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THE CORPORATE DEBT MATURITY CHOICE

AN EMPIRICAL EXAMINATION

LINA I. SHARARA-TAHER

A THESIS
IN
THE FACULTY
OF
COMMERCE AND ADMINISTRATION

Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Science in Administration
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ABSTRACT

The Corporate Debt Maturity Choice: An Empirical Examination

Lina I. Sharara-Taher, M.SC
Concordia University, 1994.

Unlike the extensive literature on the more general topic of capital structure, empirical research in the corporate debt maturity area is still scant. Related studies had formulated theoretical justifications for the observed cross-sectional multiplicity of debt maturities without a parallel concern in empirical research and to date, little empirical work has been conducted to test those formulations. In this context, this paper makes a major contribution in that it attempts to explain how corporate debt maturity choice is determined.

At the core of this study is a general multiple choice model that makes it possible to examine how the different hypotheses on debt maturity advanced thusfar determine that choice. Using an ordered model as opposed to a simple model had the advantage of capturing the segmentation in the debt maturity market while allowing a gain in efficiency for the parameter estimates.

The results from this model lend strong support to the hypothesis that, overall, when choosing the maturity of a new debt, corporate managers seek to minimize the agency costs of debt in general, especially those from the incentive for wealth expropriation by investing in riskier projects than originally anticipated. The evidence is also consistent with the assumption that managers do commit themselves not to transfer wealth from bondholders to stockholders by attaching protective covenants to the newly issued debt.

Finally, the model's classificatory ability is tested for meaningfulness by comparing it to the proportional chance model.

To My Parents,

Source and Sustenance

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CHAPTER I

I.1 INTRODUCTION

The complex problem of determining the optimal capital structure does not relate just to the form of financing corporate managers should adopt, i.e debt vs equity, but also to the wide range of choices among the multitude of financial instruments available under each. For instance, for a given debt to equity ratio, corporate managers must decide whether the equity issued would be common or preferred, voting or nonvoting, dividend paying or nonpaying, exchangeable or not, etc..., and whether the debt issued would have a fixed or a floating rate, be of a short or a long maturity, be convertible or straight, denominated in domestic or foreign currency, be callable or putable, secured or unsecured, senior or non-senior, etc... The decision to choose any one of these instruments vs another has the potential of changing the financial structure of the firm; in turn, this could alter the real or the perceived risk class of the firm and, hence, its value.

In recent years, many capital structure theories have been proposed in an attempt at explaining the observable cross sectional variations in corporate debt ratios[1]. In general, these theories have suggested that the choice of a firm's capital structure depends on firm-specific attributes which determine the costs and benefits associated with debt and equity financing.

Empirical work in this area has lagged behind the theoretical research due primarily to the difficulty of translating abstract attributes into testable measures. Relative to the extensive research, there is still little understanding of the determinants of the price effects of capital structure changes and empirical evidence is mixed[2].

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[1]. For a complete review, see Harris and Raviv (1991).

[2]. For example, Masulis (1980) has reported a significant 9.79% increase in common stock price over the two trading days preceding and including the day of the first announcement of intrafirm exchange offers when shares were retired, and a decrease when shares were issued; Dann & Mikkelson (1984) have documented a -2.31% average two-day abnormal returns for convertible debt offerings; and a positive 1.7% for straight debt offerings; Asquish & Mullins (1986) have documented a significant average two-day announcement period return of -3.22% following the offering of seasoned common stock by industrial firms; Mikkleson & Partch (1986) have reported a negative -1.97% announcement price effect for convertible debt offerings and a small stock price decline of -0.23% for straight debt offerings.

Generally, studies on corporate debt policy have tended to focus on the level of total debt without giving due consideration to the structure of that debt, although the two are closely connected. Increasingly, however, a surge of interest in the specifics of the financing decision is shifting research in corporate finance beyond an examination of the basic debt-to-equity choice toward a focus on more detailed aspects of that decision, including the maturity structure.

In this context, this paper makes a major contribution in that it attempts to explain how corporate debt maturity choice is determined.

Unlike the extensive literature on the more general topic of capital structure, empirical research in the area debt maturity is still scant. Related studies had formulated theoretical justifications for the observed cross-sectional multiplicity of debt maturities without a parallel concern in empirical research. To date, very little empirical work has been conducted to test those formulations or to explain the informational nature, if any, of debt maturity and much in this context remains to be done.

Originally, the purpose of this paper was to examine the valuation effects of debt maturity around issuance in order to infer the nature of the information about the firm that is conveyed to investors from the offering. An event study analysis using intervention techniques was designed in which common stock prediction errors of debt offerings across maturity classes provide the primary evidence about the nature of the information, if any, that is inferred by market participants. However, data constraints made this project unfeasible and as a consequence, the research was reoriented towards a cross-sectional examination of the determinants of the debt maturity choice.

At the core of this study is a general model that makes it possible to examine how the different hypotheses on debt maturity advanced thus far determine that choice; if one or more of these hypotheses significantly determine maturity in the expected direction, then an insight is gained as to the validity of the hypothesized relationships.

I.2 Outline Of Study

The paper is organized as follows: in Chapter II, the existing body of literature on corporate debt maturity structure is reviewed and synthesized; Chapter III constitutes a digression in that it explains the obstacles that made

the event study around new debt maturity announcements unfeasible. In Chapter IV, the debt maturity hypotheses from the literature are developed and their testable implications to the maturity choice are formulated. In Chapter V, a descriptive analysis is conducted separately for the full sample, the sample of regulated firms and the sample of industrials; then, diagnostic nonparametric tests are used to identify significant systematic differences between firms offering debts of different maturities. In Chapter VI, a measure of debt maturity is developed and the determinants of the term choice are analyzed in the framework of a multiple choice model. The classificatory ability of the developed model is then verified.

In closing, the paper summarizes the findings on the debt maturity choice and concludes with suggestions for future research.

CHAPTER II: LITERATURE REVIEW

II.1 INTRODUCTION

Although the literature on the optimal debt maturity structure has not been as extensive as the one discussing the more general optimal leverage ratio, there is little consensus as to what constitutes an optimal debt maturity structure. Nevertheless, several important results have been established.

Every study in the field of corporate finance has as its starting point Modigliani and Miller's (1958, 1964) two seminal papers on the cost of capital. Using arbitrage arguments, M&M have established that, under conditions of perfect capital markets of no taxes, no costs of financial distress, perfect information and complete contracting, "pure" capital structure changes do not affect firm value- a "pure" capital structure change refers to one which does not alter the market's perception of the firm's real asset composition or investment policy. An obvious implication of M&M's irrelevance hypothesis is that the security returns process is independent of the debt maturity structure (Ross, 1991). An optimal financial policy could hence result only from the breakdown of at least one of these conditions, i.e., the existence of market imperfections such as taxation, agency and bankruptcy costs.

Three major approaches have been developed to explain the observed variations in corporate debt maturity across firms. In a nutshell, the first approach involves a hedging argument, the second involves a tax-based argument and the third is based on contracting cost considerations. This chapter reviews the main findings of a selection of mostly recent studies that have examined debt maturity from different perspectives and which are thought to be the most representative. The subtleties of the models will not be discussed; rather, the main ideas will be presented.

II.2 DEBT MATURITY STRUCTURE: IS IT RELEVANT?

One of the first issues raised in corporate finance theory was whether a firm's financial policy is relevant or not. While much has been written about capital structure, little has specifically addressed debt maturity.

In what was essentially an extension to a multi-period framework of M&M's argument, Kraus (1973) and Stiglitz (1974) proved the irrelevance of corporate debt maturity in the absence of taxes and bankruptcy costs.

In the context of a general equilibrium model, Stiglitz (1974) has shown that "under seemingly weak circumstances", none of the financial policies regarding the choice of the debt-equity ratio, the dividend-payout ratio and the maturity structure of the debt, among others, seems to have a bearing on the valuation of the firm. Stiglitz's well celebrated model assumed (1) for all states of nature, a perfectly clearing market for perfectly safe bonds of all maturities and no bankruptcy; (2) a perfect substitutability of individual borrowing for firm borrowing and (3) the absence of taxation. Under this scenario, investors can make offsetting portfolio adjustments to changes in the financial structure of the firm by simply altering their holdings of bonds by exactly their share of the change in debt of each maturity of all firms, and their holdings of equity by exactly their share of each firm's change in total equity capital. In other words, individual investors can " exactly undo" any financial policy undertaken by the firm. Thus, as long as capital markets are functioning well, there is no basis for an optimal maturity structure.

In a less than perfect world, however, firms facing bankruptcy costs, agency costs and taxation engage in active financial management by varying debt ratios, debt maturity structures and making complex financial contractual arrangements. In this environment, decisions related to debt maturity become important.

Gordon and Kwan (1979) examined the consequences on capital structure of rejecting M&M's and Stiglitz's equal-access assumption; in their model, firms borrow on consols while persons are limited to one-period debt, and default risk is not bound only to bankruptcy costs but includes such factors as the reluctance of financial intermediaries and individual investors to hold risky bonds, the barriers to further financing for a firm with risky debt and the moral hazards of extending credit subject to default risk. In such an environment, corporate financial policies cannot be reversed at the individual level; consequently, the value of a corporation is higher at some positive leverage than it is at a zero leverage. When the leverage rate introduces the possibility of default risk, and beyond that level, the cost of capital rises sharply with the leverage rate and financing decisions, including debt maturity, become relevant. However, Gordon and Kwan did not elaborate any further.

Morris (1976,b) analyzed the debt maturity problem as an expected cost minimization problem with no consideration of possible risks associated with different maturity strategies but simply as a firm attempting to minimize the

present value of the expected interest and flotation costs of debt. Based on a Markov model of term structure, Morris developed a dynamic programming optimization model of the debt maturity decision in the context of which the influence of such variables as the opportunity cost for funds, flotation costs and liquidity premiums is studied. He showed that if the discount rate is equal to the yield on bonds, then all maturity policies will have the same present value of expected interest costs regardless of the shape and level of the yield curve; hence, debt maturity policy becomes irrelevant. In the same vein, Boyce & Katoley (1979) and Brick & Ravid (1985) have proved the irrelevance of debt maturity policy in an environment of a flat term structure of interest rates. However, if the discount rate is not equal to the yield on bonds, then, they all argued, the present value will vary with maturity policies and an optimal maturity policy can exist. Generally, if flotation costs increase with maturity, Morris (1974) argued that at high yield curve level, shorter maturities will be optimal relative to longer maturities since in this case, the present value of more frequent -relative to less frequent- flotation costs is reduced.

Lewis (1990) showed that even in the presence of taxation and of a non flat term structure of interest rates and bankruptcy risk, debt maturity can still be irrelevant to firm value. He examined the impact of taxation on corporate financial policy in a multiperiod time-state preference setting in which capital structure and debt maturity structure decisions are made *simultaneously*. In an environment where (1) the aggregate promised interest expense is constrained both at the corporate and personal levels, (2) there is no distinction between short term and long term debt with respect to tax provisions, and (3) different default risk levels are assumed to have no bearing on bankruptcy costs, Lewis (1990) showed that there usually exists a set of "equivalent" debt issuance strategies which generate the same state-contingent sequence of promised interest payments that maximize firm value from the net tax subsidy. However, when bankruptcy is costly, the impact of the debt issuance strategy on bankruptcy costs should be considered and debt maturity structure would no longer be a matter of indifference. Lewis, however, did not extend this argument any further.

At this point, it has become clear that with the existence of a dead-weight loss associated with debt issuance in imperfect capital markets, the case for an optimal debt maturity structure can be made. The following section presents

and discusses the three (non-mutually exclusive) approaches that have attempted to explain the existence of an optimal debt maturity structure.

II.3 Uncertainty and Bankruptcy Risk

Of the earliest and most popular theories on optimal debt maturity structure, maturity-matching has contemplated the question of debt maturity as a problem in portfolio hedging under risk and the associated costs of financial distress - such as less favorable terms from customers and suppliers, suboptimal investment policies, sizable litigation and legal costs in the event of bankruptcy, etc.

II.3.1 Maturity and Duration Matching

Essentially, maturity-matching argues that if long term assets are financed with short term borrowing, a crisis at maturity may occur as assets-generated funds may not be sufficient to reimburse the debt by maturity or to refinance it under similar terms. Similarly, if short term assets are financed with long term debt, the firm faces the risk of not being able to generate the cash flows necessary to service the debt once assets are retired. By matching debt maturity to asset life, such problems are avoided; the costs of financing the asset are known with certainty over the life of the asset, and the cash flows generated by the asset are expected to be sufficient to retire the debt by the end of the asset's life. If asset and liability maturity structures are perfectly matched, then the resulting hedged position should leave only the risk of unpredictable aberrations in cash flows. In addition to reinvestment and crisis-at-maturity risks for rationalizing matching of maturities, reestablishing management's appropriate investment incentives when new investment is required has also been suggested [Myers, 1977][3].

In an attempt to find a better strategy to hedge the firm's net worth against interest rates movements, Redington (1952) incorporated a time factor into his analysis by applying the concept of Macaulay's duration to debt maturity structure. He analyzed the investment decisions made by insurance companies and proposed an immunization rule whereby the weighted durations of asset and liability streams would be equated (Passailaigue, 1990). Applying

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[3]. While Myers's analysis provided a strong rationale for maturity-matching, it has clearly indicated that a firm's intangible assets namely, its growth options, also play a crucial role in determining the firm's debt maturity.

this concept to the problem of corporate debt maturity strategies, however, is much more complex. For instance, asset duration is generally more difficult to determine for nonfinancials as the size and timing of their cash flows are difficult to estimate accurately.

II.3.1.1 EMPIRICAL EVIDENCE

Testing the empirical validity of duration matching, Silvers (1976) studied the corporate debt behavior of a sample of manufacturing corporations over the 1961-1975 period and found little supportive evidence.

According to Silvers (1976), the determinants of the debt maturity structure were rather matching-of-maturity considerations. And whenever deviations from a matched position occurred, that was due to a variety of reasons, the most important stemming from industry or company specific factors such as Morris-type correlations (to be discussed in the next section). Other factors included a superior ability of a manager to forecast interest rates levels, the availability of corporate capital in the financial markets as this dictates the type of debt used and hence the average maturity, and finally, the degree of risk aversion in decision making as internal funds flow might be used to substitute or reduce shorter term debt.

II.3.2 SPECULATION & CROSS HEDGING

To account for factors such as attitudes towards risk, tastes in wealth and expectations, Grove (1966) approached the problem of an optimal debt maturity structure as a general problem of maximizing expected utility of portfolio investment under uncertainty, where an optimal maturity would be determined in relation to its effect on the mean and variance of net worth. Grove (1966) has shown that only investors seeking to *hedge* against interest rates fluctuations should adjust their streams to have the same weighted durations; investors wishing to *speculate* on interest rate movements, on the other hand, should adjust their asset and liability streams to yield different weighted durations. If interest rates are expected to rise (fall), then investors can increase their wealth by lengthening (shortening) the duration of their liability stream relative to that of their assets. This involves a transfer of wealth from bondholders to stockholders as part of the increase in firm value that should have accrued to the bondholders is captured by the stockholders. Hence, given an expected change in interest rates, expected net worth can be increased by departing from the hedged position at the cost of accepting an

increased variance.

Morris (1976,a) has shown that for a weighted asset life with a given duration, immunization through the choice of an equal debt duration is not necessarily the least risky maturity strategy because of the variability of the income streams from the asset. Using the Bogue and Roll multiperiod CAPM to incorporate uncertain future interest rates, he argued that even in the absence of taxes and of a probability of default, the issuance of short-term debt can reduce the risk inherent in the use of leverage to shareholders and thereby increase equity value, if the covariance between the firm's net operating income (NOI) and future interest rates or return on market portfolio (R_m) is positive. In this case, the use of short term debt may cause total interest costs to behave as variable rather than fixed costs, and a policy of financing with a sequence of short term loans- although increasing the uncertainty of interest costs in future periods- can decrease the uncertainty of net income by mitigating its variance as R_m and NOI would move simultaneously under all states of nature. Conversely, if NOI and R_m are negatively correlated then long term borrowing could reduce the variance of net income since interest costs will be fixed over the life of the debt.

However, the above lines of reasoning implicitly assume that investors cannot diversify away intertemporal risk from unexpected changes in interest rates. Moreover, they do not relate to bankruptcy costs nor to interest tax shields. The cross-hedging argument can only strengthened to the extent that cross-hedging increases debt capacity by reducing the risk of bankruptcy, thereby allowing a greater gain from leverage.

II.4 Incorporating a Tax Structure

In an environment where tax advantages to debt exist, taxes are believed to be one of the primary considerations corporate officers have in mind when choosing debt maturity.

