COSTS OF FINANCIAL DISTRESS AND CAPITAL STRUCTURE OF FIRMS

AYDIN OZKAN

Thesis presented for the degree of D.PHIL

UNIVERSITY OF YORK

DEPARTMENT OF ECONOMICS AND RELATED STUDIES

March 1996

CONTENTS

ACKNOWLEDGEMENTS

I wish to express my gratitude to Dr. Sandeep Bhargava for his supervision and encouragement during the preparation of this thesis. I am also grateful to Prof. Peter Simmons and Peter C. Smith for the helpful discussions and comments they have made on the various drafts of this study. I am also glad to acknowledge the advice and support of Prof. John Hey.

I am also indebted to Etibank for their generous financial support during my post-graduate studies.

I should also thank my parents for their patience. Their understanding and support have been invaluable.

Finally, many thanks to Gülçin, my wife, for her loving support during the preparation of this thesis. It would not be possible to complete this study without her help and support.

DECLARATION

A version of Chapter 4 was presented at the Young Economists session of the Money, Macro and Finance Group Annual Conference, September 1995, at Cardiff Business School. It has been selected to be published in *The Manchester School of Economic and Social Studies*, June 1996 Conference issue. A version of this chapter has also appeared as a discussion paper (Department of Economics Discussion Paper, No. 95/32, University of York, 1995).

A version of Chapter 5 was published in *The METU Studies in Development*, 1995, Vol.22, No.4, pp.425-439. It has also been circulated as a discussion paper. (Department of Economics Discussion Paper, No. 95/31, University of York, 1995).

Chapters 3 and 7 have been circulated as discussion papers (Department of Economics Discussion Paper, No. 96/26 and 96/27, University of York, 1996).

ABSTRACT

The main purpose of this study is to explore the interactions between costly financial distress and capital structure of firms. The topic of capital structure has been a subject of investigation in finance since the seminal studies of Modigliani and Miller (1958, 1963). Their second work implied that in a world with corporate taxes a firm's capital structure would consist of almost a 100 percent of debt. This extreme implication has led researchers to look for explanations to fill the gap between the M-M prediction and observed capital structure of firms. The topic of bankruptcy and financial distress gained a great deal of attention as a result of these attempts. However, there has not been a consensus neither on the role nor on their significance in the determination of a firm's capital structure. Therefore this thesis attempts to provide more insight into the understanding of the interaction between these costs and corporate financial policy. In order to explore this interaction this study focuses on two types of costs which are related to financial distress. First, there are costs that arise from distortionary incentives and conflicting interests of various agents of the firm. Second, there are also costs which are due to the decrease in the firm value in liquidation. This study argues that when there is asymmetric information between shareholders and bondholders about the true financial condition of the firm, shareholders may deviate from value maximising decisions in financial distress at the expense of bondholders. It is also shown that individualistic behaviour of creditors leads to premature and inefficient liquidations of firms which experience financial distress temporarily and have continuation values greater than their liquidation values. In deriving these implications liquidation costs and the impact of the firm's asset characteristics on these costs constitute the central elements of this study. This thesis also sheds light on the importance of firm size in the insolvency process. It is argued that small firms are more likely to be liquidated than large firms when they are in financial distress. The findings of the empirical analysis of this study are in line with this view. The empirical results of a UK company panel data analysis also reveal that profitability, growth opportunities and liquidity conditions of firms are important determinants of borrowing decisions of companies.

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

The purpose of this study is to extend the understanding of the interaction between costly financial distress and capital structure of firms. The topic of capital structure has been a subject of investigation in finance since the path breaking study of Modigliani and Miller (1958) who showed that, in perfect and frictionless capital markets, the valuation of firm is independent of its capital structure. Modigliani and Miller (1963) further argue that deductibility of interest payments from the firm's taxable income would lead to a *corner* solution of almost a 100 percent of debt finance. The corner-solution result is discussed and largely criticised in the finance literature in the light of several considerations. Modigliani and Miller's analysis, for example, ignores the costs which are associated with financial distress and bankruptcy, which reduce the total value of the firm. Financial economists thus suggested theories which incorporate these costs into the capital structure models to serve as a trade-off against the tax benefit of debt financing and hence fill the gap between the M-M prediction and observed capital structures of firms.[1] The common proposition of the studies which employ bankruptcy-related costs is that an optimal debt-equity ratio which maximises the value of the firm can exist resulting from the trade-off between the expected value of these costs and the tax savings associated with the deductibility of interest payments from taxable income. After these early studies the topic of bankruptcy costs gained extensive coverage in the academic literature and the financial press. In particular, researchers have attempted to explore in detail the potential costs of bankruptcy. Nevertheless, despite a great deal of work done on the existence of bankruptcy costs and their relevance in the determination of the firm's capital structure, there is no consensus yet on these issues.

[1]See, for example, Baxter (1967), Kraus and Litzenberger (1973), Scott (1976), Kim (1978).

One explanation for the lack of consensus might be the difficulties entailed in measuring all kinds of costs associated with the events of financial distress and bankruptcy. The difficulty becomes more obvious when attempting to measure the potential existence of what have come to be known as *indirect* costs of bankruptcy which are assumed to arise from the disruptions in the firm's relationships to its creditors, customers, and employees in the event of bankruptcy or financial distress. It should be noted that most of the studies on indirect costs have concentrated on what happens after the firm files for bankruptcy. These costs are thus *ex post* costs of bankruptcy. However, there are also costs that arise before the firm legally goes bankrupt, which might be called *ex ante* costs of bankruptcy. These costs are mostly due to the conflicting interests of various agents associated with the firm in financial distress. Despite the obvious difficulty in measuring these costs there is a need to further examine the existence and importance of these costs in determining the capital structure of the firm.

Another explanation for the lack of agreement on the issue of bankruptcy costs is the view that bankruptcy is often confused with liquidation (see, e.g., Haugen and Senbet (1978 and 1988)). It is argued that liquidation is a capital budgeting decision and the financial state of the firm is irrelevant for the decision. Therefore, liquidation costs can not be attributed as bankruptcy costs in determining an optimal capital structure. It is also argued that if the costs of the formal bankruptcy procedures are high, then the firm's creditors and equity holders have an interest in making an agreement outside of bankruptcy in order to avoid these costs. Thus, the relevant costs of bankruptcy is only the relatively low cost of agreeing to a restructuring, not the high cost of the formal procedures. According to this view, indirect costs of bankruptcy are immaterial to the theory of optimal

capital structure. However, it can be argued that there are several problems with the approach of Haugen and Senbet. First, there might be states under which liquidations and bankruptcy costs can not easily be separated. For example, creditors of a firm which is in financial distress can be prompted by the financial state of the firm to liquidate the firm prematurely, although they should not do so on efficiency grounds. Second, it is often difficult to reach an agreement where there are conflicting interests between the firm's different agents and a large number of participants. For example, Webb (1987a) shows that bargaining to avoid bankruptcy may break down when the parties involved have incomplete and asymmetric information regarding the continuation value of the firm. Similarly, Cutler and Summers (1988) provides a real-world example of high costs of bargaining breakdown. In a more recent work, Gilson, John and Long (1990) find that only about half of attempts by firms to rearrange their debt outside of a formal bankruptcy filing succeed. It can also be argued that expected liquidation costs might affect the decision of firms to default by increasing the renegotiation power of shareholders of firms in financial distress (see, e.g., Bergman and Callen (1991)).

As will be discussed later in this study, under certain circumstances firms can take advantage of high expected liquidation costs and achieve reducing their obligations to creditors. It is also shown that liquidation costs can affect the bankruptcy decision of creditors. All these arguments imply both that creditors are less willing to lend to firms with high liquidation costs and that firms with high costs of liquidation choose capital structures that make future financial distress less likely. The interaction between liquidation costs and the capital structure of firms should thus not be ignored. Exploring this issue in detail is one of the purposes of the present study. In addition, this study addresses three further aspects

of the interaction between costs of financial distress and the capital structure decisions of firms: (1) distortionary incentives and conflicting interests of different claimholders of financially distressed firms, which may lead to premature and inefficient liquidations by creditors, inefficient investment and bankruptcy decisions by firms; (2) the role of asset characteristics of firms in determining the capital structure of firms and the outcome of financial distress; and (3) the existence and relevance of indirect costs of bankruptcy. By addressing these issues this study attempts to show that costs of financial distress comprise not only the direct costs of bankruptcy but also the indirect costs which arise from interactions between different claimholders of firms which are in financial distress.

