticipated financing announcement, $E(\varepsilon_t^i) = 0$.
$1 - \rho_{tb}^{iA}$	=	Actual cash inflow at date t+1 from investment of one dollar made at date t in negative NPV project.
α	=	Floatation cost of raising one dollar.

Figure 1 shows the evolution of the earnings stream, investments and financing at date 0, 1 and 2 for firm i.

3.2.4 Information Structure

Investors: Investors have rational expectations[5] of the firm's investment opportunity curve (amount which can be invested in positive NPV projects and the return on investments) at date 0 and 1, and the size and type of external financing. Thus, unan-

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[5] I assume throughout that the investor anticipations, whatever their precise form, are 'rational expectations' in the sense of Muth (1961).

date	0	1	2
Cash Flow[a]	CF_0	CF_1	CF_2
Positive NPV Investments[b]	I_{0g}	I_{1g}	
Negative NPV Investments[c]	I_{0b}	I_{1b}	
External Financing[d]	F_0	F_1	

[a] $CF_t = (1 + \rho_{(t-1)g}) I_{(t-1)g} + (1 - \rho_{(t-1)g}) I_{(t-1)b}$

[b] $I_{tg} = \begin{cases} \hat{I}_{tg} & \text{if } (CF_t + F_t) \geq \hat{I}_{tg} \\ CF_t + F_t & \text{otherwise} \end{cases}$

[c] $I_{tb} = \begin{cases} 0 & \text{if } (CF_t + F_t) < \hat{I}_{tg} \\ CF_t + F_t - \hat{I}_{tg} & \text{otherwise} \end{cases}$

[d] $F_1 = \begin{cases} -F_0 & \text{if issue debt at date 0} \\ 0 & \text{if issue equity at date 0} \end{cases}$

Figure 1. Earnings, Investments and Financing of firm i.

ticipated external financing follows an increase in investment opportunities or decrease in earnings or both an increase in investment opportunities and decrease in earnings. Investors pool together information about all firms raising capital in excess of the expected amount and have rational expectations[6] of the average (pooled across all firms) increase in investments and average decrease in earnings per dollar of unanticipated external financing.

[6] Their expectations are conditional on the business conditions prevailing at the time the firm is raising capital.

Managers: Managers know the amount which can be invested in positive NPV projects and the cash flows at date 0 and 1. Thus, they know the sources and uses of funds at date 0 and 1. They also know the the return on investments for both positive and negative NPV investment projects.

Investment Bankers: The investment banker has access to all information which the managers have.

Figure 2 shows the information structure.

3.3 Equilibrium

I define an equilibrium in the security issue market under the assumption that firms' choose a security type and are price takers.

Definition: An equilibrium exists in the security issue market reflecting a price P_t, an issue policy and the following beliefs:

1) Investors weakly prefer to pay the price P_t for the security than to make an alternate investment.

2) Firms weakly prefer this issue policy to any other, taking P_t as given.

3) Investors have rational expectations.

	Investors	Managers/ Investment Banker
Investments	Distribution of amount which can be invested in positive NPV projects at date 0 and 1.	Amount which can be invested in positive NPV projects at date 0 and 1.
Earnings	Distribution of earnings at date 0 and 1.	Earnings at date 0 and 1.
Return on investments	Distribution of return on investments in positive NPV and negative projects.	Return on investments in positive NPV and negative NPV projects.
Increase in investments conditional on raising unanticipated capital.	Distribution of increase in investments per dollar of unanticipated external financing.	Amount of capital raised to be used for new investments.
Decrease in earnings conditional on raising unanticipated capital.	Distribution of decrease in in earnings per dollar of unanticipated external financing.	Amount of capital raised to compensate for decline in earnings.

Figure 2. Information Available to Participants in Capital Raising Process at date 0 for firm I.

The price P_t reflects the investors' information at date t. The issue policy is a function of the manager's/investment banker's information.

3.3.1 An Equilibrium Financing Policy

In this section I show that the choice of security type issued at date 0 reflects the financing needs of both periods 0 and 1.

Consider the case where firms' positive NPV investment opportunities exceed the cash inflow at date 0. In order to take up all positive NPV project, the firm raises F_0 . The investments at date 0 lead to cash inflow of CF_1 at date 1. Since managers maximize investments, they never pay out any cash at date 1, unless forced to. Thus, if cash inflow exceeds investment opportunities at date 1, the managers invest in negative NPV projects. Under this condition, the firm value is maximized by issuing debt maturing at date 1. This contracts the managers to pay back the face value of debt and reduces the investments in negative NPV projects. On the other hand if positive NPV investment opportunities exceed the cash inflow at date 1, firm value is maximized by issuing two period securities. The reasoning behind that is as follows. Issuing debt payable at date 1 reduces the positive NPV projects which can be taken up or increases the amount of funds which have to be raised at date 1 (which is costly).

Furthermore, there is a strictly positive default cost of issuing debt. Thus, in case funds are raised for two periods, an equity issue always dominate a debt issue. Therefore, the choice between raising debt and equity at date 0 depends upon investment opportunities and cash inflows at date 1. More precisely,

Proposition 1: The probability of issuing equity over debt at date 0 increases:

- with an increases in investment opportunities at date 1.

- with a decrease in earnings at date 1.

Option	Financing Choice	Value Added to the firm in period 2.
A	Issue Debt at date 0	$(CF_1 - F_0)\rho_{1g}$
B	Issue Debt at date 0 and 1	$I_{1g}\rho_{1g} - \alpha(I_{1g} - CF_1 + F_0)$
C	Issue Equity at date 0	$CF_1\rho_{1g}$
D	Issue Equity at date 0 and 1	$I_{1g}\rho_{1g} - \alpha(I_{1g} - CF_1)$

[a]Option C dominates option A since issuing equity at date 0 reduces the amount of positive NPV projects which have to be foregone.

[b]Option D dominates option B since issuing equity reduces the amount of funds which have to be raised at date 1 to take up the same amount of NPV projects..

Figure 3. Effect of Financing Choices on Firm Value when Investment Opportunities Exceed Cash Inflow at date 1.

Proof: From figure 3 we see that in case the investment opportunities at date 1 exceed the cash inflow, issuing equity always dominate issuing debt. This reduces the amount of positive NPV investment opportunities which have to be foregone (option C over option A) or reduces the cost of raising additional securities (option D over option B).

From case 1 of figure 4 we see that in case the investment opportunities are lower than the cash inflows at date 1 by an amount greater than the amount of external financing at date 0, issuing debt always dominates issuing equity. This is so because issuing debt reduces investments in negative NPV projects.

In case 2 of figure 4 the investment opportunities are lower than the cash inflows at date 1 by an amount less than the amount of external financing at date 0 and there is no clear cut domination of one security type over the other. In case equity is issued,

Option	Financing Choice	Value Added to the firm in period 2.
Case 1: Positive NPV Investment Opportunities are lower than the cash flow at date 1 by an amount greater than the external financing at date 0.		
A	Issue Debt	$I_{1g} - (CF_1 - I_{1g} - F_0)\rho_{1b}$
B	Issue Equity	$I_{1g} - (CF_1 - I_{1g})\rho_{1b}$
[a]Option A dominates option B since issuing debt reduces the negative NPV investments.		
Case 2: Positive NPV Investment Opportunities are lower than the cash flow at date 1 by an amount less than the external financing at date 0.		
A	Issue Debt	$(CF_1 - F_0)\rho_{1g}$
B	Issue Equity	$I_{1g}\rho_{1g} - (CF_1 - I_{1g})\rho_{1b}$

Figure 4. Effect of Financing Choices on Firm Value when Investment Opportunities are less than the Cash Inflow at date 1.

the firm can take up all positive NPV projects but will also invest in some negative NPV projects. On the other hand, in case debt is issued, the firm will have to forego fewer positive NPV projects. The choice of the security type will depend on the level of free cash flow at date 1. In case the free cash flow is low, the loss in value due to negative NPV investments will be lower than the loss in value due to foregoing positive NPV projects and the firm will issue equity. Similarly, in case the free cash flow is high, the firm is more likely to issue debt.