II.4.1 Taxes and Non-stochastic Interest Rates

With non stochastic interest rates and a tax advantage to debt, Boyce & Katolay (1984) and Brick & Ravid (1985) have shown that, when default is allowed and the term structure of interest rates is not flat, the expected value of the firm's tax liabilities, and hence firm value, will depend on the maturity structure of debt. Specifically, management selects the debt maturity that

would maximize the present value of the tax subsidy from debt financing.

Brick & Ravid have argued that, when both personal and corporate taxes are levied and the marginal tax rate on bond income, t_b, is lower than the corporate tax rate, t_c, there is a net tax advantage to debt and acceleration of the tax benefits of interest payments is beneficial. If the yield curve is upward sloping, the interest expense from issuing debt with a long maturity is greater than the expected expense from rolling over short term debt in the first period and less in later years. If the firm issues long-term debt, the firm's expected tax liability will be lower given the higher tax subsidy and hence the firm's current market will be higher. On the other hand, when the term structure of corporate coupon rates is decreasing, short-term debt would accelerate that benefit. If $t_b=t_c$, interest payments for any maturity offer no tax benefits as the corporate tax benefit of debt is completely offset by the personal tax advantage of equity, making debt maturity structure irrelevant to the firm's financing decisions. However, if $t_b>t_c$, the gain from leverage is negative.

II.4.2 Taxes and Stochastic Interest Rates

Assuming that the value of the unlevered firm follows a Gauss-Wiener process, Brennan and Schwartz (1978) examined the effect of the maturity of the debt on the optimal value of a levered firm. They allowed for both taxes and bankruptcy costs and assumed that tax benefits of debt are lost upon bankruptcy. In the absence of transaction costs, Brennan and Schwartz have argued that a firm would be better off issuing and redeeming short-term debt continuously, thereby avoiding bankruptcy while still enjoying the tax savings. However, they did not perform firm value comparisons while changing the debt maturity strategy. More importantly, their study implied a clear tradeoff between the benefits associated with interest tax deductions and the costs associated with bankruptcy and ignored that, even in default, the firm may still be profitable as a going concern or that it may be profitably reorganized, with interest deductions from subsequent debt financing providing future tax benefits.

Brick & Ravid (1991) extended their earlier tax-based argument allowing this time for the existence of stochastic interest rates. Using a return to maturity valuation approach, they made an even stronger case for the use of long-term debt under interest rates uncertainty. Their analysis suggested that, in addition to the acceleration of tax benefits documented above if the term

premium[4] is positive, uncertainty introduces a debt capacity factor which will always favor long-term debt. Brick & Ravid (1991) observe that if agency costs are related to the maturity policy, then the optimal debt maturity will reflect both agency cost minimization and tax considerations of the above mentioned type - however, they did not extend their argument any further. Moreover, in both papers, these results were obtained by putting constraints on the types of permissible debt issuance strategies, viz., implicitly constraining the firm to select a debt-asset ratio *before* a maturity structure is chosen. Doing so assumes the existence of an optimal capital structure irrespective of any considerations regarding the selection of a debt maturity structure.

In a more comprehensive approach, Lewis (1990) examined the impact of taxation on corporate financial policy in a multiperiod time-state preference setting in which capital structure and debt maturity structure decisions are made *simultaneously*. As mentioned above, Lewis showed that there usually exists a set of "equivalent" debt issuance strategies which generate the same state-contingent sequence of promised interest payments that maximize firm value, and which are consequently consistent with the firm's optimal financial policy. In other words, he found that debt maturity is irrelevant to firm value - even in the presence of taxation and of a non flat term structure of interest rates and bankruptcy risk- since only the aggregate promised interest expense is considered at both at the corporate and personal levels and that there is no distinction between short term and long term debt with respect to tax provisions, and since different default risk levels are assumed to have no bearing on bankruptcy costs. However, when bankruptcy is costly, a value-maximizing firm would not only be concerned with the net tax subsidy from promised interest payments, but also with the impact of the debt issuance strategy on bankruptcy costs; in this case, debt maturity structure would no longer be a matter of indifference. Lewis, however, did not extend this argument any further.

II.4.3 Empirical Evidence

Empirically, little support has been found to support the idea that a firm's tax status is significant to its financing decisions. Recent studies such as those

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[4]. The difference between the implied forward rate and the expected future spot rate.

conducted by Titman & Wessels (1988), Ang & Peterson (1986), Eckbo (1986), Barclay & Smith (1993) found no significant tax effects on capital structure decisions. Eckbo (1986) analyzed the effect of corporate debt offerings on stock prices and found no relation between offer-induced price effects and the firm's debt-related tax shields. However, to construct the tax shield estimate, Eckbo had to assume that the risk-adjusted discount rate was constant and that the debt was permanent (hardly the ideal proxy to study the price effects of debt maturity decisions). Barclay & Smith (1993) conducted an empirical investigation of the determinants of corporate debt maturity of industrial firms, regressing a measure of debt maturity on a measure of a risk-free term structure and found no support for the tax hypothesis.

II.4.4 Limitations of the Tax Approach

To explain this failure to finding tax effects on capital structure decisions, MacKie-Mason (1990) extended DeAngelo & Masulis's (1980) distinction between the average tax rate and the effective marginal tax rate. In a seminal paper, DeAngelo & Masulis developed the current view that relates non-debt tax shields with cross-sectional variations in debt policy and showed that a firm's effective marginal tax rate on interest deductions depended on the firm's non-debt tax shields, such as investment tax credits (ITC) and tax loss carry forwards (TLC); in this framework, non-debt tax shields would matter only to the extent that they affect the marginal tax rate on interest deductions. In this case, net taxable income is stochastic although all firms face the same statutory marginal rate; for instance, even if two firms were identical, but one had an additional dollar of TLC, this firm would have a lower effective tax rate on interest deductions. MacKie-Mason refined DeAngelo & Masulis tax status argument and argued that tax shields would affect the effective marginal tax rate only if they increase the probability of exhausting taxable income (paying zero taxes); only for those firms that are near tax exhaustion is an additional dollar of TLC likely to crowd out a dollar of interest deductions thereby significantly reducing the value of debt and affecting financing decisions, including debt maturity. However, since tax exhaustion is very unlikely for most firms, previous studies have found that variations in available non-debt tax shields had little effect on debt policy. Thus, MacKie-Mason suggested that, in empirical analyses, the interaction between tax shields and the likelihood of exhaustion, i.e., a firm's distance from tax exhaustion should be taken into account when examining tax effects. Since it is extremely

difficult to measure cross-sectional effective marginal tax rates with extremely complex calculations to account for the dynamics of loss carry backs and credit carry forwards, etc, a relatively simple approach will be used in studying the firm's tax treatment as a factor determining debt maturity choice.

II.5 Agency Costs Of Debt

In general, agency theory deals "with the implications of possible conflicts of interest between one party, the principals, who hire another party, the agents, to make decisions on the principal's behalf". Agency costs can be regarded as market imperfections related to the costs of renegotiation, monitoring, specifying protective covenants and enforcing contracts. In the context of corporate theory and financial policy, the conflict of interest between corporate managers, outside stockholders and bondholders implies that the existing contractual relationships between the different parties involved may not be a zero-sum game [Thatcher, 1985], and a firm's debt policy may simply be a reflection of such market imperfections.

In the context of capital structure, the literature on agency theory has in general addressed two general categories of costs associated with external financing namely, the agency costs of equity financing [Jensen & Meckling (1976), then Rozeff (1982) and Easterbrook (1984)]. Given the purpose of this paper, equity related agency problems will not be discussed.

In an extensive paper, Barnea, Haugen and Senbet (henceforth BH&S, 1980) have rationalized the existence of complex financial structures in general, including an optimal debt maturity structure, by the presence of market imperfections associated with debt related agency problems. They demonstrated that the maturity structure of debt, call provisions and income bonds are features of corporate debt which serve identical purposes in resolving agency problems associated with (1) informational asymmetry, (2) managerial incentives to undertake suboptimal risky projects, and (3) Myers-type forgone growth opportunities.

II.5.1 Informational Asymmetry

Informational asymmetry occurs whenever management is unable to reveal the precise identity of its investment opportunity set to the purchaser of newly issued bonds. Whenever these bonds are perceived as risky and would-be-lenders underestimate the expected cash flow from owning the bonds,

stockholders will suffer a loss at the time the bonds are sold.

In the framework of a two-period model of debt maturity choice under asymmetric information, Flannery (1986) explored the signaling implications of a firm's financing decisions on the debt market equilibrium. He argues that if firm insiders are systematically better informed than the market, firms with different "intrinsic" values will be indistinguishable to outsiders; recognizing this, rational investors will try to infer the insiders' information from the firm's financial structure, particularly its choice of risky debt maturity. When the market cannot identify individual firm's project qualities and all firms are treated as average-quality, high-quality firms pay too high a default premium while low-quality firms pay too small a premium. With positive transaction costs, good firms -that have the most to gain from being correctly identified- become willing to sacrifice some value towards this end. To minimize their market value loss, they separate themselves by issuing short term debt since it is less underpriced, while bad firms seek to maximize their gain by issuing long term debt since it is more overpriced. The firm's choice of debt maturity signals inside information to rational market investors who then might treat long and short debt issues as if they reveal a different credit quality. However, if the good firms' negative misinformation value is not sufficiently reduced to cover the added transaction cost of a rollover strategy, good firms will issue long debt and bad firms will be more than willing to follow suit and a long pooling equilibrium would result. In the absence of transaction costs, bad firms would mimic the borrowing behavior of good firms in order to gain any positive misinformation value, and a short pooling equilibrium would obtain. In the last two scenarios, good and bad firms will issue debt of the same maturity with an unavoidable redistribution of market value from high to low-quality firms. In the same vein, BH&S (1980) have concluded that firms with large potential information asymmetries would be better off issuing short-term debt because of the large information costs associated with long-term debt. They have also suggested that issuing long-term debt with a call provision would perform an identical task in eliminating this class of agency problems[5] since imperfectly informed bondholders will underestimate the likelihood of a

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[5]. If one views the call provision as a means of shortening the expected value of the life of the debt contract, then shortening the maturity of the debt becomes tantamount to attaching a call provision to the bond issue regardless of maturity - the only difference relates to uncertainty about the date of premature retirement.

call and shareholders will invoke the call provision and issue new debt that reflects the increased value of the firm.

Goswami, Noe and Rebello (1992) have shown that failure to control for cash flow properties would lead to erroneous conclusions about the informational role of the debt maturity. In what can be viewed as an extension of Flannery's signaling model, they examined the extent to which the time series properties of a firm's cash flows alone can influence the debt maturity choice. When there is information asymmetry, Goswami, Noe and Rebello have argued that a firm's debt-maturity decision is completely determined by the *relative* dependence of its cash flow on firm type. When the degree of intertemporal cash flow correlation is fairly insensitive to expected output, a short-term debt pooling equilibrium would obtain. As this sensitivity increases and the intertemporal cash flow correlation becomes uncertain, a separating equilibrium would obtain in which issuing short-term debt signals the receipt of favorable information. However, when cash-flows are non-stationary and the maturity structure of the firm's assets is uncertain (investors are uncertain regarding the position of the firm on its growth curve), the debt maturity decision is determined to a large extent by the relative sensitivities of long-term and short-term debt to liquidity risk. When this is moderate, a separating equilibrium would obtain from the inverse relationship between expected cash flows and asset maturity, in which a long-term debt issue signals favorable information. When liquidity risk is large, a long-term pooling equilibrium obtains if higher expected cash flows are associated with larger immediate payoffs[6]. Along the same line, Lee, Thakor & Vora (1983) have also demonstrated that informational asymmetry may result in long-term rather than short-term debt financing being optimal. Thus, short-term or long-term debt can be optimal depending on the time series characteristics of the firm's cash flow distribution.

II.5.2 The Risk Incentive Costs of Debt

The risk incentive problem refers to instances of expropriation of bondholders' wealth by stockholders through the increase of firm risk. Galai & Masulis (1976) first identified such a possibility using the Black-Scholes option pricing model where stockholders in a levered firm are viewed as

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[6]. Issuing long-term debt will be a positive signal to the extent that it signals higher output and high output is associated with larger near returns on investments.

holding a European call option to buy back the entire firm at an exercise price equal to the face value of the debt. According to the option pricing model, the value of the call increases with the variance of the cash flows of the underlying assets (here, the firm). If the value of the firm exceeds the face value of debt at maturity, shareholders will exercise their call option by paying off debt and keeping the balance. However, if the value of the firm is less than the face value of the debt at maturity, shareholders will simply default on the debt. It follows that stockholders have an incentive to increase the market value of equity by "going for broke", i.e., undertaking high risk activities at the expense of the bondholders since the costs of that risk will be borne by bondholders in the form of a reduction in the value of their bonds. If bondholders are aware of this incentive problem, its effects are discounted in the price at which they are willing to buy the newly issued debt; consequently, agency costs will be borne by the equity holders who issue that debt.

Boddie and Taggart (1978) have argued that if a firm faces future investment opportunities, this asset substitution effect can be reduced by adding a call option to newly issued bonds. Because the value of the call provision to the stockholders declines as the value of the firm decreases, they will have less incentive to shift to high variance/low value projects after the debt is issued. This can restore the proper incentive by allowing the firm to renegotiate its debt at the time it undertakes investment. BH&S (1980) extended the work of Boddie & Taggart and suggested that, besides the issuance of debt with a call provision, shortening debt maturity is a mechanism which can be used to resolve the incentive problem. By designing the option so that the decline in its value more than offsets the increase in equity value from high variance projects, the benefits associated with a safer debt are transferred to the shareholders in the form of a higher call option value. Similarly, the value of the short term bond is less sensitive to the difference in risk associated with the lower-higher variance projects. Thus, firms with a high variance risk will be better off issuing short-term debt.

II.5.3 Suboptimal Future Investment

Opportunistic underinvestment occurs whenever management may pass up valuable investment opportunities for which the main benefit is to increase bondholders' wealth, by committing new resources to a project only if the expected return is sufficient to pay off the outstanding debt claims *as well as* earn an acceptable return on incremental investment costs while the first-best

dictates only a return on incremental costs. And the more there are growth opportunities in the investment opportunities set, the greater is the conflict of interest between stockholders and bondholders.

Using a time-state preference framework, Myers (1977) showed that suboptimal future investment occurs whenever a firm has a risky debt outstanding that is issued against its currently held assets; in this case, stockholders cannot capture the full benefits of future investment opportunities as these partially accrue to bondholders in the form of a lower probability of default or of a greater payoff under states which produce bankruptcy. Rational bondholders recognize the incentive of management to forgo profitable future investments and discount it accordingly in the price at which they purchase the debt. As a consequence, shareholders bear these agency costs in the form of a reduced value of the firm.

According to Myers, a firm's future investment opportunities can be viewed as options; thus, shortening the effective maturity of outstanding debt so that it matures before a real investment option is to be exercised is one way to solve the incentive problem[7]. BH&S (1980), and Ho & Singer (1982) have also suggested that shortening the maturity of the debt provides a mechanism to resolving this class of agency problems, where a policy of rolling over short maturity debt claims offers a setting for continuous and gradual renegotiation of debt terms. Again, including a call provision in all debt contracts and allowing the shareholders to call the outstanding bonds at the time the investment is undertaken, like rolling over short maturity debt claims, allows shareholders to recapture any benefits lost to the bondholders, hence inducing optimal investment decisions on the part of management.

II.5.4 Empirical Evidence

Kim & Sorensen (1986) compared the capital structure of 84 firms that had a relatively high degree of insider ownership (at 25% or more of total) to 84 firms that had a low degree of insider ownership (at 5% or less of total) and found evidence that insider-owned firms issued more long-term debt than the more typical outsider-owned firms. Thatcher (1985) examined a sample of newly issued bonds and found evidence that firms with large agency costs of

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7. Other suggestions included renegotiating the debt contract, restrictive covenants in the indenture agreements, mediation, restrictions on dividends.

debt use call options to reduce the agency costs associated with future investment opportunities, informational asymmetry and the risk incentive problems. Similarly, Barclay and Smith (1993) found strong supportive evidence to the hypothesis that firms with larger potential growth options issue more short-term debt.

II.6 CONCLUSION

Determining which structure for debt maturity is optimal is far from being an easy question. The literature reviewed in this paper is representative enough to see that there is still little consensus concerning the issues involved. It has simply been established that if capital markets are perfect, then a firm's entire financing decision, including debt maturity structure, is irrelevant (Modigliani & Miller, 1958, Kraus, 1973, Stiglitz, 1974). When risk and market imperfections such as bankruptcy costs, taxes and incomplete contracting, were introduced, the case for an optimal financial policy could be made although on different grounds. Three main approaches have been presented and discussed.