Before proceeding further several points concerning the terms used in this study should be made clear. First, *capital structure* of a firm means permanent financing represented basically by long term debt and shareholders' equity. It is slightly different from *financial structure* which includes short-term debt as well. Thus, a firm's capital structure is only a part of its financial structure. In this study *capital structure* is implied whenever we use the terms capital or financial structure. Second, bankruptcy describes a *legal failure* which is different from *economic failure*. Economic failure can be defined as the situation under which revenues of the firm do not cover its costs or the realized rate of return on invested capital is less than prevailing rates on similar investments. Economic failure may lead to legal failure, but not necessarily. Similarly, a firm can be *technically* bankrupt in the sense that it can not meet its current obligations, even though the value of its assets is greater than that of its total liabilities. Technical bankruptcy does not necessarily result in the collapse and liquidation of the firm. The words "bankruptcy" or "insolvency" will be used interchangeably to mean legal failure. This leads us to the third point. In the UK,

bankruptcy by a corporation is described as insolvency whereas bankruptcy is only used for individuals. In the US, on the other hand, bankruptcy is used both for individuals and corporations.

The remainder of this study proceeds as follows. Chapter 2 reviews the existing literature on the capital structure theory by focusing on those studies which are related to the costs of financial distress. Chapter 3 develops a framework to provide further insights into the understanding of the distortionary effects of costly bankruptcy on the investment decisions of financially distressed firms. In particular, by developing a dynamic game between shareholders and bondholders, it is shown that the shareholders of a financially distressed firm follow an inefficient investment strategy at the expense of the firm's bondholders when there is asymmetric information between shareholders and bondholders about the true financial condition of the firm. It is shown that when shareholders repeatedly make investment decisions and go to the debt market, incentives to take risky investment opportunities are curtailed whereas incentives to pass up some other investment opportunities which are unobservable by bondholders still prevail. This reduces the value which bondholders expect to get upon a liquidation. The model presented in this chapter adopts a different approach from the existing literature in modelling the adverse incentives of firms. This approach is in contrast to the existing literature which emphasizes the importance of risky debt financing in affecting the investment incentives of firms. In this chapter, however, investment decisions are distorted by the fact that liquidation costs are so high that shareholders of an insolvent firm expect to receive nothing upon bankruptcy. It is also argued that the asset characteristics of insolvent firms plays an important role. Inefficient investment decisions are more likely to be taken when firms have assets with high

liquidation costs.

Chapter 4 explores the role of reputation on the creditor's side and analyses the implications of reputation acquisition by banks for financially distressed firms. The objective of this chapter is to provide more insight into the incentives of banks toward borrowing firms which are in financial distress. It is argued that banks might in the long-run benefit from establishing reputation for being tough against financially distressed firms. This might give banks incentives to liquidate even those firms that experience temporary financial difficulties with greater continuation values than their liquidation values. Reputation acquisition provides incentives even for banks which have no immediate advantage from liquidating firms in financial distress. However, the short-term loss might be outweighed by the long-term gain by deterring other firms from defaulting in future. The analysis of this chapter allows us to examine the incentives of banks other than those discussed in the existing literature. It also sheds some light on the higher number of company liquidations among small-to-medium sized companies.

Chapter 5 discusses the incentives of the creditors of financially distressed firms and the role of insolvency procedures in creating these incentives. It establishes the relationship between insolvency procedures and premature/inefficient liquidations of financially distressed but efficient firms by developing a game-theoretic model. Doing so enables us to identify the determinants of an inefficient outcome. This chapter re-stresses the importance of the type of assets owned by distressed firms in the bankruptcy decision process. The analysis of this chapter is carried out by incorporating two UK insolvency procedures into the model: receivership and administration. It is argued that the nature of

these insolvency procedures gives incentives to the creditors of a firm in financial distress to choose receivership even when the administration is a more efficient option.

Chapter 6 develops a multi-period optimal capital structure model in order to examine the determinants of financial structure of firms. The analysis of this chapter incorporates bankruptcy and liquidation costs in conjunction with the tax deductible interest payments. Doing so yields a trade-off between these costs and tax savings of debt financing, which leads to an optimal capital structure. This chapter also incorporates non-debt tax shields, corporate tax rate, earnings variability and asset characteristics into the model and explores their influence on the capital structure of the firm. Again, asset characteristics of firms are shown to be crucial in determining the optimal capital structure of firms in the sense that firms with higher proportion of intangible assets which have high liquidation costs rely less on debt financing. The results of this chapter confirm the significance of liquidation costs as the determinant of the capital structure of the firm.

Most of the above arguments are put to test in chapter 7 which investigates the empirical determinants of financial leverage. The purpose of this chapter is to gain more insight into the determinants of capital structure since the existing empirical studies provide relatively little evidence. The empirical analysis is carried out by using a panel data set of UK firms. The econometric technique (Generalised Method of Moments) used in this chapter incorporates both cross-section and time-series features of variables predicted by this study. Panel data analysis provides more reliable results than the cross-sectional studies by providing a richer data set and controlling for unobservable firm-specific fixed effects. A partial adjustment model is utilised to capture the idea of the adjustment process involving

a lag when firms adjust to changes in their long-run target debt ratio. One important result of this analysis is that firms have long-term target leverage ratios and the speed of firms in adjusting to the target ratio is relatively fast.

Finally, in chapter 8 we bring together various themes developed in this study. In particular, the importance of the conflicting interests of different agents, asset characteristics of firms, and liquidation costs and indirect costs of financial distress in influencing the capital structure decisions of firms is re-stressed. We also point out avenues for further research.

CHAPTER 2

A SURVEY ON CAPITAL STRUCTURE THEORIES

2.1 Introduction

The question whether capital structures of firms really matter has involved a great deal of controversy in the finance literature. Since the seminal study of Modigliani and Miller (1958) who show the irrelevance of financial policy of firms, financial economics has made a significant progress in explaining why companies choose particular financing policies. Capital structure theories over the past three decades have expanded beyond the examination of the basic leverage decision to include many different aspects of corporate finance, namely; conflicts between different claimholders of firms, imperfect information, agency problems and the control of these problems, ownership and corporate control, and financial instruments and financial markets. However, there is no single theory which answers the question of why some firms borrow more than others. It is beyond the purpose of this chapter to give a detailed survey of all capital structure theories.[1] The main purpose of this chapter is to examine the main strands of the theory of capital structure which have its origin in the paper of Modigliani and Miller (1958). The capital structure analysis of Modigliani and Miller is, therefore, provided since all other discussions about capital structure of firms are based on their original analysis. Theoretical and empirical studies which deal with potential determinants of capital structure are also summarized in a table for ease of reference.

The remainder of this chapter is organised as follows. In Section 2.2 Modigliani and Miller's capital structure analysis including their correction for taxes is presented. In section 2.3 capital structure theories based on the trade-off between bankruptcy costs and tax

[1] A more extensive survey of capital structure theories is given by Harris and Raviv (1991). They survey capital structure theories based on agency costs, asymmetric information, product/input markets interactions, and control considerations. However, their survey excludes tax-based theories and covers the studies up to 1991.

savings are reviewed. Section 2.4 examines the effects of personal as well as corporate taxation. In section 2.5 studies on agency costs are surveyed. Section 2.6 explores the literature on the role of asymmetric information and signalling opportunities in determining the capital structure of firms. The choice between different sources of finance (private and public debt) is reviewed in section 2.7. Finally, section 2.8 provides an overall assessment of the capital structure literature surveyed in this chapter. Table 2.1, at the end of the chapter, lists main studies related to the capital structure of firms. More specifically, it summarizes the main predictions of the theories, gives the main emphasis of the theory and examines if there is any supporting empirical evidence.