3.4 Financing Announcement Effects

The price reaction to the announcement of external financing is a response to the surprise in earnings and investment opportunities. I assume the investors know the constrained objective function used by the firm to decide upon the size and type of the financing instrument. Therefore, the financing decision helps investors revise their expectations of future cash flows and investment opportunities. The price adjusts to reflect their new expectations.

The investors know that external financing is more likely when the earnings are lower than expected and when the amount which can be invested in positive NPV projects is higher than expected. Investors observe all firms raising capital in excess of the expected amount and make rational estimates of the average decrease in earnings and increase in investments per dollar of unanticipated financing. These estimates are based on historical information and prevalent economic conditions. If there are N firms issuing unanticipated external securities at date t, investors estimate the following:

$\frac{\sum_i \varepsilon_t^i}{N}$ = average decrease in earnings at date t on announcement of one dollar of unanticipated security issue.

$\frac{\sum_i \gamma_t^i}{N}$ = average increase in investments at date t on announcement of one dollar of unanticipated security issue.

Therefore, the change in market value of firm to the announcement of F_0^{iA} of equity at date 0 is:

$$\delta V_0^E = \left(F_0^{iA} - F_0^{iE}\right)\left[\rho_0^{iE}\left(\frac{\sum_i^I \varepsilon_0}{N}\right) + \frac{\sum_i^I \gamma_0}{N}\right] \tag{2.4}$$

As we see in section 2.3, unanticipated debt issue is more likely if positive NPV investment opportunities exceed cash inflows at date 0 and are less than cash inflows at date 1. Thus, in addition to the information conveyed in equity issue, unanticipated debt issue also implies that either investment opportunities will be lower than expected at date 1 or the cash inflows will be higher than expected at date 1 or both investment opportunities will be lower and cash flows will be higher at date 1. Therefore, the change in market value of debt to the announcement of F_0^{iA} of debt at date 0 is:

$$\delta V_0^D = \left(F_0^{iA} - F_0^{iE}\right)\left[\rho_0^{iE}\left(\frac{\sum_i^I \varepsilon_0}{N}\right) - \rho_1^{iE}\left(\frac{\sum_i^I \varepsilon_1}{N}\right) + \frac{\sum_i^I \gamma_0}{N} - \frac{\sum_i^I \gamma_1}{N}\right] \tag{2.5}$$

Proposition 2: The price reaction to unanticipated announcement of external financing is directly proportional to the expected return on new investment opportunities.

Proof: From equation 2.4 and 2.5 we see that the price reaction to an unanticipated security issue is the sum of two opposing effects, a downward revision in value because the earnings will be lower than expected, and an upward revision in value because the investments will be higher than expected. Investors pool together information about all firms raising capital in excess of the expected amount and have

rational expectations of the average increase in investments and decrease in earnings per dollar of unanticipated external financing. For firms earning high economic rents, an increase in investment results in a greater increase in firm value than the same increase in investment for firms earning low economic rents. Thus the price reaction which is the net of the increase in value due to an increase in investments and decrease in value due to a decrease in earnings will be related to the expected return on the firm's investment opportunities.

CHAPTER 4

EMPIRICAL TEST PROCEDURE

4.1 Hypothesis

My analysis makes predictions about the effect of future investment opportunities on the choice between different security types. In case the cash flow is likely to exceed the positive NPV investment opportunities in future periods, firm value is maximized by issuing short term securities. This will force the managers to pay back the free cash flow and prevent them from investing in negative NPV projects. Alternatively, if investment opportunities exceed cash flows in future periods, the firm value is maximized by issuing long term securities. This will insure that sufficient capital is available (or less has to be raised) to take up all positive NPV projects. Equity has infinite maturity and convertible debt/preferred stock is often converted into equity. Thus, firms with valuable investment opportunities in future periods are more likely to issue equity and convertible securities. Conversely, firms with few investment opportunities in future periods are more likely to issue straight debt.

> ***Hypothesis :*** Firms characterized by high level of investment opportunities in future periods issue equity and convertible securities while firms with fewer investment opportunities in future periods issue straight debt.

4.2 Measuring Investment Opportunities

To test the hypothesis in this paper, I require a variable to proxy for the expected marginal return on investments and the level of investment opportunities in future periods. I use three alternative measures; the Tobin's Q (Q), the analyst's expected five year growth rate in earnings per share (FORECAST), and the stock of R&D capital the firm owns standardized by the book value of the assets of the firm (RSTOCK). These proxies give the market's perception (Q), the fundamental analysis (RSTOCK), and the expert's (analysts) view (FORECAST) of the future investment opportunities.[7]

The appropriate variable which measures future investment opportunities is the marginal Q. Based on a cash flow model in which the firm faces convex costs in adjusting its capital stock, it has been shown that physical investment is determined by marginal Q, defined as the ratio of the discounted future revenues from an additional unit of capital (i.e., the shadow price of capital) to its net-of-tax purchase price [Mussa (1977), Abel (1979)]. Critical to the empirical usefulness of the Q - framework is that the unobservable marginal Q must be related to the observable average Q, defined as the ratio of the market value of the financial claims on the firm to the cost of reproducing its existing stock of capital. Average Q is equal to marginal Q only in the absence of taxes and adjustment costs for firms with declining or constant marginal efficiency of capital.[8] It has limitations as a measure of the level and quality of investment opportunities of the firm. Specifically, if a firm had many opportunities to

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[7] I also used annual growth rates in total assets, sales, equity value, net operating income, and the average ratio of capital expenditure to total assets for five years subsequent to the sample offering as alternative measures of investment opportunities. For sake of brevity, I only report the differences in results when using these different measures.

[8] For a discussion on effects of taxes and adjustment costs see Summers(1981) and Hayashi(1982).

generate economic rents then it will have a high Tobin's Q. However, if these opportunities have been exploited, then the average Q will overstate the amount of positive NPV investment opportunities the firm has in future periods and the expected marginal return on these investments. Similarly, a change in external factors can present a firm with high return investment opportunities even if none existed before. In that case Q will understate the amount of positive NPV investment opportunities the firm has in future periods and the expected marginal return on new investments. Denis, Denis and Sarin (1992) and Lang and Litzenberger(1989) abstract from the problems of using average Q and assume that it is highly correlated to the level of future investment opportunities. Along similar lines, I use average Q as a proxy for the level of investment opportunities in future periods and the expected return on new investments.

My measure of Q was obtained from the National Bureau of Economic Research (NBER) R&D Master File. The numerator of Q is the firm's market value, defined as the sum of actual market value of common stock and estimated market values of preferred stock and debt. The denominator of Q is the estimated replacement cost of the firm's plant and inventories.

RSTOCK is defined as the the stock of R&D capital the firm owns divided by the total assets of the firm. The stock of R&D capital is constructed from the history of R&D investment (COMPUSTAT data item # 46) measured in 1972 dollars. Since a continuous history of the R&D expenditure is needed to construct this variable, the missing value is interpolated using a perpetual inventory model with declining balance depreciation. This model assumes that the logarithm of R&D expenditures evolves as a random walk, which is justified by the patterns of R&D spending actually

observed.[9] I hypothesize that if a greater portion of the firm value is being accounted for by R&D investments, then it will have a greater level of investment opportunities in future periods and is expected to earn high economic rents.

Note, however, RSTOCK may proxy for non-debt tax shields. Since investments in research and development can be expensed (100% depreciated) in the year they are incurred, firms for which R&D investments constitute a higher level of their assets can be expected to have lower tax benefits of issuing debt. Consequently, they may issue less debt. My model predicts that firms with high RSTOCK will issue less debt since they have more investment opportunities in future periods. So, even if I find that firms with low RSTOCK prefer to choose debt, it is not clear whether the choice is motivated because of lack of tax advantages or lack of investment opportunities.

FORECAST is the analyst's forecasted five year growth rate in earnings per share. Firms for which EPS is expected to grow the most are likely to have the highest level of positive NPV investment opportunities. It can be argued that the expected growth in earnings may be from investments already made by the firm and expected to yield returns in the five year horizon of the analysts forecasts. Also investments in negative NPV projects can lead to EPS growth. However, I abstract from this problem and assume that the analysts forecast of the EPS growth will be correlated with the level of investment opportunities in future periods.