In general, the first approach has addressed the problem of debt maturity as a problem of debt portfolio management under risk. Under this approach, the wealth effect of debt maturity decisions would depend on the maturity structure of the firm's assets (Redington, 1952, Grove, 1966, Gauswami, Noe and Rebello, 1992), and on industry- specific factors (Morris, 1976). The second approach has addressed the problem of debt maturity as a problem of maximizing the tax benefits to debt. In this context, the wealth effect of debt maturity decisions would depend on the tax liability implied by the new debt offering (Brennan & Schwartz, 1978, Boyce & Katoley, 1984, Brick & Ravid, 1985, 1991, Lewis, 1990). The third approach has focused on agency theory considerations, in particular, the agency problems of debt from information asymmetry and the incentives for asset substitution and underinvestment. Under this approach, the wealth effect associated with the maturity choice of new debt offerings would depend on the extent it would contribute to or mitigate those agency problems (Boddie & Taggart, 1978, Myers, Barnea, Haugen & Senbet, 1980, Flannery, 1986, Kim & Sorensen, 1986).

What the reviewed studies have done was mainly to identify a number of potential determinants of debt maturity structure without empirically sorting out the meaningful ones. Moreover, virtually none of these studies has clearly

addressed the role of debt features and innovations such as convertibility, callability, extendibility, floatability, security, etc.

Isolated instances of empirical studies have revealed that a simplistic approach to the debt maturity problem is unlikely to explain the observable multiplicity of maturities for corporate debt and many of the theoretical studies had recognized that these approaches are not mutually exclusive. This notion is very important to keep in mind if one wishes to design a well-specified empirical framework for the determinants of corporate debt maturity structure. Multiple hypotheses can hence be constructed that may explain the existence of variable maturities in corporate debt policies.

CHAPTER III: A DIGRESSION

Originally, this project was conceived as an event-study analysis around the announcement of new debt of specific maturities; however, data-related obstacles made this study unfeasible. Although the course of research had shifted to a cross-sectional study of the determinants of the debt maturity choice, this chapter is included for the contribution it offers regarding the very concept of the offer date and because it has dictated the final sample size.

III.1 THE FIRST OBSTACLES

The original sample was constructed from all the public offers of new corporate debt issues for the 1985-1990 period by all firms listed on the NYSE and AMEX and for which a maturity date was specified. Debt offer dates and issue particulars were identified from, when available, the Investment Dealers Digests's (IDD) *Directory of Corporate Financing*, otherwise, from the IDD's *Weekly Review of Offerings*. Only firms with stock prices on both the Center for Research in Security Prices (CRSP) daily file, [RCHUNG.CRSP91]HEADER.DAT, and the COMPUSTAT annual Industrial file were included in the sample.

Of the original 1,813 issues identified over the sample period, multiple and R415 issues had to be omitted. Under the 1982 SEC's Rule 415, also known as "shelf registration", an eligible issuer is permitted to file a registration statement specifying its intention to partially or entirely sell an aggregate bloc of a particular class of securities not at a specified time but as opportunities would present themselves over a window of two-years. Given the offer date, tracing a "shelf" issue in order to identify an announcement date is to a large extent impracticable: the time of registration may be any day between the actual offering and day -500 (2 years x 250 trading days/year) relative to the offering date. Moreover, the actual offering may only be a portion of the aggregate registered bloc. Since Rule 415 distributions involve the sale of debt securities over such an extended period of time, they do not necessarily have an informational content at the time they are offered. Omitting multiple and Rule 415 offerings reduced the sample size significantly to 441 observations.

A search was initiated for announcement dates in, as is the case in virtually more than 90% of the event studies reviewed, the Wall Street Journal Index (WSJI). Surprisingly, of all the debt offers, only a very limited number

has been actually reported after 1984; only 148 offerings were reported, 42 offerings in 1985, 30 in 1986, 42 in 1987, 19 in 1988, 13 in 1989 and 2 in 1990. More significant, however, was the fact that all these announcements, except for 3 in 1985 and 1 in 1988, coincided with and sometimes even *followed* instead of *preceded* the actual offer date and hence, had no practical meaning attached to them for the purpose of an event study. It is interesting to note that, as of 1985, the University MicroFiche International company replaced the Wall Street Journal staff in putting together the journal's index. This institutional change has obviously had a great impact on the reporting procedures. In the context of this study, there were virtually no meaningful announcement dates in as far as the WSJI was concerned. A search for debt announcement dates was then initiated for in alternative financial news sources namely, the F&S Predicasts Index (FSPI) which covers more than 250 US and International, general and specialized financial press publications, including the Wall Street Journal, the New York and Financial Times and Value Line. The additional information from using the FSPI was very marginal, adding only 3 observations in 1985, 4 in 1986, 1 in 1987 and 1 in 1989. Moreover, the reported dates still followed the actual offer date and thus failed to contribute anything to finding the dates of interest.

These research attempts have helped identify a fundamental question as to the definition of an announcement in event studies in general. In other words, when can and when cannot an announcement be considered as "the" announcement date for event study purposes?

By definition, the announcement date corresponds to the day when news about the financial event considered is first released in the financial press. In the context of corporate finance, event studies on capital structure have all tended to use the WSJI for announcement dates. However- and especially after 1985, a closer look reveals that the relevant information is not as readily available and is not *first* released in the WSJ. The basic question then becomes " how is information disseminated in the securities market when a new security is offered"?

III.2 Announcement Dates In Perspective

For the sake of accuracy and correctness, zeroing in on the procedures involved in floating a public offering of securities, i.e., underwriting and registration, is in order.

The basic technique for offering securities in the United States has been the underwritten public offering, in which a professional investment banker prices, manages and sells the offering. The Securities Act of 1933 requires registration of securities which are publicly offered for sale "by the use of mail or other instrumentalities of interstate commerce" (Hill and Knowlton, 1979). According to Auerbach and Hayes (1986), the investment banking intermediary is charged with implementing the Securities Act's intent of "regulation by information" through his or her commitment to practice "due diligence" to ensure that the relevant information is disseminated to market participants at the time of a securities offering. Due diligence implies that the investment banker takes on the obligation to carry out the underwriting subject only to the condition that the SEC be satisfied with the registration statement, since any SEC findings as to failure of material disclosure or to any other "deficiency" are subject to comment, review and even to a "stop order" proceeding at any time, both before and after a public offering has commenced. An SEC embargo on publicity which might be understood as an improper selling effort extends from the date on which a corporate decision is made to float such an issue until 40 days after the registration statement's effective date. The preliminary prospectus included in the registration statement, also dubbed as the "red herring", contains detailed information on "all material facts" such as the nature, structure and finances of the issuing corporation, and is the only legitimate general public sales piece (Loss, 1984). After a lengthy process of investigation by the underwriters, the registration statement along with the required exhibits are filed with the SEC and NASD where "an in-depth examination of the accounting, financial and legal aspects of a filing" is carried out. After filing, but prior to the effective date, a press report of the filing by the issuer's and the underwriter's counsels is usually released and the issuer begins a "dog and pony" publicity show, using the preliminary prospectus to offer securities but not complete any sales yet. Copies of the red herring are distributed to all underwriters and dealers expected to participate in the distribution of the issue; in turn, they are expected to pass copies on to potential investors (Hill and Knowlton, 1979). The deficiency amendment, that is, the response of the SEC comments on the registration statement, if any, is then prepared and filed with the SEC. Only at this point, are the price of the offering and the compensation to be paid to the underwriters and dealers determined by the representative underwriter and company officers. The price amendment which now includes the statutory

prospectus is filed with the SEC; the registration statement is complete and, by stature, becomes "effective" upon SEC approval after a minimum 20-day "incubation" period. The underwriter may request an acceleration to the date of the price amendment and the SEC may shorten the incubation period by an order or through an administrative procedure as in the case of Rule 415; however, the SEC review may also result in the registration statement becoming effective weeks and even months after the incubation period if indicated deficiencies remain unresolved.

Based on Hill & Knowlton (1979) and Auerbach & Hayes (1986), the registration process therefore involves the following stages:

- Pre-Registration: from tentative agreement with underwriter to the conclusion of the post-offering period. A common rule of thumb as to when a company has entered the "pre-registration" stage has been to assume that a company is subject to the SEC's registration publicity limitations about 60 days prior to any anticipated filing date,
- Filing date: submitting registration statement and preliminary prospectus,
- Registration (Waiting Period): from filing to the effective date,
- Effective Date: final documents are drafted and the registration statement becomes effective upon SEC approval,
- Incubation Period/Acceleration,
- End of Registration Period: the SEC publicity embargo lifted after 40 days of effective date or upon completion of the distribution.

Based on the above discussion, the announcement date for a public securities offering is therefore around the *filing of the registration statement* with the SEC since this is the first time any piece of information on the offering is made public. Typically, public offering commences 10 weeks subsequent to the initial SEC and NASD filing (Auerbach and Hayes, 1986).

III.3 THE SEARCH FOR ALTERNATIVE SOURCES

Although the use of the WSJ for capital structure event study literature has commonly been the practice, some papers have used other sources as well. For example, Cornett & Travlos (1989) have used the *Securities and Exchange Commission Registration File* along with the WSJI for checking the earliest announcement dates to study the valuation effects of exchange offers between 1973 and 1983. Guedes & Thompson (1992) have used both the WSJI and the *Dow Jones News Retrieval Service* (DJNRS) for reports on announcement dates of adjustable rate issues for the 1978-1986 period,

selecting the earliest report when news on an issue appeared in both sources.

Lacking access to the *SEC Registration File* in Canada, and given funding constraints for the use of the DJNRS electronic data, a search was initiated for announcement dates in the Investment Dealers Digest's weekly section, *Securities Filed But Not Yet Registered.* To trace back and identify corresponding announcement dates for each debt offering in the sample, a 6-month-equivalent-of IDD weekly publications before the offering date was probed - except when the offering is a shelf registration. This extremely time-consuming and cumbersome process has added little benefit to finding the relevant announcement dates; when located, seldom did these announcements report the maturity of the filed issue- which is in the first place the raison-d'etre of this paper.

Due to the inaccessibility of vital data on announcement dates, the attempt at conducting the intended event study met a dead-end. A descriptive and analytical study of the determinants of the debt maturity choice is conducted instead.

CHAPTER IV: HYPOTHESES AND PROXIES

In this chapter, the hypotheses on the determinants of debt maturity are developed. Their testable implications are formulated and the proxy variables associated with each hypothesis are constructed.

IV.1 HEDGING HYPOTHESES

Whether it is maturity-matching, duration-matching/immunization or cross-hedging, these hypotheses have addressed the problem of an optimal debt maturity structure as a problem in portfolio hedging under uncertainty.

IV.1.1 HEDGING & SPECULATION

Under the maturity-matching and the duration-matching hypotheses respectively, debt maturity decisions will adversely or favorably affect the firm's net worth to the extent these would lead to a diversion from or a conversion to the position implied by the average asset maturity or by the average asset duration of the firm, all else being constant. However, in the event a firm wishes to *speculate* on interest rate movements, a departure from the hedged position could increase expected net worth given an expected change in interest rates- although at the cost of accepting an increased variance.

Testing the matching hypotheses is not as simple as it may first appear. The size and timing of the cash flows, especially for non-financials, are difficult to estimate accurately, the ability of each firm's managers to forecast interest rates levels and their degree of risk aversion are practically beyond measure, and the intangible costs of financial distress in the event of deviating from a matched position, such as the terms from customers and suppliers, are impossible to determine. A measure of the average maturity of the firm's assets has nevertheless been constructed to test the matching hypothesis; for a given firm, it is calculated as the ratio of the firm's total fixed assets to its total assets, both net of depreciation (March, 1982, Titman & Wessel, 1988) or **FAR**. It is hence expected that a long debt maturity will be associated with a long asset maturity, all else being constant. Alternatively, firms with higher-than-average values of FAR are expected to issue debt with a systematically longer maturity than firms with lower-than-average values of FAR.

IV.1.2 CROSS HEDGING

Under the cross-hedging hypothesis (Morris, 1976), bond maturity is determined by its effect on the firm's cost of equity capital through the variance of net income. The joint distribution of operating income and interest cost will have a mitigating effect or a precipitating effect on the variance of the firm's net income, depending on whether their covariance is positive or negative, respectively. If this is positive, the issuance of short-term debt can reduce the risk inherent in the use of leverage to shareholders thereby increasing equity value. Otherwise, long term borrowing could reduce the variance of net income as interest costs will be fixed and certain over the life of the debt.

To test the cross-hedging hypothesis, the variables **COV** and **COR** are constructed; these are calculated, respectively, as the average of the preceding 5-year's (relative to the offer year) covariance and correlation between changes in the firm's net operating income as given by its annual earnings before interest and taxes and changes in interest rates as given by the annualized US Treasury Bill rate. Figures for the latter were taken from the Federal Reserves Bulletin. Everything else being the same, it is expected that a higher COV or COR will be associated with a shorter debt maturity. Alternatively, firms with higher-than-average COV or COR are expected to issue debt with a systematically shorter maturity than their lower-than-average counterparts.

IV.2 THE TAX HYPOTHESIS

Under the tax hypothesis, when tax advantages to debt exist, firm value is expected to increase with the potential for the acceleration of tax-related benefits (Brick & Ravid, 1985), where the potential for acceleration depends on the shape of the term structure of interest rates. In an environment of a normal yield curve, a long term debt issue would contribute this acceleration while in an environment of an inverted yield curve, a short-term debt would do so. In this paper, this is captured by a term structure variable denoted by **TS**, where a higher TS is expected to induce a long-term debt choice. TS is calculated from the Federal Reserves Bulletin's Domestic Financial Statistics as the difference between the 1-year and 30-year yields on actively traded issues adjusted for constant maturities.

Zimmerman's (1983) effective tax rate is also used. This is measured as

the ratio of taxes paid to pretax income and is denoted by **EfTx**. Under the tax shield hypothesis, it is postulated that, for a higher EfTx, ceteris paribus, a longer maturity strategy would be optimal since the acceleration effect would be even more important. Stated differently, firms with higher-than-average EfTx are expected to issue debt with a systematically longer maturity than firms with lower-than-average EfTx.

IV.3 AGENCY THEORY HYPOTHESES

The literature on the three classes of debt agency problems, viz. informational asymmetry problem, the incentive for suboptimal future investment and the risk incentive problem, seems to suggest, in general, that firms inflicted with such problems would be better off shortening their debt maturity or, alternatively, attaching a feature to their long-term debt that can make it short. Three hypotheses pertaining to these debt agency problems and their testable implications are herein developed.

IV.3.1 THE SIGNALING HYPOTHESIS

Under the signaling hypothesis, a firm avoids the adverse selection agency cost from informational asymmetry by adopting a debt maturity strategy that would signal inside information to market investors who might treat long and short debt issues as revealing different credit qualities.

Many variables have been suggested as proxies for testing the signaling hypothesis. Among others, the number of financial analysts monitoring the firm's performance, insider ownership and the concentration of ownership among shareholders have been the most popular, where it is postulated that a low number of analysts would indicate the existence of a few informed traders overall and a high degree of informational asymmetry (Kim & Sorensen, 1986), and that a higher concentration of insider ownership increases the likelihood of agency-type conflicts (Rozeff, 1986). Firms with smaller potential information asymmetries will be less concerned about the signaling effects of the debt maturity choice and hence will be more likely to issue long-term debt. In this paper, the percentage of insider ownership is used. It is denoted as **%IO** and is obtained from the Value Line Investment Survey. Under the signaling hypothesis, the higher the %IO the greater is the likelihood that the firm will issue short term debt.

Under the more sophisticated approach to the signaling hypothesis where

the properties of the intertemporal cash flows are considered, it is postulated that when the degree of intertemporal cash flow correlation is fairly insensitive to expected output, a short-term maturity is optimal. When the intertemporal cash flow correlation becomes uncertain and sensitive to firm type, a short debt borrowing strategy would signal insiders' optimistic evaluation of the firm's prospects[8]. However, Goswami, Noe & Robello (1992) also suggest that when cash-flows are non-stationary and investors are uncertain regarding the position of the firm on its growth curve, the debt maturity decision is determined to a large extent by the relative sensitivities of long-term and short-term debt to liquidity risk. When this is moderate to large, a longer debt maturity would signal favorable information. It is hence plausible to find firms with higher-than-average %IO issuing debt with a systematically longer or systematically shorter maturity than firms with lower-than-average %IO.