2.2 Modigliani and Miller Analysis

In seeking to summarize the theory and practice in the capital structure area one must start with the Modigliani and Miller (M-M) analysis since all subsequent studies have been related to their work. Assumptions of the M-M approach are as follows: capital markets are complete and frictionless; individuals can borrow and lend at the risk free rate as firms; there are no costs to bankruptcy; firms issue only two types of claims, risk-free debt and risky equity; all firms are assumed to be in the same risk class; corporate outsiders and insiders have the same information (i.e., no signalling opportunities); managers always maximize shareholders' wealth (i.e., no agency cost); there are no wealth taxes on corporations and no personal taxes; and investment decisions are given. Under these assumptions their Proposition I implies that corporate financial policy is irrelevant and has no effect on the value of the firm and on its costs of capital. In a world of zero taxes, the value of such a firm would be given by capitalizing its expected net operating income at the rate appropriate to the firm's risk class. Thus, operating and financing decisions of the firm are two distinct

stages where the value of the firm relies on the operating decisions which determine the stream of future net operating income and the financing decisions depend upon the investors' preferences. The principle behind the M-M view is that, in perfect capital markets, individuals can duplicate the firms' capital structures by issuing personal debts at the same rate at which firms operate, and combining them with the purchase of shares in an unlevered firm, thus achieving *homemade leverage*. Therefore, individual investors will be unwilling to pay a premium for levered companies' shares. If two firms in the same risk class are different only in the way they finance their investments and in their total market values, then arbitrage opportunities emerge and holders of the higher-priced company's shares sell their holdings, and buy the same amount of the other firm's stock to make a capital gain and this process will continue until the two firms have the same market value.

M-M's Proposition II specifies the relationship which must exist between the cost of equity and capital structure, which can be expressed by the following equation

$$k_e = k_u + (k_u - k_d)\frac{D}{E} \tag{2.1}$$

where k_e, k_u and k_d are the cost of equity of a levered firm, the cost of capital for an unlevered firm and the cost of debt respectively. D and E denote debt and equity. Equation (2.1) reveals that the cost of equity is equal to the cost of capital of an unlevered firm plus the difference between the cost of capital of an unlevered firm and the cost of debt, weighted by the debt-equity ratio. The last term can be interpreted as the risk adjustment which is required by equityholders, which directly increases with the amount of debt. This is because increasing financial leverage implies a riskier position for shareholders as their residual claim

on the firm becomes more variable. They require a higher rate of return to compensate them for the extra risk they take. The important implication of this analysis is that any attempt to raise the firm's value by issuing debt will be exactly offset by an increase in the cost of capital. With constant interest rate on debt, the required return on equity by its holders will increase linearly by an amount just sufficient to keep the Weighted Average Cost of Capital (*WACC*) constant. Consequently, the firm's value remains unchanged irrespective of the debt-equity ratio.

In their original paper M-M did not incorporate interest tax shields into their model although they recognise it. In their 1963 "correction", however, M-M suggest that the market values of firms in each risk class are also a function of the tax rate and the degree of leverage. Since the corporation tax is based on income after deduction of interest payments on debt but before dividend payments two identical companies with respect to their cash flows pay different amount of tax if their capital structures are different. That is, a company with debt will have more post-tax income than an unlevered company. In the special case of permanent debt the implication of their "corrected" theory can be derived from the following equation

$$V_L = V_U + T_c D \tag{2.2}$$

where V_L is the value of a levered firm, V_U is the value of an unlevered firm (all equity financed firm), T_c is the corporate tax rate, D is the amount of borrowing, and T_cD denotes the present value of the tax shield of the levered firm. Equation (2.2) states that the value of a levered firm will be greater than that of an unlevered one by the amount of debt multiplied by the corporate tax rate as a result of the tax subsidy due to tax the deductibility

of interest payments on debt.

Like the Proposition I, Proposition II can be restated by the inclusion of corporate tax. Cost of capital takes the form of

$$k_e = k_u + (1-T_c)(k_u - k_d)\frac{D}{E} \tag{2.3}$$

where all variables are as defined earlier. This states that the cost of equity is equal to the cost of capital of an unlevered firm plus the after tax difference between the unlevered firm's cost of capital and the cost of debt, multiplied by the leverage ratio. It differs from Equation (2.1) in that an increase in the amount of debt causes less proportionate increase in the return demanded by shareholders. The most important implication of M-M's correction is that *WACC* declines as the debt-equity ratio rises. This leads to M-M's "extreme" policy implication of 100 percent debt in the capital structure. After M-M's tax correction model academics and practitioners have concentrated on why firms do not have 100 percent debt financing but a mix of debt and equity. Although their "corrected" version of capital structure theory does not shed light on firms' real behaviour, the trade-off between bankruptcy costs and tax savings as the primary determinant of corporate capital structure has gained considerable support since then. What follows is a review of the main studies which explore the trade-off between bankruptcy costs and tax savings of debt financing.

2.3 Bankruptcy Costs and Tax Savings

It has been demonstrated that M-M's argument of capital structure irrelevancy is intact even in the presence of a positive probability of *costless* bankruptcy. Stiglitz (1969), for example,

uses a general equilibrium state-preference model to show that the M-M theorem still holds under more general conditions than those assumed in their original study. Specifically, the validity of the M-M theorem does not depend on the existence of risk classes, on the competitiveness of capital markets, or on the homogeneous expectations of investors. Stiglitz argues that bankruptcy presents problems on two accounts. First, with the probability of bankruptcy, the nominal rate of interest which the firm must pay on its bonds will increase as the number of bonds increases whereas the M-M analysis assumes it increases at exactly the same rate for all firms and individuals. Second, if a firm goes bankrupt, individuals can no longer replicate the exact patterns of returns, except if they can buy on the margin, using the security as collateral; and if they default, they only lose the security and none of their assets. Also, in another paper, Stiglitz (1974) establishes that the value of the firm must be independent of capital structure so long as a costless financial intermediary can be established to maintain the opportunity set facing individual investors. Under this framework, Stiglitz indicates that the probability of *costless* bankruptcy does not affect the value of the firm.

One reason why M-M's capital structure analysis may seem to be in conflict with real business life is the absence of bankruptcy costs in their model. As discussed above, as long as bankruptcy costs are zero risky debt has no effect on the value of the firm and the value of the firm is equal to the value of the discounted cash flows from investment. The division of these cash flows between risky debt and risky equity does not matter. However, when bankruptcy costs are introduced this is no longer true. Costs associated with bankruptcy may take different forms. First, there are direct (out-of-pocket) costs which include legal, administrative, and advisory fees paid by the firm. Second, there are indirect bankruptcy

costs which arise because financial distress affects the company's ability to conduct its business. For example, financial distress can reduce the firm's sales or increase its production costs. These costs results in the value of the firm in financial distress (or in bankruptcy) being less than the expected cash flows from operations. That is, equation (2.2) becomes

$$V_L = V_U + T_c D - BC \tag{2.4}$$

where BC is the present value of the costs of financial distress which depends on the probability of distress and the magnitude of these costs if financial distress occurs.

It might be helpful at this point to distinguish between business and financial risks and to explain how they affect the cost of capital. Risk associated with the market value of the firm's assets arises from two different sources: *business risk* and *financial risk.* Business risk refers to the variability and uncertainty of operating earnings before interest and tax (EBIT). It is due to the nature of the industry in which the firm operates and depends on factors such as the variability of sales, selling costs and selling prices, and the existence of market power. Although the existence of business risk is essential to the capital structure decisions, this type of risk exists irrespective of the extent to which firms rely on debt financing. However, financial risk is the result of financial leverage which, since it is a fixed cost source of funds, increases the variability of earnings per share (EPS) and the probability of bankruptcy. And bankruptcy may occur when a firm is unable to meet its contractual financial obligations, which must be met irrespective of its earnings level, as they come due. Another important implication of this analysis is that the relationship between the probability of bankruptcy and leverage may not be linear. When the level of leverage

is low, an increase in the reliance on debt financing may not exert a significant effect on the likelihood of bankruptcy. However, the probability of bankruptcy starts to rise at an increasing rate as leverage increases beyond some threshold. Hence, the expected bankruptcy costs increase, which have a negative effect both on the value of the firm and the cost of capital. These effects result in a "U-shaped" *WACC* curve and an optimal capital structure where the optimal leverage is attained when WACC is minimized. This optimal leverage ratio maximises the value of the firm and equates the marginal gain from leverage to the marginal expected loss from bankruptcy costs.

Baxter (1967) is one of the first to examine the possibility of a U-shaped *WACC* curve. He argues that a high degree of financial leverage increases the probability of bankruptcy and therefore increases the riskiness of the overall earning stream. This is tantamount to relaxing the assumption of the anticipated stream of operating earnings being independent of the firm's capital structure. It is argued that the tax advantage is likely to dominate at lower levels of debt in the presence of bankruptcy cost. However, as leverage increases the expected costs of bankruptcy become more important. Therefore when the level of leverage is low the interest rate on borrowing will rise very slowly, if at all, with leverage, but it may begin to increase very sharply as the capital structure becomes more risky with the increasing reliance on debt. The paper also predicts that firms with relatively low variance of net operating earnings may find it desirable to rely more on debt financing since they are less subject to the possibility of bankruptcy. Firms with risky income streams, on the other hand, may find that the cost of capital begins to increase sharply with leverage even when the level of leverage is moderate. Thus, it is concluded that when the restrictive assumptions of M-M are relaxed the traditional cost of capital curve is obtained, declining

at low levels of leverage but rising when leverage becomes substantial.