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[9] For details on estimation of RSTOCK see Documentation of The Manufacturing Sector Master File: 1959-1987. (Appendix B).

4.3 Other Variables Affecting the Financing Choice

A number of factors other than investment opportunities may influence a firm's financing decisions. My study is primarily concerned with effect of future investment opportunities, but omitting other factors from the specification can bias the estimates. I control for factors which other models suggest will be significant in explaining the capital structure decision. Note that these variables are hypothesized to affect the choice between straight debt and equity. To what extent, and the direction in which they will affect the probability of choosing convertible debt is mostly an empirical issue. The set of variables which I control for are as follows.

4.3.1 Taxes

MacKie-Mason (1990) has shown that for firms close to tax exhaustion, the level of tax shields will inversely affect the probability of choosing debt over equity. Along similar lines as Bayless and Chaplinsky (1991), I control for the tax effects as the income expenses less deferred taxes, standardized by the total assets (TAXPAY). I hypothesize that firms with low TAXPAY are less likely to issue straight debt and convertible debt.

4.3.2 Financial Distress Costs

If bankruptcy or financial distress reduces shareholder wealth, then a firm should be reluctant to issue debt or convertible debt when the interest commitment increases the likelihood of distress. Following Bradley, Jarrell and Kim (1984), the proxy of fi-

nancial risk I use is SIGMA, the standard deviation of first differences in operating income before depreciation, interest and taxes, plus non-operating income, divided by the mean of total assets, for 10 years prior to registration (at least six years if data is missing).

4.3.3 Optimal Debt Ratios

The incremental choice approach I use avoids the assumption that firms have optimal debt ratio targets. Of course, firms may have debt-ratio targets. Thus I, along the same lines as Marsh (1982), proxy for optimal debt ratio targets by the difference between the lagged debt/asset ratio and the long-run (ten year) average of the debt/asset ratio (DEVTAR). I hypothesize that if the firm has a stable target, then the deviations from the long-run average should indicate what the security choice will be to reach back to the target ratio. However, firms for unobserved reasons may prefer high debt ratios. In that case, the lagged ratios will be correlated with a preference for debt at the margin or vice versa. So, I also include the lagged ratio (DBTRAT) by itself to reduce the omitted variable bias.

4.3.4 Information Asymmetry

Information asymmetry models (Myers and Majluf (1984), for example) suggest that when firms issue securities there is a potential wealth transfer from new security holders to old security holders. Since low priority securities like equity and convertibles are more likely to be mispriced, there is a greater degree of wealth transfer for these securities. Thus, firms with high degrees of information asymmetry will be re-

luctant to issue low priority securities like equity and convertibles. I use three variables to proxy for the degree of information asymmetry, the logarithm of assets (LNAST), the size of the new issue relative to the total assets (DILN) and an exchange dummy (EXCHDUM).

Following Booth and Smith (1986) I hypothesize that the information asymmetry will be lower for large firms. Along their lines my proxy of information asymmetry is LNAST, the natural log of a five year average of the assets preceding and including the year of the issue. The natural log is taken to take care of scale effects (it is unlikely that the dependent variable is linear in raw assets). I expect that firms with high LNAST have a greater probability of issuing equity.

My second proxy is the size of the new issue relative to the total assets (DILN). Greater dilution provides greater potential to transfer wealth. Thus, firms with high DILN are more likely to issue senior securities like straight debt (Krasker (1986)).

My other proxy of information asymmetry is an exchange dummy (EXCHDUM) which takes on a value 1 , if the firm was listed on New York Stock Exchange (NYSE) or American Stock Exchange (AMEX) at the time of the issue. Since firms traded on NYSE/AMEX are followed more aggressively, on average a greater amount of information is available on these firms. This leads to lower information asymmetries. Thus, I hypothesize that firms on NYSE/AMEX are more likely to issue equity.

4.3.5 Agency Costs

Along the same lines as Lehn and Poulson (1989), my proxy for the agency cost of

free cash flow is the undistributed cash flow divided by total assets (CFLOW).[10] I hypothesize (as in Jensen (1986)) that firms with high free cash flow are more likely to issue debt.

Along similar lines as Bradley, Jarrell and Kim (1984), my proxy of the agency conflicts between different stakeholders is the ratio of plant and equipment divided by total assets (FIXAST). Scott (1977) suggests that, by selling secured debt, firms increase the value of their equity by expropriating wealth from their existing unsecured creditors.[11] Secured debt also has lower bankruptcy costs. Arguments put forward by Myers and Majluf (1984) also suggest that firms may find it advantageous to issue secured debt. Their model suggests that there is a potential of wealth transfer from the new shareholders to old shareholders. Issuing debt secured by property with known values avoids these costs. Thus, I hypothesize that for firms with a high ratio of FIXAST (assets that can be used as collateral) are more likely to issue straight debt.

4.3.6 Market Timing

Along similar lines as Bayless and Chaplinsky (1990) , I use the mean stock price for 3 months preceding the issue divided by the mean of stock price for 36 months prior to the issue (PRICE) to proxy for market timing.[12] As argued by Lucas and McDonald,

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[10] $\text{CFLOW} = \frac{\text{INC - TAX - INT - DIVP - DIVC}}{\text{ASST}}$

where, INC equals operating income before depreciation, TAX equals taxes paid, INT equals interest payments, DIVP equals preferred stock dividends, DIVC equals common stock dividends and ASST equals total assets.

[11] For a comment on Scott's model, see Smith and Warner (1979).

[12] MacKie-Mason (1990) and Marsh (1982) analyze stock return as a determinant of security choice.

I expect that equity issues are more likely after a price increase than during periods of declining stock prices.

4.4 Data and Empirical Methodology

4.4.1 Incremental Choice Analysis

I use an approach which ameliorates some of the problems of the previous studies. I look at firms at the time they are raising capital to determine how differences in investment opportunities across firms leads them to choose among different security types. Furthermore, rather than just examining the choice between straight debt and equity, I also include convertible debt in my analysis. I do not consider private placements because of lack of data availability. Thus, my results explain the effects of investment opportunities on the choice between different securities conditional on going public.

4.4.11 Sample Description: The data for the incremental choice analysis is obtained from the Registered Offering Statistics (ROS) tape available from the SEC for the years 1977-1988. Issue dates are the day the issue was offered to the public as reported in ROS. To be included in the sample, an offering must meet the following requirements:

However, Bagnoli and Khanna (1990) argue that stock price rather than stock return is the key determinant of equity issue.

1) The security is a primary offering and is for common stock, straight debt or convertible debt.

2) No other security is issued at the time of this offering (no combination offerings).

3) The offering is registered with the SEC and is listed on ROS and I could verify it in the Wall Street Journal.

4) The firm has data available for the fiscal year prior to the offering on COMPUSTAT. Note that this precludes initial public offerings.

5) The firm is listed on the daily return tape of the Center for Research in Security Prices (CRSP) for New York Stock Exchange and American Stock Exchange firms or the National Association of Security Dealers Association firms at announcement and 250 trading days after the offering date.

6) The firm has data for the fiscal year prior to the offering on The Manufacturing Sector Master File available from the National Bureau of Economic Research.

7) The offering is made for raising capital (is not a noncash transaction).

This results in a sample of 1,984 primary offerings (Common equity: 1,224, Straight debt: 613 and Convertible debt: 147).[13] All explanatory variables are measured as of the year ending just prior to the sample offering announcement to avoid any simultaneity bias. The analyst's forecast data for my sample firms is taken from the Investment Brokers Estimate System (I\B\E\S) data base developed by Lynch, Jones,

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[13] There are 464 equity issues by firms which did not issue straight debt or convertible debt. All firms which issued either straight debt or convertible debt also issued equity.

and Ryan Co. Summary statistics of analysts' forecast of long term growth in EPS is obtained monthly from all major brokerage firms to compile the data base. I use the forecast for the month prior to the issue. This limits my sample to 1134 primary offerings (Common equity: 627, Straight debt: 436 and Convertible debt: 71).

Table 1 presents a distribution of the sample by year. As noted by other researchers, I find that 1983 is a big equity issue year (176 offerings in my sample).