IV.3.2 The Asset Substitution Hypothesis

Under the asset substitution hypothesis, it is postulated that the less stable the firm's cash flows, the greater is the potential for bondholders' wealth expropriation by stockholders and hence the greater the asset substitution effect and the agency costs associated with the risk incentive problem (Thatcher,1985). The net benefits of issuing short term debt on the one hand or long debt with a protective covenant such as seniority (Diamond, 1992) on the other hand, are thus directly related to the default risk of the firm, with agency costs being less severe for firms with a lower default risk.

The cumulative profit ratio, **CPr**, has been used to capture this effect (Altman, Haldelman & Narayanan, 1984); it is defined as retained earnings divided by total assets. It is postulated that firms with higher bankruptcy risk have lower cumulative profitability. Debt[9] to total asset ratio, **D/A**, has also been used to account for the likelihood of default. In general, as firms issue more debt, bonds become riskier and shareholders' actions have more impact

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[8]. Equivalently, issuing a longer-term debt with a call provision serves a similar purpose and would hence be associated with similar pricing implications. However, the number of debt issues with a call option is extremely small and does no allow a separate testing.

[9]. to the extent that firms are believed to have debt-ratio long-run targets when offering securities, a debt issue need not mean that the firm is below its long-run target debt ratio but rather simply that, under the current circumstances, leverage meets the firm's objective better than equity (MacKie-Mason, 1990).

on bond payoffs. Thus, firms with lower-than-average CPr or higher-than-average D/A are expected to issue debt with a systematically shorter maturity than firms with higher-than-average CPr or lower-than-average D/A, all else being the same.

IV.3.3 THE OPPORTUNISTIC UNDERINVESTMENT HYPOTHESIS

The underinvestment problem arises when management, acting in the stockholders' best interest, forgoes positive net present value projects whenever the net benefits from investment accrue partially to bondholders in the form of a lower probability of default. The cost associated with this incentive problem is likely to be higher for firms in growing industries where management enjoys a great deal of discretion over the choice of future investments. Under the underinvestment hypothesis, shortening the debt maturity (or, alternatively, attaching a call feature to long term debt) acts as a control mechanism for this incentive; higher growth-firms are hence expected to prefer shorter-term debt relative to lower-growth firms.

Several measures have been suggested to proxy Myers-type growth opportunities and a strong negative relationships with leverage have been consistently found. Since most of these studies had used long term debt and total debt interchangeably in calculating leverage, similar results are expected to hold with respect to maturity. One of the most commonly used measure is the average **R&D** expenditure divided by total assets (Bradely, Jarrell & Kim, 1984, Titman & Wessels, 1988, Crutchley & Hansen, 1989, MacKie-Mason, 1990)[10]. Due to missing data for R&D for most of the stocks in the sample, Tobin's *q* (Barclay and Smith, 1993) is used instead to measure a firm's growth options relative to the value of its assets-in-place. An equally popular measure, **Q** is calculated as the ratio of the market value of the firm over the replacement cost of its assets[11]. An approximation of *q* would be given by:

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[10]. A firm's ratio of capital expenditures over total assets, the percentage change in total assets (Titman & Wessels, 1988, Noe, K&R, 1991), the P/E ratio (Chung, 1993) have also been used as indicators of growth, while a firm's ratio of plant and equipment to total assets (MacKie-Mason, 1990, B&F, 1993) and ending inventory to total assets (Titman & Wessels, 1988, Noe, K&R, 1991) have been used to proxy the proportion of assets already-in-place

[11]. Although financial theory uses market rather than book value data for debt figures, the following analysis uses book value (BV) data for debt since market value (MV) data is not as readily available.

$$(BV_{debt} + BV_{preferred\ stock} + MV_{common\ stock}) / BV_{assets}.$$

With opportunistic underinvestment, it is expected that, for a firm with larger q ratio, a shorter maturity will be optimal, ceteris paribus. Alternatively, firms with higher-than-average Q are expected to issue debt with a systematically shorter maturity than firms with lower-than-average Q.

IV.3.4 Protective Covenants

Smith and Warner (1979) suggest that risky firms benefit from attaching restrictive covenants in their debt to mitigate the moral-hazard problems that occur after the debt is issued. Protective covenants such as the priority and security provisions have been suggested to reduce the agency problems. Under the agency approach, a protective covenant attached to a long-term debt would make it equivalent to a short-term debt.

In general, any form of collateralizing debt has been suggested (1) to reduce monitoring costs since independent asset appraisals and on-site inspections are required to establish an interest in the collateral and creditors need only evaluate the collateral, (2) to control management's incentives for risk and underinvestment since the security provision places restrictions on the disposal of collateral (Stulz and Johnson, 1985). Strict covenants such as seniority allow even long-term creditors to exercise a form of control by forcing a restructuring, such as asset sales or liquidation in the event the borrower is in financial distress (Diamond, 1992).

Two dummy variables, one for the security provision, **SEC**, and another for priority, **SR**, are included in the analytical model to capture these relationships. Therefore where agency problems do exist, the security and seniority provisions are more likely to be attached to long-term rather than to short term debt since attaching them to a new debt issue would be tantamount to shortening the effective maturity of that debt.

IV.4 Other Variables

Other variables are also thought to be important determinants of the debt maturity choice regardless of which hypothesis(es) best describes the maturity choice.

1. Firm size: Smith (1986) has suggested that small firms have higher issuance costs for public debt issues relative to large firms which enjoy economies of scale and a comparative advantage in the long end of the debt

market[12]. Barclay & Smith (1993) found evidence that large firms have longer maturities than small firms. In this paper, the logarithm of total sales, **LNS**, is used to proxy for firm size. Firms with higher-than-average LNS are expected to issue debt with a systematically longer maturity than firms with lower-than-average LNS.

2. Industry effect: To the extent that firms within the same industry are more or less homogeneous, inter-industry comparisons may reveal cross-sectional divergences in corporate debt maturity structures. For instance, Smith (1993) suggests that to the extent that a reduction in managerial discretion reduces the adverse incentive effects of long-term debt, regulated firms will have longer maturity of debt than non regulated firms.

Exhibit 1 summarizes the above analysis and reports the predicted effect (PE) on the debt maturity choice under each hypothesis. A plus sign indicates that a longer debt maturity is more likely given an increase in the value of the proxy, while a minus sign indicates that a shorter term debt is more likely.

Hypotheses/Proxies	Symbol	PE
• **Hedging Hypothesis**		
Fixed Assets Ratio	FAR	+
Covariance or Correlation	COV, COR	-
• **Tax Shield Hypothesis**		
Term Structure	TS	+
Effective Tax Rate	EfTx	+
• **Agency Costs Hypotheses**		
a. Signaling: Crude		
% of Insider Ownership	%IO	-
b. Asset Substitution		
Cum.Profitability Ratio	CPr	+
Debt to Asset Ratio	D/A	-
c. Opportunistic Underinvestt		
Future Growth Opportunities	Q	-
• **Other Variables**		
Firm Size	LNS	+
Protective Covenants	SR, SEC	+

Exhibit 1. Debt Maturity Hypotheses, Proxies and Expected Signs.

12. However, they have also suggested that multinationals are more likely to have more short-term debt since they rely on foreign debt markets to manage their currency exposure, which are relatively less liquid than debt markets in the U.S, especially for longer maturities.

CHAPTER V: DESCRIPTIVE ANALYSIS

In this chapter, a descriptive analysis of the final sample of debt issues and of the issuing firms is first carried out. Then, the Wilcoxon rank and the Median 2-sample tests are used to test (1) whether firms classified by a given proxy do issue debt of a systematically different maturity and (2) whether firm characteristics are significantly different across maturity groups.

V.1 THE DATA

A sample was constructed from all the public offers of new corporate debt issues for the 1985-1990 period by all firms listed on the NYSE and AMEX and for which a maturity date was specified. Debt offer dates and issue particulars were identified from, when available, the Investment Dealers Digests's (IDD) *Directory of Corporate Financing*, otherwise, from the IDD's *Weekly Review of Offerings*. Only firms with stock prices on both the Center for Research in Security Prices (CRSP) daily file, [RCHUNG.CRSP91] HEADER.DAT, and the COMPUSTAT annual Industrial file were included in the sample. Firms were chosen that had no missing data for the proxy variables over the 1980-1989 period. Data on firm characteristics were collected from Standard & Poor's COMPUSTAT Industrial Tape and COMPUSTAT Research Tape whenever firms could not be found on the former. For all the variables, data was collected for the year preceding the debt issues to avoid any simultaneity bias. After selecting only one issue at random, multiple issues were also deleted from the sample. This has reduced the sample size from 1,813 to 1,081 issues. R415 issues also posed a special problem since the year the debt was first conceived cannot be known with certainty, hence the elimination of the shelf registrations. This has reduced the sample size by more than a half given that 577 offerings or 53% were shelf registrations -with a concentration in the public utility and manufacturing industries.

Data on the concentration of ownership among insiders and/or major stockholders (stockholding exceeds 5% of common stock) was obtained from the Value Line Investment Survey. Nominal figures were deflated to 1985 constant dollars using the GNP deflator. Data of the GNP deflator was obtained from the IMF's International Financial Statistics. Data on interest rates was obtained from the Federal Reserves Bulletin. The final sample consisted of 268 completed debt offerings.

Maturity is calculated as the number of days between the offer date and

the redemption date as specified on the bond contract. For more than 80% of the observations, this corresponds to an exact number of years; for the remaining observations, maturity was rounded to the closest year. In the final sample, debt maturity ranges from 1 year to 40 years, has a mean of 18 and a median of 20.

Maturity	Freq	Rel.F
0-5	20	7.5
6-10	73	27.2
11-15	27	10.1
16-20	28	10.4
21-25	68	25.4
26+	52	19.4

Table 1. Frequency Distribution of Offerings Across Maturity Groups.

The frequency distribution of the maturity variable shows a particular clustering of observations in the 2nd and 4th maturity groups. Without artificially collapsing maturities in common groups, the maturity histogram shows spikes at specific maturity values, namely 7, 10, 15, 20, 25 and 30 years. As shown, the market for debt maturity is segmented and more than simply a "short" and a "long" maturity; any model used to describe debt maturity should thus account for and capture this segmentation.

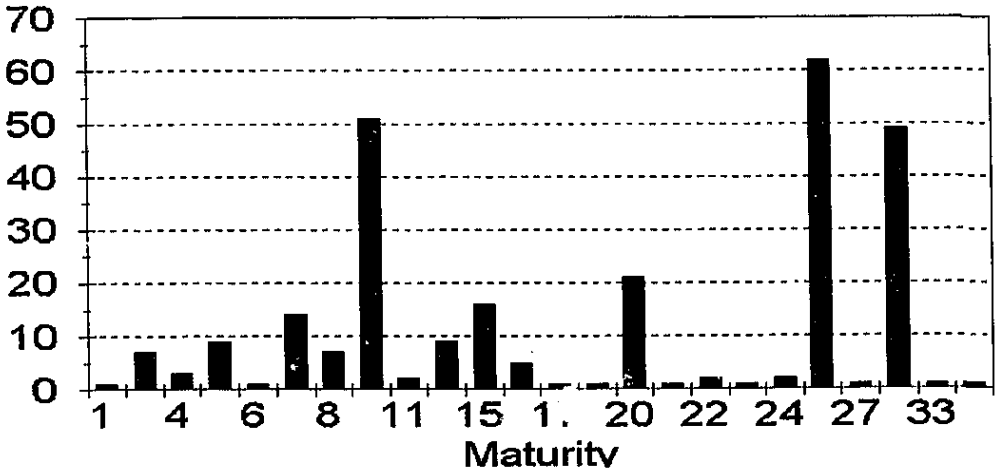

Figure 1. Maturity Histogram

To describe the data, first hand frequency distributions of the debt offerings over the sample period are calculated by calendar year, industry type and debt features.

Corporate Debt Maturity Structure: By Calendar Year

As shown in Table 2, there seems to have been a tendency for the number of debt offerings on both maturity ends to decline over the sample period -

mainly a reflection of the general economic conditions prevailing at the time. More interesting, however, is that the relative frequency of the public debt offerings within maturity groups varied widely across time. For instance, while 38% of the debt offerings in 1988 fell in the 26-above maturity group, only 4.8% fell in the 6-10 group; in contrast, only 4.8% of the debt offerings in 1990 fell in the 26-above maturity group vs. a high 42.7% in the 6-10 group. This pattern is also frequent across individual industries as shown in Graph 1.

M/Y	'85 n=61	'86 n=80	'87 n=56	'88 n=21	'89 n=29	'90 n=21	TOT
0-5	3 (4.8)	1 (1.3)	6 (10.7)	4 (19)	3 (10.3)	3 (14.4)	20 (7.5)
6-10	15 (24.6)	27 (33.7)	12 (21.4)	1 (4.8)	9 (31.1)	9 (42.7)	73 (27.2)
11-15	7 (11.5)	5 (6.3)	5 (9.0)	2 (9.6)	6 (20.7)	2 (9.6)	27 (10.1)
16-20	8 (13.1)	12 (15.0)	2 (3.5)	2 (9.6)	1 (3.4)	3 (14.3)	28 (10.4)
21-25	15 (24.6)	18 (22.5)	21 (37.5)	4 (19.0)	7 (24.1)	3 (14.2)	68 (25.4)
26 +	13 (21.4)	17 (21.2)	10 (17.9)	8 (38.0)	3 (10.3)	1 (4.8)	52 (19.4)
TOT	61 (22.8)	80 (29.9)	56 (20.9)	21 (7.8)	29 (10.8)	21 (7.8)	268 (100)
MEAN	19	19	18	20	16	14	18

Table 2. Frequency (RF) Distribution of Debt Issues: 1985-1990.

Although this pattern may be a reflection of the underlying sample of firms in each of the sample years, it may also be related to financial conditions that made it generally more or less optimal to issue debt of a given maturity.

Corporate Debt Maturity Structure: By Industry

The relative frequency distribution of the debt offerings by industry (Transportation, Extractives, Manufacturing, Other, Industrials, Financials, Utilities and Regulated) also reveals a clear segmentation across maturity groups.

M/I	TRS n=8	EXT n=11	MNF n=112	OTH n=64	*IND N=195*	FNC n=11	UTL n=62	*REG N=73*
0-5	1 (12.5)	1 (9.1)	5 (4.5)	0 (0)	7 (3.6)	7 (63.6)	6 (9.7)	13 (17.8)
6-10	2 (25)	1 (9.1)	33 (29.5)	20 (31.3)	56 (28.7)	1 (9.1)	16 (25.9)	17 (23.3)
11-15	0 (0)	2 (18.2)	10 (9)	13 (20.3)	25 (12.8)	0 (0)	2 (3.2)	2 (2.8)
16-20	0 (0)	1 (9.1)	19 (17)	5 (7.9)	25 (12.8)	1 (9.1)	2 (3.2)	3 (4.1)
21-25	1 (12.5)	4 (36.4)	27 (24.1)	24 (37.5)	56 (28.7)	1 (9.1)	7 (11.3)	8 (11)
26+	4 (50)	2 (18.2)	18 (16.2)	2 (3.1)	26 (13.3)	1 (9.1)	29 (46.7)	30 (41)
MEAN	18	20	18	17	18	10	21	19

Table 3. Frequency (RF) Distribution of Debt Issues by Industry.

As shown in Table 3 and Graph 2, this segmentation exists even within the regulated sample- which is postulated to have a generally long debt

maturity- and the financial sector displays a much shorter maturity than the public utilities sector. For example, 63.6% of the total offerings of the financial industry are clustered in the first maturity group compared to 9.3% only for public utilities; on the other hand, only 9.1% of the offerings of the financials fall in the last maturity group compared to 46.7% for public utilities. The industrial sector tend to be more or less evenly distributed in terms of maturity. Finally, there does not seem to be a systematic difference between regulated and unregulated industries in general.

Corporate Debt Maturity Structure: Debt Features

To the extent that particular debt features such as callability, putability and floatability could shorten the effective maturity of debt, ignoring them could entail an overstatement of the effective maturity. However, these features characterize only a extremely small proportion of the overall debt sample and can hence be safely ignored.

The segregation of the total public debt offerings by debt features over the sample period shows 90 convertible vs. 178 straight issues, 32 senior vs. 236 non-senior issues, and 49 secured vs. 129 unsecured issues. The mean maturity for these samples is, respectively, 22, 16, 19, 18, 24 and 17.

M/F	CV n=90	STR n=178	SR n=32	NSR n=187	SEC n=49	UNS n=219
0-5	0 (0)	20 (11.2)	0 (0)	16 (8.5)	3 (6.1)	17 (7.8)
6-10	4 (4.4)	69 (38.8)	18 (56.3)	44 (23.3)	8 (16.2)	65 (29.6)
11-15	8 (8.9)	19 (10.6)	9 (29.1)	14 (7.6)	1 (2)	26 (11.9)
16-20	19 (21.1)	9 (5)	3 (9.4)	19 (10.6)	0 (0)	28 (12.9)
21-25	57 (63.3)	11 (6.2)	2 (6.2)	52 (27.8)	8 (6.1)	65 (29.8)
26+	2 (2.2)	50 (28.2)	0 (0)	42 (22)	34 (69.3)	18 (8.3)
MEAN	22	16	19	18	24	17

Table 4. Frequency (RF) Distribution of Features By Maturity Groups.