Since Baxter's paper more sophisticated treatments have been offered by Kraus and Litzenberger (1973), Scott (1976), and Kim (1978). These authors claim that an optimal debt-equity ratio can exist resulting from a trade-off between the expected value of bankruptcy costs and the tax savings arising from the deductibility of interest payments. Essentially, the optimal debt-equity ratio is reached when the present value of the tax subsidy is just offset by the present value of the expected bankruptcy costs.

Kraus and Litzenberger (1973) provide a state preference model with wealth taxes and bankruptcy costs. In their model the firm's financing mix determines the states in which the firm will earn its debt obligation and receive the tax savings attributable to debt financing. It also determines the states in which the firm is insolvent and incurs bankruptcy costs. Hence, the problem of optimal capital structure is formulated as the determination of debt level such that the resulting division of states yields the maximum market value of the firm. It is shown that in complete and perfect capital markets the value of the firm is independent of its capital structure. However, the taxation of corporate profits and the existence of bankruptcy costs are market imperfections that are central to a positive theory of leverage on the firm's market value. It is demonstrated that the value of the firm increases with the use of debt up to the point at which a further debt rise leads to a shift from one state in which the firm would be solvent to another one in which it would face bankruptcy. At that point the market value of the firm decreases because of bankruptcy penalties.

Another optimal capital structure model is presented by Scott (1976) who shows

that, if investors are indifferent to risk, imperfect markets for physical assets imply the existence of an optimal capital structure. His model is based on the view that the value of the non-bankrupt firm is a function not only of expected future earnings but also of the liquidating value of its assets. It is shown that the optimal level of debt is an increasing function of the liquidation value of the firm's assets, the corporate tax rate, and the size of the firm. We will return to this model in chapter 6 where we develop our corporate capital structure model by modifying some of Scott's assumptions.

Kim (1978) distinguishes between debt capacity and optimal capital structure. He argues that other studies fail to recognize that debt capacity, the maximum amount of borrowing allowed by the capital market is reached well before the point of 100 percent debt financing. He claims that if debt capacity is attained first, then the optimal level of debt would not be obtainable and the question of an optimal capital structure would be irrelevant. It is when the optimal amount of debt is strictly less than the debt capacity that firms must search for the optimal trade-off between the tax savings of debt and the expected bankruptcy costs. He shows that optimal capital structure involves less debt financing than the debt capacity, and hence firms will search for optimal capital structures rather than simply maximize their borrowing. He shows that the firm's value is a strictly concave function of its end-of-period debt obligation with a unique global maximum, and the maximum is reached before debt capacity. This is essentially the same as the traditionalist's view on the relationship between the value of the firm and financial leverage.

Haugen and Senbet (1978) challenge the trade-off theory by arguing from a theoretical standpoint that bankruptcy costs related to capital structure decisions can not be

of sufficient magnitude to offset the tax advantage of debt. They consider a market in which there are a large number of participants (buyers, sellers, and issuers of financial securities) who are *rational* and *price-takers*. They argue that the costs associated with liquidating the assets of an unprofitable firm conceptually differ from the costs of changing its capital structure and these costs are unrelated to capital structure. Liquidation is a capital budgeting decision that should be considered independently from the event of bankruptcy which is merely a transfer of ownership from stockholders to creditors. Thus, even if these costs are shown to be significantly high, they can not be used to support the contemporary view which reconciles modern financial theory with observed firm behaviour. Also, the rational participants have an interest in making agreement outside of bankruptcy in order to avoid the costs of a formal bankruptcy procedure. Therefore, any costs associated with bankruptcy must be limited to the lesser of a) the costs of a formal bankruptcy filing and b) the costs of avoiding the transfer of ownership entirely. The latter is given by the transaction costs in selling new shares (at a fair market price) and using the proceeds to repurchase (at a fair market price) all fixed claims on the firm's assets. Also, in a more recent paper Haugen and Senbet (1988) discuss that the firm will not be liquidated on a basis of a rule other than that which maximizes the total value of all claimants. Otherwise arbitrage profits would arise and informal reorganization will force the management to follow an optimal rule for all existing security holders.

As can be seen from the above analysis that capital structure theories which are based on the trade-off between the tax advantage of debt financing and the costs of bankruptcy, implicitly or explicitly, assume that the magnitude of bankruptcy costs are significant enough to be effective in the determination of an optimal capital structure.

However, there has been a great deal of discussion about their magnitude. One important empirical study is provided by Warner (1977). In a study of 11 US railroad bankruptcies which occurred between 1933 and 1955, he finds that the direct administrative costs of bankruptcy averaged only 5.3 percent of the value of the firm. Moreover, he observes that there appears to be a "scale" effect in the bankruptcy costs data such that these costs are a concave function of the market value of the firm. Whilst the ratio of bankruptcy costs is 9.1 percent for the smallest firm in the sample it is only 1.7 percent for the largest one. He concludes that direct bankruptcy costs may not be sufficiently large to determine a firm's optimal financial leverage. However, Warner's evidence is inconclusive for two reasons. First, he measures only direct costs of bankruptcy, such as legal expenses and other professional fees. He does not consider indirect bankruptcy costs to creditors such as losses in asset value due to forced capital structure changes, or indirect costs to equityholders such as lost sales and profits on anticipation of bankruptcy or from disruptions in production during reorganization. Warner recognizes that some of the omitted indirect costs may be substantial. Second, his analysis may not be valid for medium or small firms since he considered railroad companies which are relatively large firms.

Ang, Chua and McConnell (1982) also examine the direct administrative costs of bankruptcy for a randomly selected sample of 55 US corporations that filed bankruptcy petitions between 1963 and 1978 and were liquidated at the end of the bankruptcy process. They find that the mean ratio of administrative bankruptcy costs (out-of-pocket costs) to the liquidation value of the business is 7.5 percent. Their findings also support the hypothesis of Warner's scale effect. They argue that if one takes the view that the only source of bankruptcy costs are the administrative costs of bankruptcy then their results

appear to be insufficient to explain observed capital structures together with the tax advantage of debt. On the other hand, if one accepts the opposite view that these costs are only a fraction of total bankruptcy costs then the findings are significant to shed light on what the actual bankruptcy costs would be.

Another empirical study is given by Altman (1984) who explores indirect bankruptcy costs. His study provides an estimate (for a sample of 19 firms that went bankrupt) to compare expected and actual profits. He based the measure of indirect bankruptcy costs on the foregone sales and profit. He estimates expected profits for the period up to three years prior to bankruptcy and compares these with actual profits to determine the amount of bankruptcy costs. Clearly, he takes the unanticipated profits or losses as a measure of bankruptcy costs. According to his analysis, the average indirect bankruptcy costs were 8.1 percent of the firm value three years prior to bankruptcy and 10.5 percent in the year of bankruptcy. Despite the difficulty associated with measuring indirect bankruptcy costs his analysis suggests that bankruptcy costs are sufficiently large to lend support to the theory of optimal capital structure based on bankruptcy costs.

White (1983 and 1989) studies both direct and indirect costs of bankruptcy. She proposes two different methods to measure bankruptcy costs. White (1983) argues that the amount of debt forgiveness during the restructuring of the firm's debts in bankruptcy is an upper bound on the level of indirect bankruptcy costs. These deadweight costs are assumed to be in addition to the direct bankruptcy costs. Using this approach, it is shown that bankruptcy costs are bounded from above at around 0.3 percent of gross national product (GNP) in 1980. It is argued that total deadweight costs of bankruptcy could be as high as

11 times the level of direct bankruptcy costs alone. White (1989), on the other hand, attempts to measure bankruptcy costs by using the risk premium on corporate bonds. It is argued that the spread between interest rates on low risk and high risk corporate bonds which have the same term should measure investors' expectations of the probability of being repaid less than the contractual amount, converted to an even level over the term of the bond. It is estimated that investors in publicly traded bonds of American corporations expected to lose about 0.5 percent of GNP during the period 1980-1985. It is concluded from these studies that bankruptcy costs are higher than has previously been thought.