Table 2 compares the characteristics of firms issuing equity, straight debt and convertible debt. All three of the proxies of investment opportunities, the Tobin's Q (Q), the level of the firm's R&D capital (RSTOCK), and analyst's expected five year growth rate in earnings per share (FORECAST) are higher for the sample of issues of equity and convertible debt than the sample of issues of straight debt. The differences are significant at the 0.01 level.[14]

On average the straight debt issuers are larger firms (LNAST), have a greater fraction of their assets invested in fixed assets (FIXAST), have a greater variance in earnings (SIGMA), a low tax bill (TAXPAY), and a lower price level (PRICE) as compared to equity and convertible issues. Also, the frequency of NASDAQ firms issuing straight debt is very low.

Another observation from table 2 is that for both the straight debt and convertible debt issues the size of the issue relative to the size of the issue (DILN) and the long run debt-asset ratio (DBTRAT) is significantly larger. Interestingly, there are no differ-

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[14] All three proxies of investment opportunities, Q, RSTOCK and FORECAST are correlated at the 0.001 level with each other. The correlation matrix between the three is:

Q	1.00		
RSTOCK	0.26	1.00	
FORECAST	0.55	0.23	1.00

Table 1

Time Profile for the sample of 1984 primary offerings made between 1977-1987 (Straight debt: 613, Convertible debt: 147 and Equity: 1224) by firms with data available on COMPUSTAT and NBER Manufacturing Sector Master File.

Decile	Straight Debt	Convertible Debt	Common Equity	Percentage of Sample
1977	22	0	77	4.99
1978	24	3	84	5.59
1979	23	2	101	6.35
1980	54	29	101	9.27
1981	35	28	116	9.02
1982	81	10	123	10.79
1983	58	24	176	13.00
1984	35	4	109	7.46
1985	72	7	123	10.18
1986	122	14	121	12.95
1987	87	26	93	10.38
Total	613	147	1224	100

TABLE 2

Descriptive Statistics

Summary Statistics of the sample of 1984 primary offerings made between 1977-1987 by firms with data available on COMPUSTAT, CRSP/NASDAQ Daily Return File and The NBER Manufacturing Sector Master File.

	COMMON EQUITY				CONVERTIBLE DEBT				STRAIGHT DEBT			
	Mean	25th Percentile	Median	75th Percentile	Mean	25th Percentile	Median	75th Percentile	Mean	25th Percentile	Median	75th Percentile
Q[a]	1.30	0.65	1.00	1.49	1.28	0.71	1.05	1.52	0.83	0.56	0.92	0.98
RSTOCK[b]	0.16	0.02	0.11	0.23	0.13	0.00	0.09	1.88	0.11	0.00	0.06	0.18
FORECAST[c]	0.17	0.12	0.15	0.20	0.17	0.12	0.16	0.20	0.12	0.09	0.11	0.14
LNAST[d]	19.52	18.20	19.42	20.96	19.34	18.03	19.23	20.42	21.27	20.41	21.52	22.40
CFLOW[e]	0.05	0.03	0.07	0.10	0.07	0.04	0.07	0.11	0.05	0.03	0.06	0.09
PRICE[f]	1.07	0.91	1.05	1.23	1.16	1.00	1.17	1.30	1.05	0.91	1.05	1.17
DILN[g]	0.07	0.00	0.01	0.04	0.25	0.09	0.17	0.35	0.14	0.03	0.05	0.12
SIGMA[h]	0.05	0.02	0.03	0.05	0.06	0.02	0.04	0.07	0.03	0.02	0.03	0.04
FIXAST[i]	0.33	0.22	0.31	0.41	0.33	0.21	0.31	0.41	0.41	0.27	0.39	0.56
DBTRAT[j]	0.20	0.10	0.19	0.27	0.22	0.14	0.23	0.30	0.23	0.14	0.21	0.29
DEVTAR[k]	-0.00	-0.01	0.00	0.00	0.01	-0.02	0.00	0.12	0.00	-0.01	0.00	0.00
TAXPAY[l]	0.02	-0.01	0.02	0.05	0.01	-0.01	0.01	0.05	-0.01	-0.04	-0.00	0.03
Number of Issues of firms on NASDAQ	254				29				17			
Total Number of Issues	1,224				147				613			
Total Number of Firms	551				125				299			

[a]Q: Ratio of the market value of the firm to the replacement cost of its assets.

[b]RSTOCK: Stock of R&D capital owned by the firm divided by the total assets of the firm.

[c]FORECAST: Analyst's forecasted 5 year growth rate in earnings per share obtained from the I\B\E\S Summary data base.

[d]LNAST: Natural log of a five year average of the assets preceding and including the year of the issue.

[e]CFLOW: Undistributed cash flow divided by total assets.

$$\frac{INC - TAX - INT - DIVP - DIVC}{ASST}$$

where, INC equals operating income before depreciation, TAX equals taxes paid, INT equals interest payments, DIVP equals preferred stock dividends, DIVC equals common stock dividends and ASST equals total assets.

[f]PRICE: Mean stock price for 3 moths preceeding the issue divided by the mean of stock price for 36 months prior to the issue.

[g]DILN: Size of the new issue relative to the total assets.

[h]SIGMA Standard deviation of first differences in operating income before depreciation, interest and taxes, plus non-operating income, divided by the mean of total assets, for 10 years prior to registration.

[i]FIXAST: the ratio of plant and equipment divided by total assets.

[j]DBTRAT: Lagged Debt Ratio

[k]DEVTAR: Difference between the lagged debt/asset ratio and the long-run (ten year) average of the debt/asset ratio

[l]TAXPAY: Income tax expenses less deferred taxes, standardized by the total assets.

[m]EXCHDUM: Dummy variable taking on a value 1, if the firm is listed at the NYSE/AMEX at the time of the issue.

ences between the deviation of long run debt ratio (DEVTAR) and free cash flow (CFLOW) between the three samples.

4.4.12 Empirical Model: My empirical model relies on a weak revealed preference restriction to measure the determinants of financing choices. Conditional on raising new funds from the public, a necessary and sufficient condition for optimization is that the observed choice must add more to the firm's objective function than do any of the other feasible alternatives.

Assume that the increment to the value function from alternative j, j ϵ { equity, straight debt, convertible debt, preferred stock, convertible preferred stock },is

$$\Delta V_j = x'\beta_j + \varepsilon_j \qquad (3.1)$$

where x is a K-vector of firm attributes, β_j is a K-vector of parameters to be estimated and ε_j is the residual term which captures unobserved variations in the value function.

The firm's choice is observed, but not the realization of the incremental value of the choice, ΔV_j. Define,

$$y = \quad j, \text{ if } \Delta V_j = \max |\Delta V_i| \text{ for all } i \qquad (3.2)$$

The econometric problem is to estimate the β_j given N observations of security issues and the characteristics vector (y_n, x_n). The probability model is

$$\text{Prob}(y = j \mid x) = \text{Prob}(\Delta V_j > \Delta V_i) \text{ for all } i \neq j \qquad (3.3)$$

Under the assumption that the error term has a logist distribution,[15] and the choice is being made between m securities, the probability of choosing security j is:

$$\text{Prob}(\, y = j \mid x \,) = \frac{e^{x'\beta_j}}{1 + \sum_{j=1}^{m-1} e^{x'\beta_j}} \qquad (3.4)$$

I obtain estimates, $\hat{\beta}_j$, by maximizing the log of the likelihood function for the sample.

In order to obtain consistent, unconditional estimates of the preference for one security type over the other, I require that the financial decision making be a nested process. One possibility is illustrated in figure 5.

First the firm determines whether to increase, decrease, or leave unchanged its total available funds. If funds are to be increased, then the choice between private and public sources is made. If the firm decides to go public, then it decides upon the financing instrument. This nested model assumes weak substitutability between alternatives on different branches, specifically that public issues are more substitutable with each other than with private issues. If figure 5 represents the true decision process behind the financing decision, then estimating the choice between public issues is appropriate. However, even if the actual decision involves the choice amongst other instruments which I do not consider (private placements, retentions, bank debt, etc.), my assuming this nested process will still yield consistent estimates. Suppose the actual choice is made between privately placed securities and publicly placed securities. In that case, the system of equations for the sources of funds can be transformed to a reduced form for the choice between the five public securities I

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[15] Although this model can be solved using any distribution for the error term. I assume it has a logist distribution , since that is easiest to handle computationally.