Again, the relative frequency distribution of debt features reveals a clear cross sectional variation among maturity groups. As shown in Table 4, only 4.4 % of the sample of convertible debt fell in the 6-10 group compared to 63.3% in the 21-25 group. The same pattern is found for the sample of secured debt. The sample of senior debt, on the other hand, is clustered around relatively shorter maturities.

FS	IND n=195	FNC n=11	UTL n=62	TOT
CV	80 (88)	1 (1)	9 (10)	90
SR	29 (90)	0 (0)	3 (9)	32
SEC	14 (28)	1 (1)	35 (71)	49

Table 5. Distribution of Debt Features Across Industries.

The industrial sector enjoys 90% of the convertible and senior issues while the public utilities claims around 70% of the secured issues (as shown in Table 5, this pattern has been consistent year in year out). Of the 195 issues for the sample of industrials, 40% are convertible, 15% are senior and only 7% are secured. In contrast, of the 73 issues by utilities, 10% are convertible, 5% are senior and 50% are secured.

1985	I	F	U	TOT	MDM
CV	14	0	1	15	23
SR	8	0	0	8	13
SEC	3	0	12	15	25
1986					
CV	30	1	2	33	21
SR	8	0	1	9	10
SEC	7	0	14	21	25
1987					
CV	21	0	1	22	23
SR	4	0	1	5	15
SEC	3	1	5	9	21

1988	I	F	U	TOT	MDM
CV	3	0	2	5	26
SR	2	0	0	2	11
SEC	1	0	1	2	22
1989					
CV	7	0	1	8	23
SR	6	0	0	6	9
SEC	0	0	2	2	30
1990					
CV	5	0	2	7	18
SR	1	0	1	2	14
SEC	0	0	1	1	30

Exhibit 2. Distribution of Features Across Industries: By Year.

This pattern is consistent when the features are distributed across maturities by calendar year. It is hence important to shed a light on the relevance of those features to the debt maturity choice both for the above samples in addition to the full sample.

V.2 STANDARD DESCRIPTIVE MEASURES

In this section, the standard descriptive measures are tabulated for the proxy and debt maturity variables for the full sample of debt offerings. In Table 6, the minimum, maximum, mean, median and standard deviation are reported for all numeric variables. Extreme values for some of the proxy variables, such as -4.98 for FAR and -17.43 for CPr, were very uncommon and hence, posed no particular problem.

FS N=268	Min	Max	Mean	Median	S.D
DM	1.00	40.00	18.00	20.00	8.96
FAR	-4.98	0.91	0.237	0.227	0.622
COV	-9092	14243	-170.2	-73.58	1505.5
COR	-0.96	0.94	-0.36	-0.57	0.54
TS	-0.08	2.36	1.60	1.50	0.65
EfTx	-0.86	1.02	0.36	0.39	0.16
%IO	0.1	85.00	16.01	8.00	19.4
CPr	-17.43	6.44	0.27	0.233	1.24
D/A	0.004	1.72	0.335	0.327	0.206
Q	0.205	6.71	1.26	0.955	0.91
LNS	3.24	11.62	7.05	7.11	1.48

Table 6. Descriptive Statistics of The Numeric Proxy Variables.

Thus, a representative firm would have an asset maturity of 0.237, a correlation between its net operating income and short-term interest rates of -0.36, an effective tax rate of 36%, would have 16% of its common stock controlled by insiders, a leverage ratio of 0.33 and a cumulative profit ratio of 27%, a 1.26 Q ratio, and $1.1 bn in sales.

DM	FAR	COV	COR	TS	EfTx	%IO	CPr	D/A	Q	LNS	SEC	SR
1.00	0.018	-0.045	-0.103	0.145	0.106	-0.142	0.104	-0.23	0.135	-0.181	0.313	-0.26
FA	1.00	0.036	0.010	0.007	0.005	0.037	0.040	0.039	0.010	0.003	0.013	-0.003
	COV	1.00	0.236	0.006	-0.000	0.021	0.004	0.002	0.005	0.093	0.009	-0.004
		COR	1.00	0.022	0.003	-0.000	0.000	-0.001	0.006	-0.007	-0.002	-0.004
			TS	1.00	0.004	-0.001	-0.001	-0.001	0.000	0.009	-0.001	-0.004
				EFTx	1.00	0.007	0.014	0.006	0.007	-0.000	-0.001	-0.003
					%IO	1.00	0.009	0.011	0.009	0.022	0.021	0.001
						CPr	1.00	0.178	0.029	0.000	-0.000	-0.002
							D/A	1.00	0.014	-0.001	-0.001	-0.001
								Q	1.00	0.027	0.000	-0.002
									LNS	1.00	-0.000	-0.003
										SEC	1.00	-0.004
											SR	1.00

Table 7. Correlation Matrix on Variables for the Full Sample.

As shown, there is little correlation among any of the proxy variables, except for CPr and D/A (0.178) and COR and COV (0.236). In the probit analysis, one is chosen to the exclusion of the other to avoid any related econometric problems. All the variables, except Q, LNS and SR, exhibit the expected relationship with the debt maturity variable DM.

V.3 Debt Maturity: A Nonparametric Analysis

If a clear-cut definition of short maturity and long maturity existed, then

the table for the standard statistical measures could have been easily replicated separately by debt term and proxy variables compared across the tables for systematic differences. However, with no such definition, two univariate approaches are adopted. In the first approach, two independent subsamples of each proxy variable are constructed, one below (B) that proxy's average and one above it (A). The two corresponding mean and median debt maturity (M|MB and M|MA) are then calculated and compared. The size of each subsample is also reported; NB indicates the sample size for the B subsample and NA indicates the sample size for the A subsample. The actual (Act) vs. the expected (Exp) relationship between these two subsamples is tabulated; small characters are used when the actual relationship is opposite to the one expected under the maturity hypotheses. For the binary variables, the mean debt maturity is reported separately for senior vs. non-senior debt issues and for secured vs. unsecured issues. Using the Median 2-sample test, the second approach compares firms for systematic differences, where two distinct samples of firms are constructed, one with maturities less than or equal to a threshold year and one with maturities longer than that same threshold.

V.3.1 The First Approach

As shown in Table 8 for the full sample, and consistent with the above developed hypotheses, firms with relatively high FAR, TS, EfTx, CPr and those attaching a seniority provision to the newly issued debt appear to have debt with a longer debt maturity than firms with their relatively lower counterpart. Similarly, firms with a relatively high COV, COR, D/A, %IO appear to issue debt with a shorter debt maturity than firms with their relatively lower counterparts. However, LNS and Q exhibit opposite results than those expected by the associated hypotheses.

FS: B&A *MEAN|MEDIAN*	*NB&NA*	M|MB	M|MA	Exp	Act
FAR	137, 131	18 | 20	19 | 20	B<A	B<A
COV	96, 172	19 | 20	18 | 20	B>A	B>A
COR	170, 98	19 | 25	16 | 15	B>A	B>A
TS	166, 102	18 | 18	19 | 20	B<A	B<A
EfTx	98, 170	17 | 15	19 | 20	B<A	B<A
%IO	176, 92	19 | 22	17 | 15	B>A	B>A
CPr	152, 116	17 | 15	20 | 24	B<A	B<A
D/A	139, 129	20 | 24	17 | 15	B>A	B>A
Q	197, 71	17 | 15	21 | 25	B>A	b<a
LNS	127, 141	19 | 20	17 | 15	B<A	b>a

Panel A. Numeric Variables.

Feature	*N*	Mnl Md	*Feature*	*N*	Mnl Md	*Feature*	*N*	Mnl Md
Convertible	90	16 | 10	Senior	32	19 | 10	Secured	49	24 | 30
Straight	178	22 | 25	Non-SR	236	19 | 21	Non-Sec	219	17 | 16

Panel B. Binary Variables.

Table 8. DM: Classification by Proxy, Expected & Actual Relationships.

As expected, debt maturity is higher for secured than for unsecured debt and for convertible than for straight debt. However, debt maturity seems to be higher for non-senior rather than for senior debt.

For the sample of industrials, similar results are obtained. Moreover, CPr holds an opposite relationship with maturity than the one expected. For the sample of regulated firms, FAR too exhibits an opposite result than the one expected under the matching hypothesis. The results with respect to the maturity of the feature- vs. non-feature debt are consistent across the samples.

For a more formal analysis, the Wilcoxon rank-sum test and the more general median 2-sample test are performed on the full sample, and on the sample of industrials and regulated firms for the numeric variables only given the small number of features in these two samples.

FS:B&A	W-Rk	Med 2-s
FAR	1.33	0.82
COV	0.75	0.77
COR	-2.69***	-3.02***
TS	1.13	0.33
EfTx	-1.68*	-1.24
%IO	-2.42**	-3.14***
CPr	2.50***	2.24***
D/A	-2.50*	-2.64***
Q	2 .87***	2.83***
LNS	1.34	1.50

CV vs. STR		SR vs. NSR		SEC vs. UNS	
W-test	4.17***	W-test	-4.11***	W-test	5.60***
Med.Diff	4.85***	Med.Diff	-4.66***	Med.Diff	4.77***

Table 9. Wilcoxon Rank and Median 2-Sample Tests for A, B & Features.

As can be seen in Table 9, the W-rank and Median 2-sample statistics for the full sample are both highly significant for COR, %IO, CPr, D/A, Q and all the covenants. All the proxies have the expected relationship between the two subsamples except Q and LNS. EfTx is significant under the first test but is only marginally so. For the remaining variables, H_0 cannot be rejected at the conventional levels of significance. Conducting a similar analysis for the

sample of industrials (Appendix 2; Table 2I) and regulated firms yielded essentially similar results. For the sample of industrials (Appendix 3; Table 2R), however, LNS is highly significant.

This first-hand diagnostic analysis lends strong support to the cross-hedging and agency hypotheses.

V.3.2 The Second Approach

Under this approach, firms issuing debts of different maturities are compared for systematic differences. For this purpose, two distinct samples of observations are constructed, one with maturities less than or equal to a threshold pre-determined year and one with maturities longer than that threshold. Then, the median value is calculated for each of the proxy variables and the 2-sample Median test is used to check for significant differences between the two samples.

Since definitions for short and long maturities are non-existent, several thresholds were chosen, below the mean, the median, at the median and above the median. Maturity thresholds (MA) at 7, 12, 20 and 25 years are reported for the full sample, the sample of industrials (Appendix 2; Table 3I) and the sample of regulated firms (Appendix 3; Table 3R). Results for the full sample are tabulated below for DM $\leq$ 7 vs. DM >7, DM $\leq$ 12 vs. DM >12, DM $\leq$ 20 vs. DM >20 and finally DM $\leq$ 25 vs. DM>25. N1 refers to the sample size below the threshold while n2 refers to that above the threshold. Md1 refers to the median of the first sample while Md2 refers to that of the second sample.

For the full sample and consistent with the previous findings, the agency variables, the debt covenants and the firm size variables have the most significant differences across maturity groups. Compared with firms issuing longer debt maturities (an asterix is used when the relationship is as expected by the related hypotheses), firms with shorter maturities are found:

* to have a lower fixed asset ratio,
* to have a higher correlation between their NOI and ST interest rates,
- to have about the same effective tax rate,
- to exhibit a reversal of relationship with the proportion of insider ownership[13];
* to have a higher leverage rate,

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[13]. In this context, it is important to note that at the very long-end of the maturity spectrum, there is a high concentration of regulated firms having a very small proportion of %IO and for which signaling is not an issue.

* to have a lower cumulative profit rate,
- less growth opportunities - here too, note a reversal,
- to be larger than firms issuing debts of longer maturities, and finally,
* to have less protective covenants attached to them.

It is interesting to note that, across thresholds, some variables cease to be significant at one point and become significant at another.

FS 268 *Medl 2-s*	MA=7 n1=35, n2=233 Md1, Md2l 2-s	MA=12 n1=104, n2=164 Md1, Md2l 2-s	MA=20 n1=148, n2=120 Md1, Md2l 2-s	MA=25 n1=216, n2=52 Md1, Md2l 2-s
FAR	0.17, 0.23 l -0.54	0.22, 0.23 l 0.00	0.19, 0.28 l 0.73	0.19, 0.63 l -2.46***
COR	-0.36, -0.59 l 1.26	-0.52, -0.60 l 1.00	-0.50, -0.61 l -1.96**	-0.54, -0.67 l -1.54
COV	-97.4, -72.3 l -0.90	-91.4, -62.6 l -1.25	-53.9, -82.6 l -0.73	-52.0, -229 l -3.08***
EfTx	0.39, 0.39 l -0.98	0.37, 0.40 l -1.92**	0.39, 0.40 l 0.90	0.39, 0.39 l -0.25
TS	1.33, 1.50 l -1.61	1.50, 1.50 l -0.92	1.50, 1.50 l 0.33	1.50, 1.50 l 1.65*
%IO	2.00, 8.3 l -1.48	8.25, 8.00 l 0.29	10.15, 5.20 l -2.12**	10.0, 0.45 l -4.44***
D/A	0.37, 0.31 l 2.35**	0.36, 0.28 l 2.75***	0.24 , 0.28 l -2.69***	0.33, 0.32 l -0.30
CPr	0.18, 0.24 l -1.99**	0.19, 0.28 l -2.75***	0.20, 0.28 l 2.45**	0.23, 0.22 l -0.30
Q	0.85, 0.96 l -1.62	0.88, 1.01 l -2.75***	0.91, 1.00 l 1.96**	0.97, 0.90 l -2.15**
LNS	7.86, 6.96 l 2.35***	7.53, 6.75 l 3.25***	7.22, 6.91 l -1.47	6.87, 7.42 l 3.08***
SEC	-1.12	-2.26**	- 4.66***	9.76***
SR	-0.09	4.08***	4.77***	-2.95***

Table 10. Firm and Debt Characteristics Across Maturities: A Comparison.

As shown in Appendix 2-Table 4*I*, similar results are generally obtained for the sample of industrial firms in that the same firm characteristics seem to be differentiated across maturity lines. Again, compared with firms issuing longer debt maturities, firms with shorter maturities are found to exhibit a reversal of relationship with the proportion of insider ownership; to consistently have a higher leverage rate; a lower cumulative profit rate; less growth opportunities and a larger size.

For the sample of regulated firms as shown in Appendix 3-Table 4***R***, however, firms seem to be systematically different across maturity almost exclusively with respect to the proportion of fixed to total assets, whereby firms issuing debts of relatively shorter maturities are found to have systematically and significantly smaller FAR than regulated firms issuing debt of relatively longer maturities. Firms are differentiated with respect to D/A for only the 25 years threshold.

CHAPTER VI: DETERMINANTS OF DEB T MATURITY

In this chapter, an ordered probit analysis of the determinants of the corporate debt maturity choice is conducted, first, to determine the direction of the effect, if any, of the proxy variables and, second, to test the ability of these variables to jointly classify firms into groups on the basis of the maturity type they choose.

A general model is developed that would allow to examine how different hypotheses specialize the probit function; if one or more of these variables significantly determine maturity in the expected direction, and if the classification is successful and meaningful, then more insight is gained as to the validity of the hypothesized relationships.

The univariate tests performed only look empirically at how the above predetermined individual variables vary with maturity. The joint influence of these variables on the debt maturity decision is investigated using an ordered probit analysis which tests whether the proxy variables uncover systematically significant differences among firms issuing debt of different maturities.

This probit function is also used to test the ability of the proxy variables to jointly classify firms into groups on the basis of the maturity of the debt they issue. Classification results are compared with the proportional chance classification model which randomly assigns firms to maturity groups with probabilities equal to the actual group frequencies. If the classification is successful and meaningful, then more understanding is gained as to what determines debt maturity when a new debt is issued.

VI.1 THE PROBIT MODEL

Complications arised at the outset right at the level of the concept at hand. Short-term and long-term maturities are not readily available measures and any benchmark used to separate between the two classes of debt maturity remains, to a large extent, arbitrary (ref. Barclay & Smith, 1993). The conventional balance sheet classification of short-term debt as any liability maturing in a year and long term debt as any one maturing in more than a year is highly gross and unpractical since it makes no difference, say, between a debt maturing in 2 years and one maturing in 30 years. Given that no clearly defined classification exists for short and long term maturities, a debt maturity variable is constructed.