Weiss (1990) also presents evidence on the direct costs of bankruptcy. He finds that, in a sample of 37 firms which filed for bankruptcy between 1979 and 1986, directs costs average 3. 1 percent of the book value of debt plus the market value of equity at the end of the fiscal year preceding bankruptcy. His study does not support the scale effect of Warner (1977). Although the direct costs are highly correlated with total assets, the ratio of these costs to total assets does not decline as the size of the firm increases. Weiss (1990) argues that the difference between the findings of the two studies may be explained by the changes in the bankruptcy code, new financing techniques, and differences in samples.

2.4 Personal and Corporate Taxation

In response to the studies which give much importance to the trade-off between costs of bankruptcy and tax savings of debt Miller (1977) developed a model in which personal taxes are considered as well as corporate tax. In that paper he attempts to show that even with fully deductible interests in computing corporate income taxes, the value of the firm will be independent of its capital structure. When personal income tax is considered along with the

corporate income tax, the value of the levered firm takes the form of

$$V_L = V_u + [1 - \frac{(1-T_c)(1-T_{ps})}{(1-T_{pb})}]B_L \qquad (2.5)$$

where T_{ps} and T_{pb} are respectively the personal income tax rates on income from common stock and bonds, and B_L is the market value of the levered firm's debt. The second part of the RHS of this equation reveals the *gain* from leverage, G_L, for the stockholders in a firm holding real assets. It is clear that when all taxes are equal to zero, the gain from leverage vanishes and the result is the same as the M-M no tax result of $G_L=0$. And when T_{ps} and T_{pb} are equal the gain from leverage is the familiar T_cB_L. But when T_{ps} is less than T_{pb} then the gain from leverage will be less than T_cB_L. In fact, for a wide range of values for T_c, T_{ps}, and T_{pb} there is a possibility that the gain from leverage can vanish entirely or even turn negative. This is explained as the following; investors hold securities because they generate "consumption possibilities." Therefore, they evaluate the yields of these securities net of all tax drains. If, therefore, T_{ps} is less than T_{pb} then the before-tax return on bonds must be high enough to eliminate this disadvantage. Otherwise, no taxable investor would want to invest in bonds. And when $(1-T_{pb}) = (1-T_c)(1-T_{ps})$ is satisfied then the owners of the levered firm has no advantage from using tax deductible debt. There are two important implications of Miller's tax analysis. First, the gain from leverage may be much smaller than previously thought. Consequently, optimal capital structure may be explained by a trade-off between a small gain from leverage and relatively small costs such as expected bankruptcy costs. Second, there is an equilibrium amount of debt outstanding in the economy determined by corporate and personal taxes.

Despite the important implications the model has also several shortcomings. First of all, it is based on a strong assumption that all firms have to face the same marginal tax rate, which can easily be disputed. The extensive use of depreciation and investment credits shows that many firms face, in fact, lower tax rates. DeAngelo and Masulis (1980) extend Miller's tax analysis by focusing on these kinds of non-debt tax shields. Their model predicts that with positive corporate non-debt tax shields which substitute for debt, Miller's conclusion of firm level leverage irrelevancy does not hold any more. In the model, investors who have personal tax rates lower than the marginal individual receive a positive gain (consumer surplus) because they have higher after tax returns. Similarly, corporations with higher tax rates than the marginal firm earn a producer surplus, in equilibrium, since they pay a low pre-tax debt rate. They argue that relative market prices will adjust in equilibrium until each firm has a unique interior optimum leverage decision. This occurs because there *is a constant expected marginal personal tax disadvantage to debt and the* expected marginal corporate tax advantage decreases, as leverage rises, because of the tax shield substitutes for debt. Then, the unique optimum is achieved where the expected marginal corporate tax benefit is equal to the expected marginal personal tax disadvantage of debt. It is, therefore, clear that companies will select a level of debt which is negatively related to the level of available tax shields substitutes for debt. If these tax shields are high then the firm will have a low marginal effective tax rate and hence will supply a small amount of debt.

The second shortcoming of the Miller's analysis is that it is not capable of explaining cross-sectional variations in debt ratios. In his model only market equilibrium can be identified. This equilibrium quantity of debt gives the total amount of debt supplied by all

companies. The determinants of the debt levels of individual firms are not identified.

2.5 Agency Costs

Agency costs were introduced into the corporate finance theory by the seminal paper of Jensen and Meckling (1976). Since then researchers have paid a considerable attention to agency costs which arise as a result of the conflicts of interest between different agents of the firm. The main approach introduced by Jensen and Meckling (1976) is that of explaining behaviour of firms with regard to financial policies which minimise agency costs. They point out two types of conflicts.

The first type of conflicts arises between managers and equityholders because managers hold less than 100 percent of the residual claim. Consequently, while managers bear the entire cost of the firm's activities they do not have the entire gain from these profit enhancement activities. Managers, therefore, can transfer the firm's resources to their own interests by consuming *perquisites*. As a result they may over-indulge in these sort of activities rather than those which would maximize the value of the firm. It is argued by Jensen and Meckling (1976) that if the manager's investment in the firm is held constant, a rise in the fraction of the firm financed by debt raises the manager's share of equity and hence reduces the loss from conflicts between equityholders and managers. Moreover, as a result of debt which firm is committed to pay managers have less cash to spend on pursuits, which constitutes the benefit of debt.

The second type of conflict arises between shareholders and debtholders because debt contract gives equityholders an incentive to invest suboptimally. To put it differently,

the structure of debt contract is such that if an investment yields large returns this gain is captured by equityholders. If, however, the investment fails, because of limited liability of equityholders, only debtholders bear the consequences. While owners benefit from the upside gains from high risk investments they do not bear the costs of downside losses. As a result equityholders can invest in very risk projects, even if they have negative net present value. Then such investments result in a decrease in the value of the debt. This may mean that prospective lenders insist on (expensive) legal safeguards to protect them. One way in which this can be done is to use protective covenants to monitor the action of stockholders. Costs involved in monitoring are one type of agency costs. These costs are likely to be born by equityholders in terms of higher interest rates asked by creditors. That is, the higher the anticipation of monitoring costs by creditors, the higher the interest rate, and, *ceteris paribus,* the lower the value of the firm to shareholders. Therefore, shareholders will have an incentive to minimise monitoring costs which are likely to increase as leverage increases.

A somewhat related to Jensen and Meckling's agency costs argument is the underinvestment analysis of Myers (1977) who argues that in the presence of risky debt firms will not follow strictly the value-maximizing investment decision rule. He recognizes the underinvestment problem by noting that shareholders may fail to exercise the investment option when the expected return on investment is less than the promised payment to bondholders. By preventing an optimal investment policy, in turn, risky debt reduces the present value of the firm. Such a loss due to the suboptimal investment policy is regarded as a particular type of the agency cost related to the corporate leverage. His main prediction is that the level of corporate borrowing is related to the proportion of the market value accounted by growth opportunities. He defines discretionary investments as maintenance

of plant and equipment, advertising or other marketing expenses, or expenditures on raw materials, labour, research and development etc. All variable costs are discretionary investments. Thus, the theory predicts that the amount of debt issued by the firm should be set equal to V_D^* which maximizes the market value of the firm. It has no direct relationship to the probability of default. It is, however, inversely related to the part of the firm value that is contingent on discretionary future expenditure by the firm.

Jensen (1986) also presents an agency costs model which is based on conflicts of interest between shareholders and managers. It is argued that debt financing reduces the agency costs of free cash flow which is available for spending by managers. This is one of the benefits of debt financing. Another benefit of debt is that, by increasing the probability of bankruptcy, debt issue acts as a motivating force for managers to make their firms more efficient. However, increased leverage also involves costs such as costs of bankruptcy. Therefore, Jensen argues that, the optimal leverage ratio is attained where the marginal costs of leverage just offset the marginal benefits. The theory predicts that the controlling function of debt becomes crucial for firms whose activities operate large cash flows but have low growth prospects. Thus, such firms are expected to resort to more debt financing.

Ofek (1993) argues that highly-leveraged firms are more likely to respond operationally (such as restructuring assets and laying off employees when performance deteriorates) and financially (through dividend cuts, debt restructuring and bankruptcy) to financial distress than less-leveraged firms. This argument suggests that a choice of high leverage during normal operations subjects the firm to the discipline provided by debt financing and prevents the firm's going-concern value to substantially decline during the

financial distress.