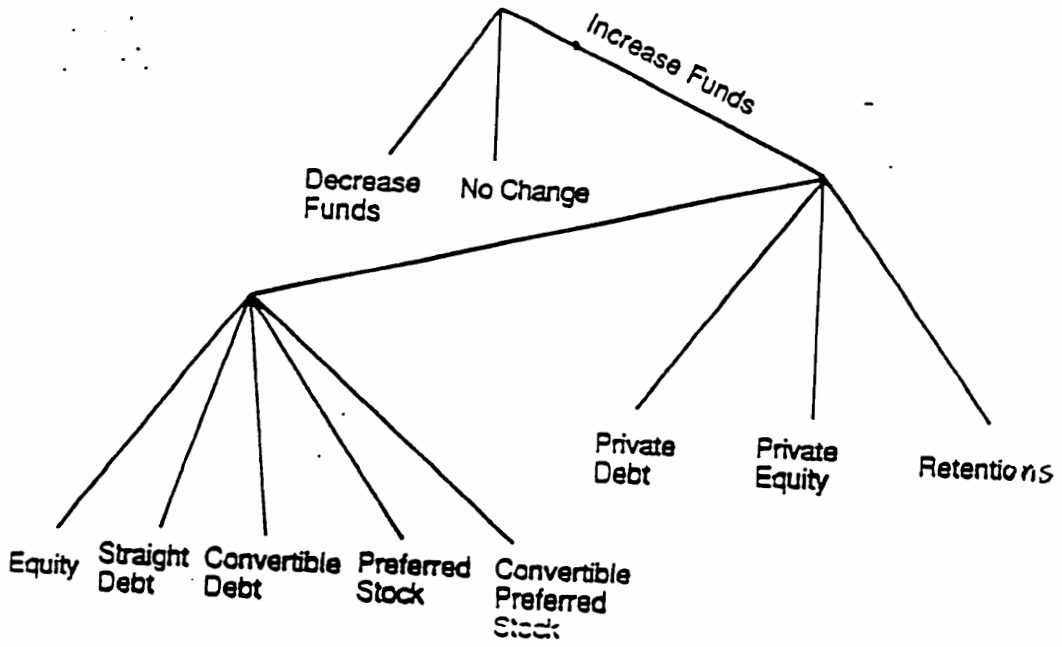

Figure 5. A Sequential Process of Financing Decision: If the firm decides to increase funds, it first chooses between private or a public issue. In case it decides to issues securities publicly, it chooses between equity, straight debt, convertible debt, preferred stock and convertible preferred stock.

consider. The reduced form works because the only condition for optimality which I require in estimating the model is that the chosen instrument must add more to the firm value than the other alternatives I consider.

4.4.2 Cross Sectional Analysis

The incremental choice analysis has one important limitation. The sample includes only public offerings of debt, equity and convertible debt. It is plausible that firms with high investment opportunities prefer privately placed/ bank debt and firms with fewer investment opportunities prefer privately placed equity. Also firms with low growth opportunities may use a lot of internally generated equity. If that were the case, our results show how investment opportunities affect the choice between public and private issues and are inconclusive regarding their effect on the leverage. To account for that, I examine if the cross sectional variation in debt equity ratios can be explained by my proxy of investment opportunities.

4.4.21 Sample Description: The sample is drawn from the population of firms listed on any of three Compustat files: the primary, supplementary and tertiary file, the full coverage file, or the industrial annual research file in 1985. I require the firm to have a December 31 year end. I also delete financial institutions and utilities from the sample to avoid confounding effects of regulation on the leverage. I further restrict the sample to those firms for which we can calculate Tobin's Q from the NBER Manufacturing Sector Master file. This results in a sample of 813 firms.

I compute four versions of the debt-asset ratio: 'book' debt-asset ratio and 'market' debt-asset ratio. The book debt-asset ratio is total debt divided by total assets.[16] The market debt-asset ratio is the market value of total debt divided by market value of the firm.[17] I also calculate the book and market value of debt-asset ratio after excluding the convertible debt from the total debt. I use the debt-asset ratio as against some other researchers who use the debt-equity ratio. The problem in using debt-equity ratio arises when using the book value of debt-equity ratios. The book value of equity can go down if the firm is posting losses and may even take on a negative value. In case the equity value is very low, the firm will have a very high debt-equity ratio. However, if the equity value goes down further and takes on a negative value, the debt equity ratio becomes negative. So effectively, the highest and lowest debt-equity ratio firms have similar poor prospects. However, when I use the debt-asset ratios, a negative value of equity or a very low value of equity will lead to a ratio close to 1.

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[16] Compustat data item (6-60-130)/6.

[17] All market values are obtained from the NBER file.

CHAPTER 5

RESULTS

My hypothesis suggests that firms for which valuable investment opportunities exceed the cash flow in future periods, prefer to issue equity and convertible debt. Consequently, firms with valuable investments opportunities should exhibit a preference for equity and convertible debt at the margin. Also, the firms' debt-asset ratio should be inversely related to the investment opportunities.

5.1 Incremental Choice Analysis

In Table 3, I have arranged all offerings into deciles based on the firm's Tobin's Q. I find that firms with low Q (fewer positive NPV investment opportunities) have a higher tendency to issue straight debt. As Q increases, the frequency of debt (equity, convertible debt) issues decrease (increase) almost monotonically. The top decile contains 100 issues of straight debt; only 9 issues of straight debt reside in the bottom decile. The mean (median) Q of a firm making a straight debt offering is 0.826 (0.715), convertible debt offering is 1.225 (1.027) and equity offering is 1.205 (0.984). The difference in the Q is significant at the 0.01 level. Similarly, the difference between

FORECAST and RSTOCK values for equity issues and convertible debt issues is significantly different at the 0.01 level with that for straight debt issues.[18]

The results of table 3 suggest a strong relation between the level of investment opportunity and the preference for equity and convertible debt. However, there are other factors which are known to affect the capital structure and the relationship we observe in table 2 could be a byproduct of Q being related to these other variables. So in Tables 4-6, I estimate a multinomial regression to control for these other factors. The difference between these three tables is the proxy of investment opportunities used. In table 4 I use Tobin's Q, in table 5 the level of R&D capital and in table 6 the analyst's expected five year growth rate in earnings as the proxy of investment opportunities. I find that even after controlling for other effects, the probability of issuing equity and convertible debt is related to the level of investment opportunities the firm has. This relationship is not effected by the proxy of the investment opportunity used. I also estimated the models in Tables 4-6 after adding two digit SIC code industry dummies (not reported here). This specification controls for industry -specific effects, which could have been correlated with the capital structure, leading to spurious results. I find, however, that the magnitude and significance levels on the proxy of investment opportunities are virtually unchanged.[19]

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[18] I also split the sample into deciles on the basis of my other proxies of investment opportunities. The relationship was far less strong, and for sake of brevity, I do not report those results.

[19] The correlation between independent variables raises the question of the influence of multicollinearity on the statistical estimates. There are no diagnostics designed specially for discrete choice analysis, but those designed for the ordinary least square regressions can be expected to point to any problems. I performed several of those diagnostic tests and found the influence of muticollinearity was negligible.

Table 3

Frequency of different security issues partitioned into deciles on the basis of the issuing firm's Tobin's Q for a sample of 1984 primary offerings (Common Equity: 1224, Straight Debt: 613 and Convertible Debt: 147) made between 1977-1987 by firms with data available on NBER Manufacturing Sector File.

Decile	Common Equity	Convertible Debt	Straight Debt	Median Q
1	118	13	100	0.42
2	112	13	104	0.53
3	128	8	97	0.61
4	117	19	95	0.71
5	144	10	78	0.82
6	143	24	65	0.95
7	160	23	48	1.13
8	158	17	56	1.35
9	166	20	45	1.66
10	195	27	9	2.79

[a]Tobin's Q is defined as the ratio of the market value of the firm to its replacement value, where market value and replacement value are taken from the NBER's Manufacturing Sector Master File.