In the following sections, the simple and ordered probit models used to test the joint influence of the proxy variables on the maturity decision are presented. The GAUSS econometric package is used for the ordered probit analysis while SAS and SHAZAM are used for the simple probit and results from using both models are compared. The simple model is used whenever the sample size does not allow the use of the ordered model.

VI.1.1 THE SIMPLE PROBIT MODEL

As advanced by McFadden (1973) in the context of a general choice model, let W_{i1} denote agent i's preference for alternative 1 and let W_{i2} denote agent i's preference for alternative 2. It is then presumed that i would choose 1 over 2 if $W_{i1}>W_{i2}$ and vice-versa. Preference may be assumed a linear function of exogenous variables, say:

Alternative 1: $W_{i1}= \Sigma a_{k1}X_{ik} + v_{i1}$ and

Alternative 2: $W_{i2}= \Sigma a_{k2}X_{ik} + v_{i2}$,

where vi's are random aspects of behavior. As such, alternative 1 will be chosen when $W_{i1} - W_{i2} > 0$, viz., $\Sigma (a_{k1}-a_{k2}) X_{ik} + (v_{i2}- v_{i1}) >0$. Let Y_i^* denote this difference, and let $b_k= a_{k1}-a_{k2}$ and $u_i = v_{i2}- v_{i1}$. Y_i^* is an *unobservable* random index for each agent that defines their propensity to choose an alternative. The linear preference function becomes:

$$Y_i^*= \Sigma b_k X_{ik} - u_i.$$

Hence, alternative one will be preferred if $Y_i^*>0$, or if $\Sigma b_k X_{ik}>u_i$. Y_i^* cannot be observed; instead, the choice made by agent i, Y_i, and which is a function of Y_i^*, can be measured. If Yi=1 when $Y_i^*>0$, and if Yi=0 when $Y_i^*<0$, then Yi becomes related to X_{ik} by a probabilistic transformation of $\Sigma b_k X_{ik}$, or

$$P(Y_{it}=1) = P(Y_i^* > 0) = P(u_i< \Sigma b_k X_{ik}).$$

Therefore, estimating $P(Y_{it}=1)$ is tantamount to knowing the cumulative probability that $u_i< \Sigma b_k X_{ik}$, or the cumulative distribution function (CDF), F(.). Letting $Z_i=\Sigma b_k X_{ik}$ and assuming that u_i follows a normal distribution, the cumulative normal distribution function or the Probit (normit) function is::

$$P(u_{i<} \Sigma b_k X_{ik})=P(u_i<Z_i)= F(Z_i)= \int_{-\infty}^{Zi} \left(1/\sqrt{2\pi}\right)\exp(-u^2/2)du \equiv \Phi(Z).$$

In this formulation, Zi or $\Sigma b_k X_{ik}$ is not $E(Y_i|X_i)$ but rather it is $E(Y_i^*|X_i)$; and this conditional mean is a linear function of the observed

"explanatory" variables.

The observed values of Y are merely realizations of a binomial process with probabilities given by the above equation, and changing from trial to trial depending on the values of the exogenous variables (Maddala, 1991). When the number of repeated observations is not very large, as is the case here with N=268 or less depending on whether the full sample or a subsample is used, maximum likelihood estimation of the probit function is carried out (Judge et al., 1985). The likelihood and the log-likelihood functions (LLF) are, respectively

$$L=\prod_{yi=0} F(-Z_i)\prod_{yi=1}[1-F(-Z_i)]$$

$$\ln l = \Sigma y_i \ln F(-Z_i) + (1-y_i)\ln[1-F(-Z_i)]$$

where F(.) is the standard normal CDF.

Joint hypothesis tests about coefficients are carried out using the likelihood ratio procedure. If n is the number of successes (Yi=1) observed in the N observations, then the maximum value of the LLF under H0 is:

$$\ln l(\omega) = n\ln\left(\frac{n}{N}\right)+(T-n)\ln\left(\frac{N-n}{N}\right).$$

If H0 is true, then asymptotically, $-2[\ln l(\omega)-\ln l(\Omega)] \sim \chi^2_{(k-1)}$,

where $\ln l(\Omega)$ is the LLF evaluated at β_L, and the probability that Yi=1 is estimated by the sample proportion, n/N (Judge et al., 1985).

If $P(Y_{it}=1)$ is the probability of firm i choosing a given type debt at time t, the estimated coefficients reflect the effect of a change in an independent variable upon the *probability* of belonging to that particular type. For the simple probit, this is given by the derivatives for the probabilities from the probit model:

$$\frac{dP(Y=1)}{dX_k} = \frac{1}{\sqrt{2\pi}}\exp(-Z^2/2)b_k \equiv \Phi(Z)b_k .$$

As can be seen, b_k determines the *direction* of the effect of a change in X_k on P(Y=1) but the magnitude of the effect depends on the magnitude of Z which, in turn, depends on the magnitude of *all* of the X_k's (Aldrich & Nelson, 1984). In general, the effect of a unit change in an explanatory variable varies according to the location of the starting point on the X scale; the steeper the CDF is at Z, the greater is the impact of a change in the value of an explanatory variable. The SAS output provides the marginal effect on the

probability P(Y=0) of 1% increase in the value of each independent variable evaluated at the mean value of all the other independent variables.

VI.1.2 THE ORDERED PROBIT MODEL

A multinomial simple probit model fails to account for the ordinal nature of the dependent variable, debt maturity which is inherently ordered. The ordered probit technique was developed by Aitchison (1957) and Ashford (1959) and is most frequently used in cross-sectional studies of dependent variables that assume only a finite number of values possessing a "natural ordering". At the heart of the ordered probit analysis is a 'virtual' regression model with a latent, unobserved, dependent variable whose conditional mean is a linear function of the observed regressors. Let Y^*_k denote this unobservable continuous random variable; then,

$$Y^*_k = X'\beta + \varepsilon_k, \quad E[\varepsilon_k | X_k]=0, \ \varepsilon_k \text{ i.i.d } N(0,\sigma^2_k),$$

where X_k is a q x1 vector of the proxy variables that are hypothesized to govern the conditional mean of Y^*_k. The ordered probit model is based on the assumption that the observed maturities Y_k are related to Y^*_k in the following fashion:

$$Y_k = \begin{cases} s_1 \ \textit{if} \ Y^*_k \in A_1 \\ s_2 \ \textit{if} \ Y^*_k \in A_2 \\ \vdots \\ s_m \ \textit{if} \ Y^*_k \in A_m \end{cases}$$

where the sets A_j are exhaustive and mutually exclusive sets of the state Ψ^* of Y^*_k, and s_j's are the discrete values that comprise the state space Ψ of Y_k. Hence, Y can be viewed as an indicator function for Y^* over the partition regions. In general, the state-space partition of Ψ^* are specified as intervals:

$$\begin{aligned} A_1 &\equiv (-\infty, \alpha_1] \\ A_2 &\equiv (\alpha_1, \alpha_2] \\ &\vdots \\ A_i &\equiv (\alpha_{i-1}, \alpha_i] \\ &\vdots \\ A_m &\equiv (\alpha_{m-1}, +\infty). \end{aligned}$$

Uncovering the mapping between Ψ^* and Ψ, and relating it to the set of predetermined economic regressors constitute the motivation behind the ordered probit specification (Hausman et al, 1992).

The conditional distribution of observed maturities is hence determined by the partition boundaries and by the distribution of ε_k, and is given by:

$$P(Y_k = s_j) = P(Y^*_k \in A_j) = P(X'_k\beta + \varepsilon_k \in A_j | X_k)$$

$$= \begin{cases} P(X'_k\beta + \varepsilon_k \le \alpha_1 | X_k) & \text{if } i = 1 \\ P(\alpha_{i-1} < X'_k\beta + \varepsilon_k \le \alpha_i | X_k) & \text{if } 1 < i < m \\ P(\alpha_{m-1} < X'_k\beta + \varepsilon_k | X_k) & \text{if } i = m \end{cases}$$

$$= \begin{cases} \Phi\left(\dfrac{\alpha_1 - X'_k\beta}{\sigma_k}\right) & \text{if } i = 1 \\ \Phi\left(\dfrac{\alpha_i - X'_k\beta}{\sigma_k}\right) - \Phi\left(\dfrac{\alpha_{i-1} - X'_k\beta}{\sigma_k}\right) & \text{if } 1 < i < m \\ 1 - \Phi\left(\dfrac{\alpha_{m-1} - X'_k\beta}{\sigma_k}\right) & \text{if } i = m, \end{cases}$$

where $\Phi(\cdot)$ is the standard normal cumulative distribution function.

Thus the probability of any particular observed maturity is determined by the position of the conditional mean relative to the boundaries of the partition; that is,

$$pi \equiv P(Y_k = s_i | X_k) = P(\alpha_{i-1} < Y^*_k \le \alpha_i | X_k)$$

To illustrate, Figure 1 (reprinted from Hausman et al.) assumes, m=9 , $\alpha_0 \equiv -\infty$, $\alpha_9 \equiv +\infty$, and p_i be the probability of observing maturity of s_i.

This probability is determined by where the unobservable 'virtual' maturity Y^*_k falls. Specifically, if Y^*_k falls in the $[\alpha 3, \alpha 4[$ interval, then the ordered probit model implies that the observed maturity is s4. More formally, $p4 \equiv P(Y_k = s4 \mid X_k) = P(\alpha 3 < Y^*_k \le \alpha 4 \mid X_k)$.

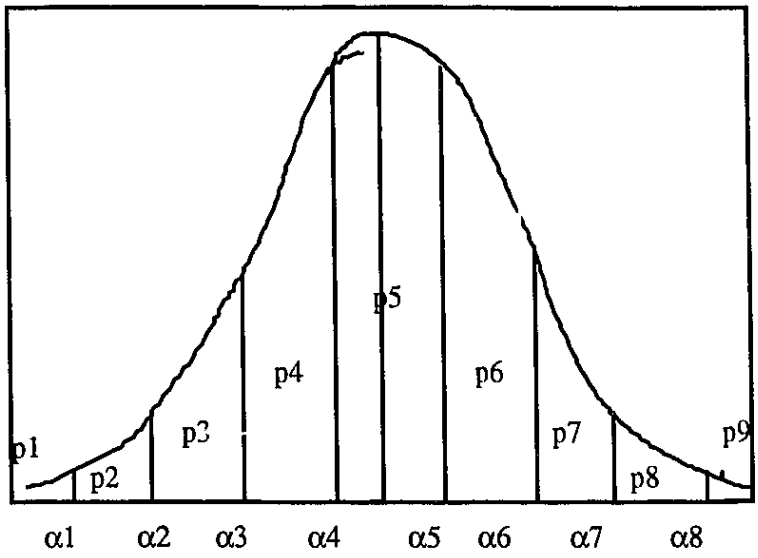

Figure 2. Illustration of Probabilities p_i of Observing a Maturity of s_i.

Increasing one of the X's, all else held constant, is tantamount to shifting the distribution slightly to the right- assuming its beta is positive. The effect of the shift is to shift some mass out of the leftmost cell into the rightmost cell; this means that p1 must decline and p9 must rise (Greene, Chap 21). To simplify, consider the case of only 3 categories. Then the three probabilities are given by:

$$\Pr[y=0]=1-\Phi(\beta' x)$$
$$\Pr[y=1]=\Phi((a-\beta' x)-\Phi(-\beta' x)$$
$$\Pr[y=2]=1-\Phi(a-\beta' x), \text{ and}$$

and the marginal effects on these probabilities is given by

$$\frac{\partial \Pr[y=0]}{\partial x}=-\Phi(\beta' x)\beta,$$
$$\frac{\partial \Pr[y=1]}{\partial x}=(\Phi(-\beta' x)-\Phi(a-\beta' x))\beta$$
$$\frac{\partial \Pr[y=2]}{\partial x}=\Phi(a-\beta' x)\beta.$$

The derivatives are evaluated at the mean values of the other regressors. Thus, a higher conditional mean $X_k'\beta$ simply means a higher probability of observing a more extreme positive state. Again, the marginal effects of the regressors on the probabilities are not equal to the coefficients but depend on all the X's. Unlike SAS, the GAUSS output does not give elasticities at the mean.

The likelihood function for the ordered probit is specified as follows; let I_{ik} be an indicator variable which is equal to one if the realization of the kth observation Y_k is in the ith state of S_i and zero otherwise. Then, the log-likelihood function LLF for the vector of maturities Y=[Y1 Y2 ... Yn]' conditional on the regressors vector X=[X1 X2...Xn']' is given by:

$$LLF\,(Y|X) = \sum_{k=1}^{n} \begin{cases} I_{1k}.\mathrm{Log}\,\Phi\left(\dfrac{\alpha_1 - X'_k\beta}{\sigma_k}\right) \\ +\sum_{i=2}^{m-1} I_{ik}.\mathrm{Log}\left[\Phi\left(\dfrac{\alpha_i - X'_k\beta}{\sigma_k}\right) - \Phi\left(\dfrac{\alpha_{i-1} - X'_k\beta}{\sigma_k}\right)\right] \\ +I_{mk}.\mathrm{Log}\left[1 - \Phi\left(\dfrac{\alpha_{m-1} - X'_k\beta}{\sigma_k}\right)\right]. \end{cases}$$

The proxy variables used as regressors for the ordered probit allow to separate the significance of the various hypotheses that influence the *likelihood of one state vs. another.*

In the framework of this study, the specification of $X_k'\beta$ is given by:

$$X_k'\beta = \beta_0 + \beta_1 FAR + \beta_2 COR + \beta_3 TS + \beta_4 EfTx + \beta_5 \%IO + \beta_6 D/A + \beta_7 Q + \beta_8 LNS + \beta_9 SEC + \beta_{10} SR.$$

By letting the data determine the partition boundaries and the coefficients β of the conditional mean $X_k'\beta$, the ordered probit unmapps the empirical relation between the unobservable continuous state space of Y^* and the observed discrete state space of Y as a function of the regressors X_k (Hausman et al, 1992). By increasing m, that is, by introducing more states, a finer model resolution may be obtained; however, the data imposes a limit on the extent to which m can be increased since there won't be enough observations in some states to allow the estimation of the parameters.

VI.2 THE EMPIRICAL SPECIFICATION

To guide the choice of the number of states, m, for the full sample, the frequency distribution of the maturity variable, DM, is used. The choice of the empirical definitions of DM reflect a compromise between maximizing the model's resolution and ensuring a sufficient number of observations under each state to be able to estimate the probit parameters (α's and β's).

Three ordinal categorical variables were constructed for the ordered

probit namely, DM1, DM2 with m=6 and DM3 with m=4.

$$DM1 = \begin{cases} s1 \ if \ MA \le 7 \\ s2 \ if \ MA > 7 \ and \ MA \le 12 \\ s3 \ if \ MA > 12 \ and \ MA \le 17 \\ s4 \ if \ MA > 17 \ and \ MA \le 21 \\ s5 \ if \ MA > 21 \ and \ MA \le 27 \\ s6 \ if \ MA > 27, \end{cases}$$

$$DM2 = \begin{cases} s1 \ if \ MA \le 7 \\ s2 \ if \ MA > 7 \ and \ MA \le 10 \\ s3 \ if \ MA > 10 \ and \ MA \le 15 \\ s4 \ if \ MA > 15 \ and \ MA \le 20 \\ s5 \ if \ MA > 20 \ and \ MA \le 25 \\ s6 \ if \ MA > 25, \end{cases} \qquad DM3 = \begin{cases} s1 \ if \ MA \le 7 \\ s2 \ if \ MA > 7 \ and \ MA \le 15 \\ s3 \ if \ MA > 15 \ and \ MA \le 25 \\ s4 \ if \ MA > 25 \end{cases}$$

For instance, for DM3, s1 DM3 corresponds to the state-space of DM with a maturity of 7 years or less, s2 correponds to a maturity greater than 7 years but less than or equal to 15 years, s3 to a maturity greater than 15 years but less than or equal to 25 years and s4 to a maturity greater than 25 years. Hence, if the "virtual" maturity Y^* is less than α_1, then Y=s1 and the observed maturity is equal to 7 years or less; if Y^* is between α_1 and α_2, then Y=s2 and the observed maturity is greater than 7 years but less than 15 years; and so on.

For the DM variables defined above, the ordered probit would not capture differences, if any, between, say, a maturity of 3 years and that of 7 years since these maturities have been grouped together under the above specification. However, there are only 7 observations with a 3 years maturity in the whole sample and subsets of parameters are not identified and cannot be estimated with such a small number of observations- for instance, the 6-state specification requires the estimation of 5 partition boundaries, that is, α_1, α_2, α_3, α_4 and α_5 as well as the coefficients of the explanatory variables β_1, β_2, ..., β_{10}. The 4-state specification requires only 3 α's in addition to the β's .