Harris and Raviv (1990) also provide a capital structure theory which is based on the conflicts between equityholders and managers. They argue that managers do not always act in the best interests of their investors. Debt may serve to discipline managers by giving creditors the option to force the firm into liquidation and generating information which can be used by investors when implementing major operating policy changes such as liquidation of the firm's assets or reorganisation of the financial structure. The idea behind their capital structure theory is as follows. Since managers are unwilling both to liquidate the firm and provide information to investors which lead to liquidation, investors use debt to generate information and monitor management. One source of information is the ability of the firm to make payments. The other source is costly investigation in the event of default. In the model, the optimal leverage is determined by the trade-off between the value of information and opportunities for disciplining management (improved liquidation decisions) and the probability of incurring costs of investigation.

Implications of agency costs analysis can be summarised as follows. First, bond contracts are expected to have some restrictions such as prohibitions against investment in new and unrelated lines of business and prohibition of borrowing above a certain amount. Second, industries for which agency problems are more limited and which are relatively easier to monitor are expected to have higher debt levels *ceteris paribus*. That is, regulated public utilities, banks and firms in mature industries with small growth opportunities will have a higher debt-equity ratio. Third, firms which have large amounts of cash flows should have more debt. The same is true for the firms for which slow growth rate is optimal. This

is because increases in debt reduces free cash available and increases the proportion of manager's residual claim.

2.6 Asymmetric Information and Signalling Approach

The introduction of asymmetric information into the theory of capital structure has made it possible to explain many important features of corporate finance. Theories which utilise asymmetric information are based on the idea that insiders of the firm (managers or shareholders) have private information about the certain characteristics of the firm which outside investors do not have. In the following, some of the most influential studies in this area are reviewed.

Under the assumption that market prices do not really reflect full information, changes in capital structure of firms can be used as a signalling device to convey information to the market (investors). A substantial literature has developed to examine the impacts of information asymmetries on financial policy. Ross (1977) first applied signalling to finance theory by emphasizing managerial incentives in the presence of informational asymmetries. He argues that the implicit assumption of the M-M irrelevance proposition that the market knows the random return stream of the firm raises the possibility that changes in the financial market can alter the market's perception. That is, in the terminology of M-M, by changing its financial structure the firm alters its *perceived* risk class, even though its actual risk class remains unchanged. In the model, managers have the true information about the firm's expected cash flows. It is assumed that investors take larger debt levels as a signal of higher quality. Ross's model suggests that managers might use financial leverage to send unambiguous signals to the investors about the true performance of the firm. That is,

leverage may signal target levels of earnings which firms expect to attain. Issuing debt in his model is a signal of high quality because the firm exposes itself to the costs of bankruptcy and financial decision.

Leland and Pyle (1977) provide a capital structure model in which entrepreneurs seek to finance projects where the qualities of these projects are private information only to entrepreneurs. In the model, it is shown that the willingness of entrepreneurs to invest can serve as a signal to the lending market of project quality and lenders value the project on the basis of information transferred by the signal. It is demonstrated that the value of the firm increases with the share of the firm held by the entrepreneur and the capital structure and value of the firm are related even when there are no taxes. More importantly, it is shown that, firms with projects having riskier returns will have lower debt levels even when there are no costs of bankruptcy.

Myers and Majiluf (1984) also present a signalling model in which a firm must issue common stock to raise cash to undertake a valuable investment opportunity. It is assumed that managers have better knowledge about the future value of the firm and the projects which might be undertaken and they act in the interests of the existing shareholders. In the model, issuing new shares is seen as bad news by the market because shareholders have incentive to do so when the firm is overvalued. The implication of this argument is that original shareholders cannot take advantage of their superior information since issuing new shares will reveal their information to the market. Since investors are perfectly informed about the quality of firms, high-quality firms might suffer in value of their existing shares when they issue new equity. If this loss is sufficiently high, they might pass-up the valuable

investment opportunity. Myers and Majiluf's analysis suggests that internally generated funds are preferred to external funds. They point out that when the firm uses its internal sources to finance the projects with positive NPVs, then all projects are undertaken since there will be no new equity issued to finance these projects and hence the problem arising from asymmetric information is resolved. They also argue that external debt finance will be preferred to external equity since debt, at modest levels of borrowing, has payoffs which have less correlated with future states of the world than equity.

The above argument suggests a "pecking order" of corporate finance explored by Myers (1984) in detail. Myers argues that if finance is required firms prefer internal finance (retention finance) to external finance. This is because firms try to avoid facing the dilemma of either passing valuable investment opportunities or issuing equity at a price they think is too low. If external finance is required, however, firms issue the safest security first. That is, debt comes first as the safest security, then hybrid securities such as convertible bonds, and then equity as a last resort. In his model, there is no optimal debt-equity ratio, since there are two different kinds of equity, internal and external. Whereas the former is at the top of the pecking order, the latter is at the bottom. He argues that each firm's observed debt ratio is the cumulative requirement for external finance, where this requirement accumulates over an extended period.

2.7 Sources of Finance and Bargaining-based Theories of Capital Structure

Although the models discussed above explain many features of corporate finance, they do not explain one important aspect of it: the choice between intermediated bank finance and market sources of finance, in particular bonds. This feature of corporate finance has

recently been addressed by several authors.

Berlin and Loeys (1988) study a model of a firm's choice between bank loans (loan contracts enforced by a monitoring specialist) and bonds (loan contracts with covenants but no monitor), in which the choice is driven by the trade-off between the losses arising from inefficient liquidations of firms under bond contracts and the agency costs of hiring a delegated monitor. The critical assumption of the model is that bondholders have inadequate incentives to monitor on their own.

Diamond (1991) also analyses the choice between bank loans and publicly traded loans. The model argues that borrowers establish reputation by repaying loans from a bank that monitors to alleviate moral hazard in the initial period and then issue publicly traded loans by using their good track record from the monitored borrowing. That is, they initially rely on bank finance but subsequently they can go to bond markets. The model implies that this is particularly relevant to small and new firms that have no established reputation. Despite the generally accepted view that banks reduce costs associated with lending to small and medium firms, many such firms in practice diversify away from bank financing.

Rajan (1992) argues that this may occur even if banks are willing to lend more. His explanation for this behaviour of firms is as follows. He argues that the costs of bank financing are not understood well. While better informed banks make flexible financing decisions which prevent inefficient liquidations of profitable projects, there are also costs of banks' credit in terms of banks having bargaining power over the firm's profits. Thus, the firm attempts to optimally restrict the power of the bank when choosing its borrowing

sources and priority of its debt claims.

Chemmanur and Fulghieri (1994a) also develop a reputation model in which they argue that banks' treatment of firms are different from that of bondholders since banks have incentives to develop a reputation for being flexible to borrowing firms. This is because banks are long-term players in the debt market. They show that firms with a relatively high probability of being in financial distress prefer bank loans to publicly traded debt, even though the interest rate is higher on bank loan. Those firms with a lower probability of being in financial distress, however, choose to issue publicly traded debt to benefit from the lower equilibrium yield on debt. Moreover, it is shown that firms are willing to pay higher interest rates for loans from banks which have greater reputations for flexibility against financially distressed firms.[2]

There are also capital structure studies which are based on bargaining between the firm and its investors. Bergman and Callen (1991) present a bargaining game between debtholders and shareholder-oriented management, in which management renegotiate the debt with the creditors by threatening to run down the firm's assets. This opportunistic behaviour by management is deduced by creditors who impose an upper bound on debt capacity. Creditors anticipate that, when the firm increases the face value of debt while

[2]There are also studies which analyse the role of the choice between public and private debt for the outcome of financial distress (see, e.g., Gilson etal (1990), Gertner and Scharfstein (1992), and Asquith et al (1994)). These studies argue that the composition of debt may be an important determinant of the outcome of financial distress and hence it is a potentially important element of the capital structure decision. Gilson et al (1990) argue that firms with more bank debt relative to public debt are less likely to go bankrupt where public debt is a major impediment to out-of-court restructuring. In the model of Asquith et al (1994) the impediment to out-of-court restructuring is , however, the combination of secured private debt and numerous subordinated public debt issues. Gertner and Scharfstein (1992) point out to coordination problems among public debtholders which introduce investment inefficiencies in the workout process.

keeping the same investment plan, it is more likely that the debt contract will ultimately be renegotiated to the creditor's disadvantage. One important implication of this model is that, in contrast to the trade-off theories of capital structure, it implies an interior capital structure even in the absence of realized bankruptcy costs, in which debt is optimally issued at capacity. The model also predicts that the greater the proportion of intangibles in the firm's asset structure, the smaller the firm's debt-equity ratio, which implies that capital-intensive industries will be more heavily debt financed by comparison to high-tech and service industries.