Table 4

Estimated Coefficients from a multinomial logit model of firm choices between publicly issued debt, equity and convertible debt for a sample of 1984 primary offerings (Common equity: 1224, Straight debt: 613 and Convertible debt: 147) made between 1977-1987 by firms with data available on COMPUSTAT, CRSP/NASDAQ Daily Master File and NBER Manufacturing Sector File. Estimation by maximum likelihood. Asymtotic p-statistics in parentheses.

	$\text{Ln}(P_E/P_D)$[a]	$\text{Ln}(P_{CD}/P_D)$[a]
INTERCEPT	22.15 (0.000)	10.86 (0.000)
TOBINQ	1.56 (0.000)	0.47 (0.003)
CFLOW	-6.73 (0.000)	2.19 (0.137)
PRICE	0.92 (0.003)	1.11 (0.009)
DILN	-18.99 (0.000)	-2.78 (0.000)
LNAST	-1.06 (0.000)	-0.64 (0.000)
FIXAST	1.25 (0.013)	-1.04 (0.181)
TAXPAY	2.37 (0.128)	-3.548 (0.146)
SIGMA	4.76 (0.034)	1.47 (0.534)
DBTRAT	-2.12 (0.004)	0.07 (0.946)
DEVTAR	0.25 (0.857)	2.46 (0.138)
EXCHDUM	-0.65 (0.001)	-0.40 (0.047)
Pseudo R^2	0.50	
Log likelihood ratio	3940	

[a] P_i = Probability of issuing security type i , where i = D(Straight Debt), CD(Convertible Debt), E(Equity).

[b] See table 2 for description of the independent variables.

Table 5

Estimated Coefficients from a multinomial logit model of firm choices between publicly issued debt, equity and convertible debt for a sample of 1984 primary offerings (Common equity: 1224, Straight debt: 613 and Convertible debt: 147) made between 1977-1987 by firms with data available on COMPUSTAT, CRSP/NASDAQ Daily Master File and NBER Manufacturing Sector File. Estimation by maximum likelihood. Asymtotic p-statistics in parentheses.

	$\text{Ln}(P_E/P_D)$[a]	$\text{Ln}(P_{CD}/P_D)$[a]
INTERCEPT	24.57 (0.000)	11.10 (0.000)
RSTOCK	1.94 (0.000)	0.18 (0.805)
CFLOW	-4.52 (0.000)	2.46 (0.047)
PRICE	0.53 (0.075)	1.10 (0.008)
DILN	-15.30 (0.000)	-1.87 (0.001)
LNAST	-1.11 (0.000)	-0.63 (0.000)
FIXAST	1.32 (0.007)	-0.93 (0.224)
TAXPAY	5.31 (0.000)	-2.66 (0.253)
SIGMA	2.76 (0.175)	1.38 (0.533)
DBTRAT	-0.93 (0.224)	-1.55 (0.024)
DEVTAR	1.34 (0.322)	2.98 (0.075)
EXCHDUM	-0.83 (0.000)	-0.48 (0.017)
Pseudo R^2	0.53	
Log likelihood ratio	3940	

[a] P_i = Probability of issuing security type i , where i = D(Straight Debt), CD(Convertible Debt), E(Equity).

[b] See table 2 for description of the independent variables.

Table 6

Estimated Coefficients from a multinomial logit model of firm choices between publicly issued debt, equity and convertible debt for a sample of 1134 primary offerings (Common equity: 627, Straight debt: 436 and Convertible debt: 71) made between 1977-1987 by firms with data available on COMPUSTAT, CRSP/NASDAQ Daily Master File and I\B\E\S Summary File. Estimation by maximum likelihood. Asymtotic p-statistics in parentheses.

	$\text{Ln}(P_E/P_D)$[a]	$\text{Ln}(P_{CD}/P_D)$[a]
INTERCEPT	23.14 (0.000)	6.92 (0.029)
FORECAST	14.02 (0.000)	11.63 (0.000)
CFLOW	-2.26 (0.000)	1.77 (0.118)
PRICE	0.52 (0.200)	1.98 (0.001)
DILN	-20.39 (0.000)	-4.36 (0.000)
LNAST	-1.14 (0.000)	-0.58 (0.000)
FIXAST	1.10 (0.082)	-0.13 (0.907)
TAXPAY	4.64 (0.019)	-0.57 (0.862)
SIGMA	14.79 (0.001)	10.37 (0.070)
DBTRAT	-0.13 (0.907)	-0.98 (0.332)
DEVTAR	1.16 (0.606)	2.27 (0.431)
EXCHDUM	-0.67 (0.025)	-0.41 (0.185)
Pseudo R^2	0.50	
Log likelihood Ratio	2244	

[a] P_i = Probability of issuing security type i , where i = D(Straight Debt), CD(Convertible Debt), E(Equity).

[b] See table 2 for description of the independent variables.

The coefficients on the control variables, with the exception of the the fraction of firm's book asset accounted by net plant and equipment (FIXAST) and tax payable (TAXPAY), are, in the direction as predicted.

Jensen's (1986) 'free cash flow' hypothesis suggests that firms with excess cash tend to issue debt to reduce discretion over future cash flow. I find that for all three models, the proxy for excess cash flow (CFLOW) is negatively related to the probability of issuing equity. This relation is significant at the 0.01 level. However, the probability of issuing convertible debt is positively correlated to CFLOW. This relation is not significant at any reasonable level in two out of three cases, and is significant when RSTOCK is used as the proxy of investment opportunities at 0.05 level.

I find the same market timing phenomenon as other researchers: firms are more likely to issue equity and convertible debt when the stock prices are high. The coefficient on PRICE is positive in all six cases. It is significant at the 0.01 level for the probability of choosing convertible debt in all three case. The effect on the probability of issuing equity is not significant when the analyst's growth rate forecast is used as the proxy of investment opportunities.[20] Previous empirical researchers have not tried to explain this apparent violation of efficient market.[21] However, Bagnoli and Khanna (1987) argue that this behavior is consistent with a signalling equilibrium if a shift in, say, technology or market conditions improves both the expected value of assets in place (increasing the stock price) and the value of future projects (decreasing the signalling cost of equity relative to cost of borrowing). Thus, the timing effect may be

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[20] I also used stock returns instead of stock prices, to measure the timing effect. The performance of this alternative proxy was similar and is therefore not reported.

[21] A new issue should be priced at its expected value: firms shouldn't be able to win by selling when the price is high

evidence in favor of signalling costs. The fact that it is stronger for convertible debt issues as compared to equity issues, is still puzzling.

The dilution variable (DILN) is negative and significant in all six cases. As predicted by both the moral hazard and signalling hypothesis, potential dilution of ownership is strongly associated with a higher probability of straight debt issue. The moral hazard effect is plausible if concentration of ownership has a beneficial value in terms of improving monitoring of management. Also, as shown by Asquith and Mullins (1986), big issues lead to unusually large drops in stock prices.[22] They thus signal bad news and therefore 'good firms' are reluctant to issue equity when the capital requirements are large.

Smith and Watts (1991) argue that firm size can influence financing policies. Specifically, if large firms are more diversified and have lower return variance, and if the costs of financial distress are a major determinant of capital structure, then large firms will tend to use higher levels of debt financing. I find that indeed the natural log of the firm's assets is negatively correlated to the probability of issue of equity and convertible debt. This relation is significant at the 0.01 level in all cases. The coefficient for the probability of equity issue are larger than the coefficient for the probability of convertible debt issue, indicating that equity is clearly not preferred by larger firms. However, this is inconsistent with the hypothesized prediction by Booth and Smith (1986) that larger firms with lower information asymmetry will prefer equity issues.

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[22] Marsh (1979) and Hess and Frost (1982) rejected this hypothesis, when studying price effects on the equity issue date.

The coefficients on FIXSAT and TAXPAY are inconsistent with previous findings and the theoretical predictions. The probability of issuing equity is positively correlated with the fraction of the firm's book asset accounted for by net plant and equipment (FIXAST). This contradicts Myers's (1977) conjecture that debt issuance is supported by 'bonding' in the form of tangible assets. However, there is no relation between FIXAST and probability of issuing convertible debt. Also, my proxy for the tax effects is significant for equity issues in two of the three cases only and is opposite to the predicted effect. I find that probability of issuing equity increases with the tax liability of the firm (TAXPAY). It is possible that TAXPAY is proxying for investment opportunities, since a more profitable firm is likely to have a larger tax bill.