It is important to mention in this context that finer resolutions than the one specified above were attempted by introducing more states (with 5,7,10,12,15,20 and 25, and 5, 7, 10, 12, 17, 21, 25 to define the s's) and

convergence of the maximum likelihood estimation procedure could not be achieved. Even when equal and less numbers of states were attempted (with 7,12, 20 and 25 to define the s's), this problem still arrised.

Similar tests were performed for the samples of industrials vs. regulated, straight vs. convertible, senior vs. non-senior and secured vs. unsecured debt. For the samples of senior, secured and convertible debt, the maximum likelihood procedure did not converge given the small number of observations in these samples. Constructing coarser measures did not eliminate this problem and eventually, a simple probit was used. Again, several definitions - in terms of the threshold value for maturity -were constructed for the categorical variable DM. Even with a simple probit, convergence could not always be achieved.

VI.3 PROBIT RESULTS

The maximum likelihood estimates (MLE) for the ordered probit model and for which convergence could be achieved are tabulated below. For the full sample, these are shown in Table 11. OPEst1 denotes the ordered probit estimates when the ordinal categorical variable DM1 is used, OPEst2 is associated with DM2 and OPEst3 with DM3. $SPEst_{(7)}$ denotes the simple probit estimates when the threshold maturity is at 7 years.

T-values and standard errors are reported between parentheses; The z-statistic used to test for the significance of the beta coefficients is asymptotically standard normal under the null hypothesis that the coefficient is equal to zero. Two goodness of fit indicators are reported for each probit estimation, namely the likelihood ratio test (L. Ratio) and the percentage of observations correctly predicted or the success rate (S. Rate) by the probit equation. The likelihood ratio test has a chi-square distribution with 10 degrees of freedom, expect for the non-secured sample where the degrees of freedom are reduced to 9.

For the simple probit, the change in the probability of below-threshold maturity choice is reported alongside with the parameter estimates for a 1% increase in the value of each independent variable as an elasticity evaluated at the mean value of all the independent variables.

FS N=268	OPEst1	OPEst2	OPEst3	SPEst(7)	PS
FAR	-0.16 (-1.43; 0.124)	-0.150 (-1.33; 0.112)	-0.123 (-1.16; 0.106)	-0.065 I 0.002 (-0.36; 0.180)	+
COR	-0.09 (-0.76; 0.123)	-0.081 (-0.65; 0.124)	-0.047 (-0.38; 0.124)	-0.055I 0.003 (-0.26; 0.213)	-
TS	0.078 (0.59; 0.131)	0.072 (0.56; 0.131)	0.127 (0.95; 0.134)	0.221 I 0.067 (1.24; 0.177)	+
EfTx	0.540 (1.33; 0.405)	0.636 (1.55; 0.412)	0.520 (1.29; 0.404)	0.028 I -0.08 (0.04; 0.613)	+
%IO	0.0001 (0.03; 0.004)	-0.0006 (-0.13; 0.004)	0.0002 (0.03; 0.004)	0.012** I 0.038 (1.94; 0.006)	-
D/A	-0.990** (-2.86; 0.347)	-0.886** (-2.52; 0.351)	-1.021*** (-2.83; 0.361)	-1.29*** I -0.08 (-2.78; 0.466)	-
Q	0.109 (1.02; 0.107)	0.105 (0.98; 0.107)	0.081 (0.74; 0.111)	0.230 I 0.05 (1.36; 0.169)	-
LNS	-0.128** (-2.32; 0.052)	-0.118** (-2.16; 0.054)	-0.101* (-1.80; 0.056)	-0.188** I -0.25 (-2.48; 0.075)	+
SEC	1.390*** (8.03; 0.173)	1.397*** (8.09; 0.172)	1.387*** (8.02; 0.173)	0.58** I 0.02 (1.82; 0.319)	+
SR	-0.429 (-1.39; 0.308)	-0.353 (-1.24; 0.286)	-0.403 (-1.36; 0.296)	0.26I 0.006 (0.75; 0.354)	+
L. Ratio	83.5***	80.09***	79.86***	29.77***	
S. Rate	42.5 %	44.77 %	58.20 %	85 %	

Table 11. MLE (t-value; S.E) of OPM and SPM and Measures of Fit.

Results from the ordered and simple probits indicate that, in general, there is consistency as to the significance of the estimated parameters regardless of how the ordinal DM variable is defined.

Table 11 shows that D/A, SEC LNS are the most important variables influencing the direction of the conditional means of the Y_k^* and hence of Y_k. The negative beta of D/A, inducing a lower conditional mean for Y^* for a positive D/A and hence a higher probability of observing a more extreme negative state (i.e., a shorter maturity), lends support to the asset substitution hypothesis. The positive coefficient of SEC induces a higher probability of a longer maturity. The negative beta of LNS induces a higher probability of observing a shorter maturity the larger the firm size is. This finding does not conform with the assumption that larger firms tend to capitalize on their comparative advantage in the long-term debt market; however, Smith and Barclay (1993) also report a reversal of the relationship between debt maturity and size for firms with a market value larger than $1bn- which is characteristic of the sample at hand.

For the simple probit, D/A is also the most significant determinant of the

debt maturity choice. The elasticity estimate of D/A indicates that a 1% change in the leverage ratio lowers the probability of a 7 year maturity and less by 8%.

The tax proxies, TS and EfTx, hold the predicted relationship to the debt maturity choice but are insignificant thus offering no support to the tax hypothesis. The hedging proxies are also insignificant and exhibit opposite relationships to the ones expected under the associated hypotheses. The signaling and underinvestment proxies are insignificant as well and also seem to hold opposite relationships to the ones expected.

The log likelihood test of the ordered probit for the full sample is significant at the 0.01 level. Moreover, the ordered probit function correctly predicted 42.5%, 44.7% and 58.2% of the total cases respectively when DM1, DM2 and DM3 were used. When significant, the estimated β's are about the same order of magnitude across the three definitions suggesting that the results are quite robust. The success rate is lower for the ordered than for the simple probit model because the former misses out completely in intermediate ranges (ref. Tables 13 and 14) while the latter does not have any such problem. However, the standard errors of the ordered probit are much smaller than those of the simple unordered probit suggesting a gain in efficiency from using an ordered model for maturity.

When the same tests were performed on the sample of unsecured issues, findings were very consistent with and similar to the ones reported above in terms of the significance and signs of LNS and D/A (See Appendix 1). For this sample, D/A becomes by far the most significant regressor.

Leverage was also highly significant for the sample of straight debt as shown in Table 12. For the sample of convertible debt, results of the simple probit show that only the COR variable is significant.

STR n=178	OPEst 3	$SPEst_7$	*CV n=90*	$SPEst_{20}$	PS
FAR	-0.134 (-0.95; 0.142)	-0.052 (-0.27; 0.193)		-0.545 (-1.29; 0.428)	+
COR	-0.0001 (-0.001; 0.153)	0.023 (0.10; 0.229)		-0.874** (-2.17; 0.401)	-
EfTx	0.375 (0.70; 0.536)	-0.184 (-0.27; 0.673)		1.048 (0.85; 1.232)	+
TS	0.089 (0.50; 0.179)	0.146 (0.74; 0.197)		-0.545 (-1.89; 0.287)	+
%IO	0.003 (0.62; 0.005)	0.016** (2.23; 0.007)		-0.009 (-1.12; 0.08)	-
D/A	-0.901** (-2.22; 0.405)	-1.215** (-2.36; 0.513)		0.400 (0.32; 1.239)	-
Q	0.108 (0.65; 0.168)	0.499 (1.57; 0.316)		0.112 (0.75; 0.148)	-
LNS	-0.037 (-0.50; 0.073)	-0.105 (-1.22; 0.086)		-0.186 (-1.28; 0.144)	+
SEC	1.379*** (6.42; 0.215)	0.891*** (2.66; 0.334)		5.62 (0.005; 1119.8)	+
SR	-0.146 (-0.41; 0.355)	0.369 (1.01; 0.364)		-1.28 (-1.57; 0.815)	+
L. Ratio	52.8***	22.46***		15.07*	
S. Rate	56.17 %	82.02%		67.7 %	

Table 12. MLE (T-Value; S.E) and Measures of Fit: Str vs. Cv.

Interestingly, when the full sample was divided across industry lines, leverage ceased to be a significant determinant especially for regulated firms (Appendix 3: Table 5***R***), and very marginally so for the sample of industrials (Appendix 2: Table 5***I***), if at all. This might be related to the fact that regulated firms are all highly leveraged to begin with, and the incentive problem is not as relevant since these are constantly monitored. Moreover, the significance of the leverage variable for the full sample might simply be a reflection of the difference in leverage between the sample of industrials and the sample of regulated firms.

For the sample of industrials, SEC and LNS are highly significant and leverage does not seem to influence the predicted probability under any specification. SR and FAR are also significant, although only marginally so for the latter, and the negative sign of their coefficients is not what would be expected under the associated hypotheses. The likelihood ratio indicates an overall good fit and the model correctly predicted 46.15% and 61.02% of the total cases when DM1 and DM3 were used respectively. The simple probit with a 7-year maturity threshold correctly predicted 90% of the cases;

however, its estimates still had larger standard errors than their ordered model counterparts.

For the sample of regulated firms, SEC is the only significant variable and has the expected beta sign. The likelihood ratio test is significant and the model correctly predicted about 50% of the total number of cases.

Overall, results indicate that there is consistency as to the significance of the variables. Consistent with the findings of Barclay and Smith (1993), strong support is found to the asset substitution hypothesis; the negative coefficient of D/A indicates that, all else being the same, firms with higher leverage ratios tend to use shorter maturity than firms with lower leverage ratios. When included as explanatory variable, SEC is consistently the most significant determinant of the debt term choice; its positive coefficient indicates that secured debt issues tend to have longer maturities than non-secured issues. Taken together, these findings provide supportive evidence to the hypothesis that, when choosing debt maturity, firms seek to reduce the agency costs associated with the risk incentive problem- except when the incentive problem is not relevant as is the case for regulated firms.

VI.4 CLASSIFICATORY ABILITY

Beside looking at the coefficients determined by the model, the in-sample predictive success of the model is also reported. Each firm is classified by plugging in its variable scores and calculating a p value, a kind of "posterior probability of the firm belonging to a particular classification group", i.e., issuing debt of a specific maturity group.

The GAUSS package provides a table of observed and predicted outcomes based on the probit function. The results of the classification and the success rate of the ordered probit model (SR:OPM) are compared with those of the proportional chance model (SR:PCM) which classifies firms with probabilities equal to the actual group frequencies. The expected proportion of correctly classified firms for group i is equal to ni/N, where ni is the actual number of observations in group i and N is the sample size. The overall expected proportion of correctly classified firms or observations is $\Sigma(ni/N)^2$. The test statistic for significance is equal to: $(d-p)/\sqrt{p(1-p)/n}$, where d is the proportion of observations correctly classified by the probit function, p is the probability of classification by chance and n is the number of observations in

the sample being classified (Thatcher, 1985).

In Table 13, the classification results are compared for the full sample when DM1 is used as the ordinal variable for the OPM.

FS: DM1	1-7	8-12	13-17	18-21	22-27	28-40	Total
Observed	35	69	22	23	68	51	268
COR.Pred	3	39	0	0	39	33	114
SR:OPM	8.5%	56%	0%	0%	57.3%	64.7%	42.5%
SR:PCM	13%	25%	8.2%	8.5%	25.3%	19%	19.3%
test-statistic	9.62***						

Table 13. Comparison of the Classificatory Ability of OPM and PCM.

In terms of the overall predictive ability, the probit function is better than the proportional chance criterion at a significance level of 1%. It is interesting to note that both models perform very badly in predicting the intermediate maturity ranges; the case is even more severe with the OPM which misses out completely on those ranges. When DM3 is used, the performance of both models is only marginally enhanced, if any, at the maturity ends whereas it is greatly improved in the intermediate ranges.

FS: DM3	1-7	8-15	16-25	26-40	Total
Observed	35	85	96	52	268
COR.Pred	2	48	72	35	157
SR:OPM	5.7%	56.4%	75%	67.3%	58.5%
SR:PCM	13%	31.7%	35.8%	19.4%	28.3%
test-statistic	10.97***				

Table 14. Comparison of the Classificatory Ability of OPM and PCM.

Similar tests were constructed for the samples of industrials (DM1, DM3), straight debt (DM3) and convertible debt (DM) and similar results were found. For the sample of regulated firms, the test was insignificant.

Table 15 and Table 16 below show the results for the sample of straight and convertible debt, respectively.

STR: DM3	1-7	8-15	16-25	26-40	Total
Observed	32	76	20	50	178
COR.Pred	2	65	0	33	100
SR:OPM	6.2%	85.5%	0%	66%	56.2%
SR:PCM	18%	42.7%	11.2%	28%	30.5%
test-statistic	4.1***				

Table 15. Comparison of the Classificatory Ability of OPM and PCM.

CV: DM	1-20	21-40	Total
Observed	31	59	90
COR.Pred	9	52	61
SR:SPM	29%	88.1%	67.7%
SR:PCM	34.4%	65%	54%
test-statistic	6.4%***		

Table 16. Comparison of the Classificatory Ability of SPM and PCM.

VI.5 SUMMARY OF RESULTS

What the above analysis has shown is that, first, debt maturity is not after all as simple a concept to test as one might first think. In practice, there are no counterparts to what theory simply casts as short and long maturity and the difficulty of building empirical measures for these theoretical constructs is consistently outlined by the few researchers that had attempted to explain empirically the debt maturity choice[14].

The results from the univariate tests give suppotive evidence that firms differentiated by cross hedging, agency measures and size do issue debt of systematically different maturities.

The results from the probit models lend strong support to the hypothesis that, overall, when choosing the maturity of a new debt, corporate managers seek to minimize the agency costs from the incentive for wealth expropriation by investing in riskier projects than originally anticipated.

The role of leverage as being one of the most significant determinant of the maturity decision was even more pronounced when the analysis was applied to the sample of straight and unsecured debt. Interestingly however, when the full sample was divided across industry lines, leverage ceased to be a

[14]. Refer Barclay & Smith (1992).

significant determinant especially for regulated firms, and very marginally so for the sample of industrials, if at all.

The evidence is also consistent with the assumption that managers do commit themselves not to transfer wealth from bondholders to stockholders by attaching protective covenants to the newly issued debt. Unlike the leverage variable, the security provision is found to be consistently significant across all the samples, except for the sample of convertible where only the cross-hedging variables seemed to significantly influence the maturity choice.

Taking advantage of the natural ordering of the maturity variable by choosing an ordered probit model as opposed to a simple probit model has resulted increased the efficiency of the parameter estimates - as suggested by lower standard errors.

Finally, the ordered probit was found to significantly outperform the proportional chance model in terms of its classificatory ability for the full sample, the sample of industrials and for the sample of straight debt. However, the success ratio was not significantly better for the sample of regulated firms.

CONCLUSION

This paper has attempted to explain the observed cross-sectional variation in debt maturity *at issuance*, which to date, remains a much neglected area of corporate finance. Previous empirical studies (Barclay and Smith, 1993) have looked at oustanding debt maturity to explain the maturity structure but have recognized the limitations of their approach.

In this paper, the debt maturity hypotheses were presented and their empirical implications were tested using nonparametric techniques and within the framework of a general probit model. The meaningful determinants of the debt maturity choice were empirically sorted out and for the first time, the role of protective covenants like the security and priority provisions was empirically addressed.

Consistent with the findings of Barclay and Smith (1993), the results of this study lend strong support to the asset substitution hypothesis where the debt maturity choice becomes a mechanism to control the incentive for risk problem. Strong support was also found to the hypothesis that restrictive covenants in the bond indentures such as seniority and security - especially the latter- exert a major influence on the debt term choice. Although the role of these and other protective provisions in determining that choice has frequently been highlighted, no empirical evidence has been presented so far to support this claim and the findings of this paper constitute a major contribution in this respect.

Results also indicated that firm size is an important determinant of debt maturity, although not in the expected direction. On the other hand, no support was found to the tax hypothesis. Some support was found for the hedging hypotheses, especially for the sample of regulated firms.

A major contribution in this paper lies in the development of a maturity measure that, unlike the balance-sheet based measures, captures and reflects the segmentation of the debt maturity market; more importantly, the choice of the probabilistic analytical model highlighted and took advantage of the fact that the maturity variable is inherently ordered and that the marginal effects of one determinant are not constant but are conditioned on the values of the other determinants as well - unlike a least square regression which assumes a constant marginal effect for all the regressors.