Berglof and Thadden (1994) also develop a bargaining based theory of capital structure, in which financial decisions of the firm is influenced by the anticipation of potential future negotiations between the firm and its creditors. The optimal choice of financial contracts is derived from a trade-off, which determines endogenously an optimal cost of financial distress, between, on the one hand, the desire to avoid *ex post* renegotiation (strategic default), and on the other hand, the wish to limit inefficient liquidation when the firm is in financial distress (liquidity default). The model also implies that firms with readily deployable assets which have high liquidation values have a higher debt capacity than firms with highly specific assets.

2.8 Conclusions

This chapter has surveyed capital structure theories based on bankruptcy costs and tax savings trade-off, agency costs, asymmetric information and signalling opportunities, and sources of finance. These theories are highly suggestive of factors which may make financial policy of firms relevant in the sense that debt financing exerts significant effect on the value

of the firm. However, all we have from these theories are insights regarding different aspects of capital structure decisions of firms, rather than a complete and coherent theory. Although agency costs and asymmetric information models seem to be relatively more successful in explaining the incentives of firms in deciding on their financial policy, there has been little attempt to integrate the traditional taxation arguments into these models. Our understanding of firms' capital structure decisions will be imperfect until different insights of these theories are integrated so as to give a coherent theory of capital structure.

Table 2.1 Capital Structure Theories and Empirical Results

Reference	Model Type	Main Prediction(s)	Empirical Evidence
Alderson & Betker (1995)	Asset characteristics, liquidation costs	Assets with high liquidation costs lead firms to choose lower levels of debt.	Yes: Alderson & Betker (1995)
Barclay & Smith (1995)	Informational asymmetry	Large firms and firms with more growth options have less long-term debt.	Yes: Barclay & Smith (1995)
Bergman and Callen (1991)	Opportunistic underinvestment	The greater the proportion of intangibles in the firm's asset structure, the smaller the firm's debt-equity ratio.	Yes: Alderson and Betker (1995)
Baxter (1967)	Probability of bankruptcy , cost of capital	There is an optimal leverage at which the value of the firm is maximized.	Yes: Castanias (1983), Bayles & Diltz (1994)
Castanias (1983)	Bankruptcy costs, probability of bankruptcy	Firms with higher probability of bankruptcy have lower leverage ratios.	Yes: Castanias (1983), Bayles & Diltz (1994)
Chen (1979)	Bankruptcy costs, multi-period CAPM	In the presence of both corporate income taxes and costly bankruptcy there exists an optimal leverage ratio.	Yes: Castanias (1983), Bayles & Diltz (1994)
Chung & Smith (1987)	Asset type, reputation, product quality	Leverage decreases as the proportion of nonsalvageable assets increases.	Yes: Balakrishnan & Fox (1993)

Table 2.1 (continued)

DeAngelo & Masulis (1980)	Corporate and personal taxation, non-debt tax shield	Firms with higher non-debt tax shields should have lower financial leverage.	Yes: Bowen et al. (1982), No : Bradley et al. (1984), Balakrishnan & Fox (1993)
Ferri & Jones (1979)	Determinants of leverage	Leverage changes with (1) industry type, increases with (2) the size of the firm, and decreases with (3)business risk and (4) operating leverage.	Yes: (1), (2) and (4), Ferri & Jones (1979), (3) Balakrishnan & Fox(1993) (*): (4), Ferri & Jones (1979) (2), Homaifar et al. (1994)
Flath & Knoeber (1980)	Bankruptcy costs, taxes	Bankruptcy costs and taxes imply an optimal capital structure.	Yes: Flath & Knoeber (1980) (*): Bayles & Diltz (1994)
Harris & Raviv (1990)	Agency costs, liquidation value	Firms with higher liquidation value and higher firm value, e.g., those with more tangible assets will have more debt.	Yes: Lys & Sivaramakrishnan (1988), Long & Malitz (1985), Bradley et al. (1984)
Hoshi, Kashyap & Scharfstein (1991)	Information and incentive problems	Liquidity is an important determinant when there are incentive and information problems.	Yes: Hoshi et al (1991)
Jensen & Meckling (1976)	Agency costs	Leverage increases with the lack of growth opportunities. The cost of capital is higher when there are incentive problems.	Yes: (1) Kim & Sorensen (1986), Titman & Wessels (1988), Chung (1993), Barclay & Smith (1995)
Jensen (1986)	Agency costs	Leverage increases with (1) increases in free cash flow and (2) extent of regulation.	Yes: (2), Bowen et al. (1982), Bradley et al. (1984)

Table 2.1 (continued)

Kim (1978)	Mean-variance analysis, bankruptcy costs, debt capacity	When firms are subject to bankruptcy costs their debt capacities are reached prior to one-hundred percent debt financing.	
Kraus & Litzenberger (1973)	Bankruptcy costs, state-preference model	Corporate income tax and the existence of bankruptcy penalties are market imperfections which are central to the effect of leverage on the value of the firm.	
Long & Malitz (1985)	Tangible, intangible investment opportunities	It is the type of investment opportunities facing the firm which determines financial leverage.	Yes: Long & Malitz (1985), Chung (1993), Balakrishnan & Fox (1993)
Marsh (1982)	Target debt level, choice between debt and equity	Leverage increases with (1) higher proportion of assets in place and (2) the size of the firm and decreases with (3) bankruptcy risk.	Yes: Marsh (1982), Bayles & Diltz (1994)
Miller (1977)	Corporate income and personal taxes	There exists an optimal level of leverage for an economy as a whole and there is no optimal leverage for individual firms.	
Myers (1977)	Agency costs, growth opportunities, underinvestment	Leverage is inversely related to the proportion of the market value accounted by growth opportunities.	Yes: Long & Malitz (1985) Chung (1993), Barclay & Smith (1995)
Myers (1984)	Pecking Order	Firms prefer internal finance to external finance.	

Table 2.1 (continued)

Myers & Majiluf (1984)	Asymmetric information, corporate financing, investment decisions	Leverage increases with (1) the extent of the informational asymmetry and decreases with (2) increases in free cash flow.	Yes: (1), Barclay and Smith (1995)
Rajan & Zingales (1995)		Leverage is positively correlated with (1) tangibility of assets, (2) size, and negatively correlated with (3) investment opportunities, (4) profitability	Yes: (1), Long & Malitz (1985), (2), Ferri & Jones (1979), Hamaifar et al (1994), (4) Titman & Wessels (1988)
Ross (1977)	Asymmetric information	(1) Higher leverage is used by managers to signal an optimistic future for the firm. (2) Leverage increases with profitability.	Yes: (2), Titman and Wessels (1988) (*): (2), Long & Malitz (1985)
Shleifer & Vishny (1992)	Liquidation value, debt capacity	Firms having illiquid assets which are underpriced in liquidation will borrow less.	
Scott (1976)	Bankruptcy costs, liquidation value	The optimal leverage is positively related to (1) the liquidation value of assets, (2) the corporate tax rate, and (3) the size of the firm.	Yes: (2), (3), Homaifar et al. (1994), (*): (2), Bayles & Diltz (1994)
Stiglitz (1972)	Bankruptcy, financial and investment decisions	When there is a real possibility of bankruptcy the firm's valuation depends on its debt-equity ratio.	
Stulz (1988)	Informational asymmetry	Debt can be used to reduce the agency costs of managerial discretion.	Yes: Stulz (1990)

Table 2.1 (continued)

Stulz (1990)	Agency costs	Leverage increases with (1) lack of growth opportunities, (2) extent of regulation, (3) free cash flow, and (4) firm value.	Yes: (1), (2), (3), (4), Lys & Sivaramakrishnan (1988), Cornett & Travlos (1989), Ofek (1993)
Titman (1984)	Liquidation value, agency costs	Firms which potentially impose high costs on their customers in liquidation have relatively low debt-equity ratios.	Yes: Titman & Wessels (1988)
Titman & Wessels (1988)	Factor-analytic technique, asset type, product uniqueness	Leverage increases with (1) size, (2) profitability, (3) collateral value of assets, and decreases with (4) non-debt tax shields, (5) expected future growth, (6) uniqueness, (7) volatility of earnings.	Yes: (2), (6), Titman & Wessels (1988) (*): (1), (3), (4), (5), (7), Titman & Wessels (1988)
Williamson (1988)	Liquidation value	Leverage increases with increases in liquidation value.	Yes: Bradley et al. (1984), Long & Malitz (1985), Aldersen and Betker (1995).