The coefficient on the variance of earnings (SIGMA) is dependent on the proxy of investment opportunities being used. In case I use the analysts' forecast of five year earnings growth (Table 6), the probability of issuing equity and convertible debt increases with the increase in SIGMA. When I use the level of the firm's R&D capital (RSTOCK), the probability of issuing equity and convertible debt is not correlated with SIGMA. Moreover, when I use Tobin's Q as the proxy of investment opportunities, the probability of issuing equity increases with increase in variance of earnings, but the probability of issuing convertible debt is not related to it.

The effect of the long run debt ratio and the deviation from the target debt ratio is weak. Only when I use Tobin's Q as the proxy of investment opportunities (Table 4), the probability of issuing equity decreases with the increase in the debt-asset ratio. Also, only in case I use the level of R&D capital (RSTOCK), the probability of issuing convertible debt decrease with an increase in debt ratio (DBTRAT) and the deviation from the long run debt-ratio (DEVTAR).

Also, the exchange dummy (EXCHDUM) is significantly negative in all six cases, implying that NYSE/AMEX firms are more likely to issue straight debt. This is contrary to the predictions of the signalling equilibrium, which would imply that firm's on NASDAQ will have higher information asymmetries, and greater reluctance to issue equity.

The specifications reported in Tables 4-6 are arrived after examining alternative proxies for SIGMA, PRICE and TAXPAY. Specifically, the variance in returns in lieu of SIGMA, the stock returns as an alternative to PRICE, and tax loss carryforwards for TAXPAY were used. The performance of these alternative proxies was not qualitatively different from those reported in Tables 4-6 and are therefore not reported.[23]

To gain additional insight into the economic importance of the effect of investment opportunity, I calculate the marginal impact of Q on the probability of choosing equity and convertible debt. I estimate the incremental probability of choosing equity and convertible debt for an average firm when the Q is changed from the 25th percentile to 75th percentile. while holding other independent variables in the model constant. The probability of choosing equity over straight debt goes up by 21% and the probability of choosing convertible debt over equity goes up by 7%.[24] These results indicate

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[23] I also estimated the models in Table 4 using annual growth rates in total assets, sales, equity value, net operating income, and the average ratio of capital expenditure to total assets for five years subsequent to the sample offering as alternative measures of investment opportunities. The results from using the average ratio of capital expenditure are qualitatively similar to those obtained using Q or RSTOCK. When using the annual growth rate in total assets, sales and equity value, the probability of issuing equity over straight debt, is significantly positively related to each of these measures, but the probability of issuing convertible debt over straight debt is not related to these measures. Moreover, there is no relationship between the probability of issuing equity or convertible debt and growth rate in net operating income.

[24] I estimate the probability of choosing equity and convertible debt over straight debt using the model in Table 4, when Q is at the 25th percentile and the 75th percentile value and all other explanatory variables are at there median values. The difference in the probability is reported above.

that the investment opportunities have an economically meaningful impact on the probability of choosing equity and convertible debt.[25]

5.1 Cross-Sectional Analysis

There is at least one caveat attached to the analysis of the previous section. The sample includes only public offerings of straight debt, equity and convertible debt. It is possible that firms with high levels of investment opportunities prefer to raise privately placed debt/bank debt and the ones with fewer such opportunities prefer privately placed equity/retentions. To account for this I examine if the cross sectional variation in debt ratios can be explained by investment opportunities.

Tables 7-9 report the estimates of cross-sectional regressions relating the debt-asset ratios to the level of investment opportunities. Four different measures of debt-asset ratios and three different proxies of investment opportunities are used. In table 7, I use Tobin's Q, in table 8 the level of R&D capital and in table 9 the analysts' expected 5 year growth rate in earnings are used as the proxy of investment opportunities. For all three tables, the dependent variable in model (1) is book total debt-asset ratio (book value of total debt divided by book value of total assets), in model (2) is market total debt-asset ratio (market value of total debt divided by market value of the firm), in model (3) is book straight debt-asset ratio (book value of total debt less book value of convertible debt divided by book value of total assets) and in model (4) is market straight debt-asset ratio (market value of total debt less market value of convertible

[25] Qualitatively similar results are obtained when using my other two proxies of investment opportunities.

debt divided by market value of the firm). All market values are taken from the NBER's file.

Tables 7-9 show that the debt-asset ratios are negatively correlated to Tobin's Q and the level of the firm's R&D capital and are uncorrelated to the analysts' expected five year growth rate in earnings.[26] There are three noteworthy findings in these tables. First, when the market ratios are used as a dependent variable, the estimated coefficients are larger (in absolute value). This may be expected when Q is being used as a measure of investment opportunities, because the denominator in calculation of both Q and the market debt-asset ratio is the same and that may lead to spurious correlations and higher coefficients. However, I find the same when using the level of firm's R&D capital as the proxy of investment opportunities. Furthermore, the same holds for all other explanatory variables - the coefficients in models 2 and 4 (using market debt ratios) are larger (in absolute terms) than those for models 1 and 4. Also, the regressions have a higher adjusted R^2. This implies that the market ratios are better explained by our theories of capital structure. This is puzzling, keeping in view that some of these theories specifically explain the book debt ratios. Secondly, the difference between the coefficients, when convertible debt is included as debt (models 1 and 2), or when they are not included (models 3 and 4) are virtually unchanged. After looking at the results of the previous section, I expected that excluding convertible debt from the debt-asset ratio would increase the explanatory power of investment opportunities. Contrary to that, the parameter estimate of the proxy of investment opportunities is virtually unchanged. This is because the amount of convertible debt used in the capital structure is an insignificant amount of the total debt,

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[26] The correlation between independent variables raises the question of the influence of multicollinearity on the statistical estimates. I performed several diagnostic tests and found the influence of muticollinearity was negligible.

Table 7

Estimates of cross-sectional regressions relating the debt-asset ratio to the Tobin's Q (Q) for a sample of 752 firms with data available on COMPUSTAT and NBER Manufacturing Sector File in 1985. The dependent variable in model (1) is book total debt-asset ratio (book value of total debt divided by book value of total assets), in model (2) is market total debt-asset ratio (market value of total debt divided by market value of the firm), in model (3) is book straight debt-asset ratio (book value of total debt less book value of convertible debt divided by book value of total assets) and in model (4) is market straight debt-asset ratio (market value of total debt less market value of convertible debt divided by market value of the firm).[a] T-statistics are in parentheses.

Independent	Model			
Variables	(1)	(2)	(3)	(4)
Intercept	0.31***	0.32	-0.27***	0.27
	(4.70)	(1.65)	(-4.12)	(1.41)
TOBINQ	-0.06***	-0.32***	-0.06***	-0.32***
	(-6.64)	(-12.95)	(-7.63)	(-12.79)
CFLOW	-0.59***	-1.37***	-0.59***	-1.34***
	(-10.48)	(-8.34)	(-10.71)	(-8.11)
LNAST	0.01***	0.04***	0.01***	0.04***
	(3.63)	(3.96)	(4.13)	(4.08)
FIXAST	0.00	-0.02	0.05*	-0.01
	(0.07)	(-0.16)	(1.13)	(-0.10)
TAXPAY	-0.30**	-0.34	-0.10	-0.24***
	(-2.11)	(-0.84)	(-0.73)	(-0.57)
SIGMA	0.08***	0.14	0.06**	0.13
	(2.34)	(1.53)	(2.00)	(1.37)
EXCHDUM	0.05***	0.09**	0.03**	0.08
	(2.94)	(2.01)	(1.99)	(1.63)
Adj. R^2	0.24	0.30	0.24	0.29
F-Stat	34.57	46.29	34.75	44.01

[a]All market values are taken from the NBER's file.

[b]See table 2 for a description of the independent variables.