Moreover, the use of an ordered model as opposed to a simple model

significantly improved the efficiency of the parameter estimates as evidenced by the smaller standard errors for the estimates.

Although innovative in many respects, this study still has limitations; although the debt maturity meausre is much better constructed, its design still depended to a great extent on the sample size - ideally, a large enough sample of observations would make it possible to define as many states as there are maturities.

Another limitation pertains to the fact that there is still not yet a clear standard method of comparison across the various model specifications that were developed in this paper. Furthermore, although the analytical model developed in this study has included a fairly wide range of regressors that are thought to determine the debt maturity structure, it cannot give any insights beyond the structure that has been imposed on it *a priori*. This structure was dictated by the basic three hypotheses in relation to hedging, tax, and contracting costs considerations.

The debt maturity model developed in this paper could be extended to include an agency variable that would account for the intertemporal cash flows properties and liquidity risk, and another that would reflect firm type, a tax variable that would account for tax carry forwards and credit losses, a transaction cost variable, and a dynamic variable such as a lagged maturity variable as "regressors", to name but a few possibilities. In addition, the sample size could be significantly enlarged to allow a separate study for each industry, e.g., financials, utilities, manufacturing, etc.

Finally, an event study analysis could be developed to complement this cross-sectional study.

APPENDIX 1: Unsecured Debt

I. PROBIT RESULTS

UNSEC N=219	OPEst DM1	OPEst DM3	PS
FAR	-0.14 (-1.41; 0.104)	-0.105 (-1.07; 0.098)	+
COR	0.04 (0.31; 0.138)	0.129 (0.92; 0.139)	-
TS	0.157 (1.12; 0.140)	0.229 (1.58; 0.145)	+
EfTx	0.365 (0.82; 0.445)	0.322 (0.72; 0.445)	+
%IO	0.0006 (0.15; 0.004)	0.0009 (0.22; 0.004)	-
D/A	-1.076*** (-3.17; 0.339)	-1.135*** (-3.20; 0.354)	-
Q	0.139 (1.39; 0.100)	0.081 (1.07; 0.104)	-
LNS	-0.122** (-2.18; 0.056)	-0.091 (-1.58; 0.057)	+
SR	-0.530* (-1.79; 0.295)	-0.403* (-1.74; 0.288)	+
Likelihd Ratio	42.2***	36.15***	
Success Rate	42.0 %	52.96 %	

Table 1*UNS*. MLE (t-value; S.E) and Measures of Fit.

II. CLASSIFICATORY ABILITY

UNS: DM1	1-7	8-12	13-17	18-21	22-27	28-40	Total
Observed	31	61	22	23	64	18	219
COR.Pred	3	38	0	0	51	0	92
SR:OPM	9.6 %	62.3 %	0 %	0 %	79.6 %	0 %	42 %
SR:PCM	14.1 %	27.8 %	10 %	10.5 %	29.2 %	8.2 %	21 %
test-statistic	7.63***						

Table 2*UNS*. Comparison of the Classificatory Ability of OPM and PCM.

UNS: DM3	1-7y	8-15y	16-25y	26-40y	Total
Observed	31	77	93	18	219
COR.Pred	3	35	78	0	116
SR:OPM	9.6%	45.4%	83.8%	0%	52.9%
SR:PCM	14.1%	35.1%	42.4%	8.2%	33%
test-statistic	6.26***				

Table 3*UNS*. Comparison of the Classificatory Ability of OPM and PCM.

Appendix 2: Industrials

I. Descriptive Analysis

IND N=195	Min	Max	Mean	Median	S.D
DM	3.00	30.00	18.00	20.00	7.96
FAR	-4.98	0.722	0.106	0.163	0.66
COV	-9092	14243	-84.4	-45.64	1698.1
COR	-0.96	0.94	-0.35	-0.57	0.55
TS	-0.08	2.36	1.58	1.50	0.62
EfTx	-0.86	1.02	0.37	0.40	0.17
%IO	0.10	75.00	19.29	12.00	18.44
CPr	-17.4	6.44	0.30	0.30	1.46
D/A	0.004	1.72	0.30	0.26	0.21
Q	0.20	6.71	1.37	1.07	1.00
LNS	3.24	11.62	6.93	6.82	1.59

Table 1*I*. Descriptive Statistics of The Numeric Proxy Variables.

IND: B&A *MEAN|MEDIAN*	*NB&NA*	MB	MA	Exp	Act
FAR	184, 11	18 | 20	19 | 20	B<A	B<A
COV	27, 168	16 | 12	18 | 20	B>A	b<a
COR	116, 79	19 | 20	17 | 15	B>A	B>A
TS	126, 69	17 | 16	19 | 20	B<A	B<A
EfTx	46, 149	16 | 15	19 | 20	B<A	B<A
%IO	67, 128	18 | 20	18 | 18	B>A	B>A
CPr	52, 143	15 | 15	19 | 20	B<A	B<A
D/A	154, 41	19 | 20	15 | 12	B>A	B>A
Q	76, 119	16 | 14	20 | 24	B>A	b<a
LNS	124, 71	19 | 20	16 | 12	B<A	b>a

Feature	*N*	Mnl Md	*Feature*	*N*	Mnl Md	*Feature*	*N*	Mnl Md
Convertible	81	22 | 25	Senior	29	12 | 10	Secured	13	27 | 30
Straight	114	15 | 10	Non-SR	166	19 | 20	Non-Sec	182	17 | 16

Table 2*I*.DM: Classification by Proxy, Expected & Actual Relationships.

IND:B&A	W Rk	Med 2-s
FAR	0.39	0.23
COV	-1.29	-1.40
COR	-1.94*	-2.12**
TS	1.56	0.29
EfTx	-1.70*	-1.48
%IO	0.60	0.55
CPr	-3.05***	-3.55***
D/A	-2.51**	-2.92***
Q	-3.45***	-3.25***
LNS	-2.31**	-2.06**

Panel A: Numeric Variables

Panel B: Features

CV vs. STR		SR vs. NSR		SEC vs. UNS	
W-test	5.29***	W-test	-4.55***	W-test	3.99***
Med.Diff	4.97***	Med.Diff	-4.14***	Med.Diff	3.78***

Table 3*I*. Wilcoxon Rank and Median 2-Sample Tests for B,A & Features.

IND 195 *Medl 2-s*	MA=7 n1=19, n2=176	MA=12 n1=72, n2=123	MA=20 n1=113, n2=82	MA=25 n1=173, n2=22
FAR	0.17, 0.16 I 0.26	0.15, 0.16 I -0.24	0.16, 0.16 I 0.35	0.17, 0.06 I -2.23**
COR	-0.54, -0.57 I 0.31	-0.53, -0.59 I 0.75	-0.48, -0.60 I -1.84*	-0.56, -0.68 I -1.27
COV	-97.4, -39.2 I -1.18	-53.9, -37.4 I -0.83	-39.2, -50.4 I -0.80	-39.3, -109 I -0.87
EfTx	0.42, 0.40 I 0.45	0.39, 0.41 I -1.28	0.40, 0.40 I -0.32	0.40, 0.41 I 0.68
TS	1.33, 1.50 I -0.86	1.41, 1.50 I -1.38	1.50, 1.50 I 0.29	1.82, 1.50 I 1.99**
%IO	6.7, 12.00 I -0.55	17.6, 10.0 I 1.86*	15.6, 9.50 I -2.18**	12.0, 6.50 I -1.17
D/A	0.31, 0.25 I 1.70*	0.31, 0.23 I 2.12**	0.31, 0.21 I -3.12***	0.28, 0.16 I -3.13***
CPr	0.22, 0.32 I -1.66*	0.22, 0.36 I -2.90***	0.23, 0.42 I 3.24***	0.26, 0.56 I 3.63***
Q	0.87, 1.08 I -1.66*	0.90, 1.22 I -4.08***	0.95, 1.25 I 3.82***	1.05, 1.28 I 1.83*
LNS	7.79, 6.72 I 2.19**	7.46, 6.52 I 3.31***	6.94, 6.62 I -1.09	6.64, 7.44 I 3.18***

Table 4*I*. Firm and Debt Characteristics Across Maturities.

II. PROBIT RESULTS

IND: N=195	OPEst1	OPEst3	SPEst7	PS
FAR	-0.217* (-1.93; 0.112)	-0.160 (-1.50; 0.107)	-0.018 (-0.07; 0.243)	+
COR	-0.007 (-0.05; 0.152)	0.092 (0.59; 0.156)	0.325 (1.12; 0.288)	-
TS	0.201 (1.22; 0.164)	0.303* (1.70; 0.178)	0.169 (0.72; 0.233)	+
EfTx	0.095 (0.19; 0.501)	0.050 (0.10; 0.489)	-0.015 (-0.02; 0.773)	+
%IO	-0.003 (-0.57; 0.005)	-0.0049 (-0.85; 0.005)	0.011 (1.39; 0.008)	-
D/A	-0.639 (-1.30; 0.490)	-0.632 (-1.26; 0.502)	-0.481 (-0.79; 0.605)	-
Q	0.151 (1.47; 0.322)	0.109 (0.99; 0.113)	0.124 (-0.57; 0.158)	-
LNS	-0.124** (-2.04; 0.060)	-0.095 (-1.50; 0.063)	-0.195** (-2.28;0.085)	+
SEC	1.719*** (5.39; 0.318)	1.58*** (5.07; 0.312)	0.122 (0.22; 0.552)	+
SR	-0.70** (-2.19; 0.322)	-0.69** (-2.12; 0.328)	-0.126 (-0.57; 0.379)	+
L Ratio:	63.15***	56.35***	13.99*	
Success Rate	46.15 %	61.02 %	90 %	

Table 5*I*. MLE (t-value; S.E) and Measures of Fit: Industrials.

III. CLASSIFICATORY ABILITY

IND: DM1	1-7	8-12	13-17	18-21	22-27	28-40	Total
Observed	19	53	22	20	59	22	195
COR.Pred	1	35	0	0	45	9	90
SR:OPM	5.2%	66%	0%	0%	76%	41%	46.1%
SR:PCM	9.7%	27.1%	11.2%	10.2%	30.2%	11.2%	21%
test-statistic	3.94***						

Table 6*I*. Comparison of the Classificatory Ability of OPM and PCM.

IND: DM3	1-7	8-15	16-25	26-40	Total
Observed	19	69	85	22	195
COR.Pred	1	39	70	9	119
SR:OPM	5.2%	56.5%	82.3%	41%	61%
SR:PCM	9.7%	35.3%	43.5%	11.2%	33.5%
test-statistic	4.7***				

Table 7*I*. Comparison of the Classificatory Ability of OPM and PCM.

Appendix 3: Regulated

I. Descriptive Analysis

REG N=73	Min	Max	Mean	Median	S.D
DM	1.00	40.00	19.00	25.00	11.21
FAR	0.01	0.91	0.58	0.67	0.28
COV	-3590	1158	-399.2	-180.0	750.0
COR	-0.96	0.85	-0.40	-0.58	0.51
TS	-0.08	2.36	1.64	1.50	0.71
EfTx	-0.37	0.53	0.33	0.36	0.13
%IO	0.1	85.00	7.24	0.10	19.24
CPr	0.01	0.66	0.17	0.13	0.13
D/A	0.09	0.94	0.42	0.39	0.15
Q	0.51	4.12	0.94	0.87	0.50
LNS	4.19	10.00	7.36	7.50	1.07

Table 1*R*. Descriptive Statistics of The Numeric Proxy Variables.

REG: B&A MEAN|MEDIAN	*NB&NA*	MB	MA	Exp	Act
FAR	31, 42	14 | 10	23 | 30	B<A	b<a
COV	22, 51	17 | 15	20 | 25	B>A	b<a
COR	47, 26	20 | 25	17 | 16	B>A	B>A
TS	40, 33	19 | 25	19 | 25	B<A	b=a
EfTx	30, 43	17 | 10	21 | 25	B<A	B<A
%IO	59, 14	20 | 25	17 | 20	B>A	B>A
CPr	45, 28	19 | 25	19 | 23	B<A	b>a
D/A	42, 31	21 | 30	16 | 11	B>A	B>A
Q	51, 22	19 | 25	18 | 23	B>A	B>A
LNS	33, 40	22 | 25	17 | 12	B<A	b>a

Feature	*N*	Mnl Md	*Feature*	*N*	Mnl Md	*Feature*	*N*	Mnl Md
Convertible	9	25 | 25	Senior	3	5 | 12	Secured	36	23 | 30
Straight	64	18 | 16	Non-SR	70	19 | 25	Non-Sec	37	15 | 10

Table 2*R*. DM: Classification by Proxy, Expected & Actual Relationships.

REG:B&A	W Rk	Med 2-s
FAR	-3.74***	-4.17***
COV	-0.87	-0.02
COR	-1.15	-1.32
TS	0.13	-0.26
EfTx	-1.25	-1.11
%IO	-1.34	-2.85***
CPr	-0.20	-0.24
D/A	-1.96**	-2.74***
Q	-1.07	-1.05
LNS	1.89*	1.15

Panel A: Numeric Variables

Panel B: Features

CV vs. STR		SR vs. NSR		SEC vs. UNS	
W-test	0.68	W-test	-0.55	W-test	3.84***
Med.Diff	-1.22	Med.Diff	-1.46	Med.Diff	4.82***

Table 3*R*. Wilcoxon Rank and Median 2-Sample Tests for B, A. & Features.

REG 73 Medl 2-s	MA=7 n1=16, n2=57	MA=12 n1=32, n2=41	MA=20 n1=35, n2=38	MA=25 n1=43, n2=30
FAR	0.22, 0.71 I -3.31***	0.56, 0.71 I -2.24**	0.54, 0.72 I -2.91***	0.76, 0.74 I 3.87***
COR	-0.16, -0.65 I 1.74*	-0.51, -0.65 I 1.03	-0.51, -0.66 I 1.27	-0.51, -0.66 I -1.32
COV	-117, -180 I 0.06	-212, -180 I -0.37	-171, -192 I 0.34	-133, -236 I -1.79*
EfTx	0.34, 0.43 I -0.50	0.31, 0.38 I -1.30	0.35, 0.37 I -0.58	0.36, 0.35 I 0.09
TS	1.33, 1.82 I -1.82*	1.50, 1.50 I 0.25	1.50, 1.50 I 0.08	1.50, 1.50 I -0.26
%IO	0.1, 0.1 I 0.17	0.1, 0.1 I -0.19	0.1, 0.1 I 0.74	0.1, 0.1 I -0.89
D/A	0.41, 0.39 I 0.06	0.42, 0.39 I 1.03	0.43, 0.39 I 1.27	0.43, 0.38 I -2.26**
CPr	0.12, 0.14 I -1.06	0.12, 0.14 I -0.36	0.13, 0.14 I -0.58	0.13, 0.14 I 1.04
Q	0.80, 0.88 I -1.06	0.83, 0.88 I -0.36	0.85, 0.88 I -0.58	0.88, 0.85 I -0.37
LNS	7.90, 7.37 I 1.74*	7.61, 7.21 I 1.03	7.62, 7.19 I 1.27	7.58, 7.21 I -0.84

Table 4*R*. Firm and Debt Characteristics Across Maturities: A Comparison.

II. PROBIT RESULTS

REG N=73	OPEst3	SPEst7	PS
FAR	1.409 (1.13; 1.244)	1.246 (0.97; 1.273)	+
COR	-0.557 (-1.07; 0.519)	-0.804 (-1.21; 0.663)	-
TS	-0.004 (-0.01; 0.366)	0.495 (1.19; 0.414)	+
EfTx	2.464 (1.30; 1.879)	1.25 (0.58; 2.147)	+
%IO	0.0215 (1.07; 0.020)	0.028 (1.52; 0.018)	-
D/A	-3.83 (-1.38; 2.778)	4.59* (-1.74; 2.63)	-
Q	-0.529 (-0.81; 0.656)	1.384 (0.78; 1.758)	-
LNS	-0.262 (-1.19; 0.220)	-0.380 (-1.37; 0.276)	+
SEC	0.981*** (2.91; 0.339)	0.930* (1.82; 0.510)	+
SR	-0.048 (-0.02; 3.139)	7.02 (0.04; 102.5)	+
Lklhd Ratio:	44.74***	35.38***	
Success Rate	50.68 %	84.9 %	

Table 5*R*. MLE (t-value; S.E) and Measures of Fit.

III. CLASSIFICATORY ABILITY

REG: DM3	1-7	8-15	16-25	26-40	Total
Observed	16	16	11	30	73
COR.Pred	8	1	0	28	37
SR:OPM	50%	6.2%	0%	93%	50.6%
SR:PCM	22%	22%	15%	41%	33.5%
test-statistic	1.79				

Table 6*R*. Comparison of the Classificatory Ability of OPM and PCM.

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