***,** and * denote significance at 0.01, 0.05 and 0.10 levels respectively.

Table 8

Estimates of cross-sectional regressions relating the debt-asset ratio to the stock of R&D capital owned by the firm standardized by the book value of assets (RSTOCK) for a sample of 752 firms with data available on COMPUSTAT and NBER Manufacturing Sector File in 1985. The dependent variable in model (1) is book total debt-asset ratio (book value of total debt divided by book value of total assets), in model (2) is market total debt-asset ratio (market value of total debt divided by market value of the firm), in model (3) is book straight debt-asset ratio (book value of total debt less book value of convertible debt divided by book value of total assets) and in model (4) is market straight debt-asset ratio (market value of total debt less market value of convertible debt divided by market value of the firm).[a] T-statistics are in parentheses.

Independent Variables	Model (1)	(2)	(3)	(4)
Intercept	0.21*** (3.25)	-0.27 (-1.35)	0.15*** (2.44)	-0.31 (-1.51)
RSTOCK	-0.13*** (-4.36)	-0.43*** (-4.44)	-0.14*** (-4.64)	-0.43*** (-4.40)
CFLOW	-0.57*** (-9.95)	-1.13*** (-6.28)	-0.56*** (-9.94)	-1.09*** (-6.00)
LNAST	0.02*** (4.48)	0.06*** (4.96)	0.02*** (5.01)	0.06*** (5.04)
FIXAST	-0.04 (-0.79)	-0.17 (-1.19)	0.01 (0.16)	-0.17 (-1.15)
TAXPAY	-0.55*** (-4.00)	-1.79*** (-4.15)	-0.40*** (-2.90)	-1.74*** (-3.94)
SIGMA	0.06* (1.82)	0.05 (0.49)	0.04 (1.39)	0.03 (0.34)
EXCHDUM	0.05*** (3.21)	0.15*** (2.90)	0.04*** (2.33)	0.13*** (2.54)
Adj. R^2	0.21	0.16	0.21	0.15
F-Stat.	30.08	21.52	28.27	20.06

[a]All market values are taken from the NBER's file.

[b]See table 2 for a description of the independent variables.

***,** and * denote significance at 0.01, 0.05 and 0.10 levels respectively.

Table 9

Estimates of cross-sectional regressions relating the debt-asset ratio to the analysts forecast of the long term growth (FORECAST) for a sample of 513 firms with data available on COMPUSTAT and I/B/E/S Summary File in 1985. The dependent variable in model (1) is book total debt-asset ratio (book value of total debt divided by book value of total assets), in model (2) is market total debt-asset ratio (market value of total debt divided by market value of the firm), in model (3) is book straight debt-asset ratio (book value of total debt less book value of convertible debt divided by book value of total assets) and in model (4) is market straight debt-asset ratio (market value of total debt less market value of convertible debt divided by market value of the firm).[a] T-statistics are in parentheses.

Independent	Model			
Variables	(1)	(2)	(3)	(4)
Intercept	-0.04 (-0.40)	-0.71*** (-2.12)	-0.12 (-1.34)	-0.77*** (2.24)
FORECAST	0.08 (0.70)	-0.30 (-0.75)	-0.09 (-0.90)	-0.41 (-1.00)
CFLOW	-0.73*** (-8.12)	-2.18*** (-6.59)	-0.62*** (-7.16)	-2.06*** (-6.10)
LNAST	0.02*** (5.66)	0.07*** (4.39)	0.03*** (6.74)	0.07*** (4.49)
FIXAST	0.05 (1.00)	0.17 (1.04)	0.08* (1.81)	0.17 (0.96)
TAXPAY	-0.42*** (-3.10)	-1.29*** (-2.60)	-0.23* (-1.73)	-1.20*** (-2.33)
SIGMA	0.07*** (2.33)	0.09 (0.85)	0.06*** (2.21)	0.08 (0.77)
EXCHDUM	0.05*** (2.64)	0.11 (1.62)	0.04** (1.99)	0.10 (1.43)
Adj. R^2	0.28	0.21	0.30	0.21
F-Stat	29.56	21.02	30.91	19.65

[a]All market values are taken from the NBER's file.

[b]See table 2 for a description of the independent variables.

***,** and * denote significance at 0.01, 0.05 and 0.10 levels respectively.

and therefore including it (or excluding it) does not effect the debt ratios significantly. Of the 752 firms in our sample, only 180 had convertible debt, and on an average it formed only 0.15 % of the book value of the assets. Third, the estimate on the forecasted earnings growth is not significant even though in the logit analysis it was significant at the 0.01 level.

The coefficients on the other explanatory variables are almost identical to those for the discrete choice analysis. The only differences are for the proxy of excess cash flow (CFLOW) and the variance of earnings (SIGMA). The coefficient on CFLOW is negative and significant at the 0.01 level for all models. However, in the previous section I had found evidence consistent with Jensen's free cash flow hypothesis that CFLOW is negatively related to the probability of issuing equity and convertible debt. This implies that firms with a higher level of cash flows use a larger amount of internally generated equity, leading to a lower debt ratios but when they raise external funds they prefer straight debt.

The coefficient on SIGMA is positive and significant when the book debt ratios are used. This is contradictory to the results of the previous section, which document a positive relation between the variance in earnings and the probability of issuing equity and convertible debt.

To gain some additional insight into the economic importance of the impact of investment opportunities on leverage, I estimate the impact of Q using models (1) and (2) of table 7. I estimate the incremental leverage for an average firm in the 75th percentile of Q as compared to an average firm in the 25th percentile of Q, while holding other repressors constant. Increasing Q from the 25th percentile (Q = 0.695) to the 75the percentile (Q = 1.300) decreases the book debt-asset ratio by 3.63%

(-0.06*0.605*100) and market debt-asset ratio by 19.36%. (-0.32*0.605*100) These results indicate that the investment opportunities have a meaningful impact on the leverage the firm maintains.

CHAPTER 6

CONCLUSIONS

The analysis presented in this paper makes predictions about the effect of future investment opportunities that the firm has in future periods on the choice between different security types. In the case where cash flow is likely to exceed the positive NPV investment opportunities in future periods, firm value is maximized by issuing short term securities. This will force the managers to pay back the free cash flow and prevent them from investing in negative NPV projects. Alternatively, if investment opportunities exceed cash flows in future periods, firm value is maximized by issuing long term securities. This will insure that sufficient capital is available (or less has to be raised) to take up all positive NPV projects. Equity has infinite maturity and convertible debt/preferred stock is often converted into equity. Thus, firms with valuable investment opportunities in future periods are more likely to issue equity and convertible securities. Conversely, firms with few investment opportunities in future periods are more likely to issue straight debt.

The empirical results support the hypothesis. I use three different proxies of investment opportunities: Tobin's Q, the level of the firm's R&D capital, and analysts' expected 5 year growth rate in earning per share.

The level of investment opportunities of firms making public issues of equity and convertible debt are higher than those issuing straight debt. This result is not sensitive to the proxy of investment opportunities used and holds even after I control for other factors which are known to effect the investment opportunities by estimating a multinomial regressions. This relationship is economically significant.

One caveat attached to estimating the effect of investment opportunities on the probability of choosing one publicly placed security type over the other is that the analysis does not include the entire range of financing choices available to the firm. To account for all financing sources, I provide additional evidence by estimating cross sectional regressions relating the debt-asset ratio to the level of investment opportunities. The results of the regressions suggest a negative correlation between debt and investment opportunities.

I interpret these results to mean that investment opportunities are an important determinant of the firm's financing policy. The direction of this relationship is the same as that predicted by the tax models of DeAngelo and Masulis (1980) and Dotan and Ravid (1985), and agency models of Myers (1977), Jensen (1986) and Stulz (1990).

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Vita

Atulya Sarin was born to Nirmala Sarin and Mahendra Nath Sarin on the 19th of December, 1961, in Meerut, India. After receiveing a B.Sc in Mechanical Engineering from Delhi College of Engineering in June, 1992, he worked for Larsen & Toubro Ltd. as a Sales Engineer in New Delhi, India. Atulya Sarin entered the graduate business program at Virginia Polytechnic Institute in the fall of 1986. After receiving his MBA in June 1988, he continued on for a Ph.D. in finance. Starting in the Fall of 1992, Atulya Sarin will be an assistant professor of Finance at the Santa Clara University, Santa Clara, California.