Notes:
Those empirical studies which support the main prediction of the theory are given after the word "Yes" while those whose findings are inconsistent with the theory are given after the word "No", blank cells, on the other hand, show that there is no empirical study on the particular implications of that paper. Finally, the sign of (*) indicates weak or statistically insignificant relationship.

CHAPTER 3

INVESTMENT INCENTIVES OF FINANCIALLY DISTRESSED FIRMS

3.1 Introduction

The main objective of this chapter is to provide more insight into the understanding of the distortionary effects of costly bankruptcy on the investment decisions of financially distressed firms when firms cannot precommit to future decisions. The adverse effects of risky debt on the investment incentives of a firm are much discussed in the finance literature. This literature demonstrates how conflicts among different agents can lead to inefficiencies when firms have risky debt in their financial structure. The common proposition of this literature is that in the presence of risky debt and absence of binding state-contingent contracts shareholders/managers of a firm have incentives to deviate from investment policies which maximise the total value of the firm. For example, in a seminal study Myers (1977) argues that future investment opportunities of a firm can be seen as options whose value depends on the likelihood that the firm will exercise them optimally. With the presence of risky debt in the capital structure of the firm, the benefits from undertaking these investments are shared between shareholders and bondholders. In some cases, shareholders fail to exercise the investment option or invest less than the optimal amount when the expected return on investment is such that a profitable investment does not offer shareholders a normal return. In turn, by preventing an optimal investment policy risky debt reduces the present value of the firm which is called *underinvestment problem* in Myers (1977). The loss due to the suboptimal investment policy is regarded as a particular type of agency cost related to the corporate leverage.

In another pathbreaking study, Jensen and Meckling (1976) also recognise the suboptimal investment policy induced by risky debt outstanding. They also argue that the owner/manager of a firm will not be indifferent between two investment opportunities which

have different payoff variances if (s)he has the opportunity to *first* issue debt, then to decide which investment opportunity to take. This is because, by promising to take the low variance investment, issuing bonds and then taking the high variance investment (s)he can transfer wealth from the bondholders. If the owner has little investment in the company it is more likely that (s)he will engage in activities which promise high payoffs if successful with a very low probability of success. If investments turn out well (s)he captures most of the benefits and if they turn out badly the creditors bear most of the costs. This game which is played at the expense of bondholders is sometimes called the *risk shifting problem* (see, e.g., Brealey and Myers (1988)).[1]

The model presented in this chapter captures both the underinvestment and risk-shifting problems associated with risky debt. This is achieved by incorporating two aspects of investment as a discretionary decision by shareholders: the level of total investment and its split between risky and safe investments. In contrast to the the existing literature we focus our attention on financially distressed firms in considering the incentive effects of risky debt. It is shown that shareholders of firms in financial distress might have different

[1] There are also other studies which analyse the incentive effects of risky debt and financial distress. Titman (1984) examines the increased maintenance costs which are borne by the firm's customers if the firm is liquidated. It is argued that the terms of trade at which the firm does business with its customers will be worsened by an increase in the firm's debt level, which increases the probability of bankruptcy, to reflect the customers' perception of the increased probability of liquidation. Titman (1984) argues that this less favourable product price is a cost of debt financing. White (1983) presents a bankruptcy costs model which focuses on the costs arising from inefficient decision making before the firm's actual bankruptcy filing. In the model, firms which are already failing face three possibilities: liquidation, reorganization, or continuation. It is argued that managers, representing equity, have incentives to make economically inefficient decisions by choosing the alternative which maximizes the value of equity. In doing so they generate *ex ante* bankruptcy costs. Bergman and Callen (1991) present a debt renegotiation model which develops a bargaining game between debtholders and shareholders, where shareholders threaten to run down the firm's assets to force concessions from the creditors. They demonstrate that when the realisation of the profit arising from a project taken by the firm and partly financed by debt is less than a certain level shareholders have nothing to lose and they renegotiate the debt to their advantage. They threaten debtholders to adopt a suboptimal investment policy which would further deteriorate the value of the firm's assets. Shareholders whose threat is credible when the firm is insolvent gain from renegotiating the debt, and debtholders are paid less than the full promised face-value of the debt.

incentives regarding their investment decisions. Insolvency condition of firms, which is determined by the liquidation value of their assets and their total debt obligations, plays an important role in taking investment decisions. In our model, in contrast to the existing literature, it is not debt financing which affects the investment incentives of the firm. Instead, investment decisions are distorted by the fact that shareholders of an insolvent firm receive nothing after the firm is liquidated. This is because the firm is assumed to be insolvent on a *stock basis* which means that its total debt obligations exceed the liquidation value of its assets. In our analysis the source of the agency problem of underinvestment is the existence of asymmetric information between shareholders and bondholders about the liquidation value of the firm. In particular, it is assumed that shareholders have better knowledge about the value which the firm's assets will fetch when they are sold (see Shleifer and Vishny (1992) for a formal and detailed discussion).

This chapter presents a dynamic game theoretic model in which bondholders rate the firm's bonds. They give low rating to the firm's bonds if the firm is known to have a liquidation value which is less than its total obligations. This outcome arises because shareholders of such firms are known to have incentives to invest in risky projects (risk shifting problem) and pass up some valuable investment opportunities (underinvestment problem). By doing so shareholders can increase their current benefits as well as the future expected payoffs at the expense of bondholders who may be paid less upon a liquidation. However, firms being in financial distress and knowing that the bond market rationally rates its bonds may try to maintain a favourable reputation for being otherwise. In order to gain a favourable reputation they choose low-risk investments rather than high-risk investments which have negative net present values but very high returns that enable shareholders to

receive a positive residual value upon liquidation. By doing so they can pass up unobservable investment opportunities which would increase the value of the firm when taken.

The analysis of this chapter shows that when there is asymmetric information about the true financial condition of the firm the *risk shifting* problem is curtailed to some extent. This is because the firm in financial distress mimics the behaviour of a solvent firm by choosing low-risk investments (positive effect of reputation) in response to anticipated (and realised) higher bond rating and non-pecuniary benefits which are received by shareholders as long as the firm is run by them. However, the *underinvestment problem* of unobservable investments still prevails (negative effect of reputation).[2]

The remainder of this chapter is organized as follows. The next section develops a reputation model to discuss the distortionary effects of financial distress on the investment decisions. More specifically, it analyses how the *underinvestment* and *risk shifting* problems are affected by the existence of informational asymmetry between bondholders and shareholders about the financial condition of the firm. Finally, main conclusions are listed in section 3.3.

[2]Other studies which explore the role of reputation acquisition in a somehow related context include: Webb (1987b) who demonstrates that when there is informational asymmetry between a firm and its bondholders the underinvestment problem of Myers (1977) is curtailed. This is because firms with less profitable future investments may mimic the behaviour of firms with better investment opportunities by taking value maximising decisions in order to gain a reputation for acting in all security-holders' interest and thereby to improve their bond rating. Diamond (1989) analyses the effects of reputation on the incentive problems between borrowers and lenders and shows that reputation effects can eliminate the conflict of interest for borrowers with a long credit record of repayment without a default, whereas the borrowers with short track record these effects will be too weak to be effective. Maksimovic and Titman (1991) discuss the effect of financial policy of a firm on its incentives to maintain its reputation for producing a high quality product.

3.2 The Model

The model of this chapter comprises an agency relationship between two groups of players, namely shareholders and bondholders of a firm. Hereafter the terms firm and shareholders will be used interchangeably since shareholders are assumed to be the owner-manager of the firm. It is assumed that ownership and control rights are concentrated in a small group of insiders. Shareholders of the firm make investment decisions whereas its bondholders give ratings to the firm's bonds and finance some of the firm's investments. Both groups are expected utility maximizers.

The firm faces two kinds of investment opportunity sets, *observable* and *unobservable*, which are independent of each other. Observable investments can be of two types, *low-risk* and *high-risk*, which are mutually exclusive investment opportunities and require the same initial outlay. A low-risk investment has positive net present value (NPV) whereas a high-risk investment has negative NPV, which has a low probability of an extremely high return. Some other investments, on the other hand, are not observable in the sense that they can not be monitored by bondholders. They include, for example, research and development expenditures, maintenance of plant and equipment, advertising or other marketing expenses.[3] These investments are supposed to increase the value of the firm when taken.

A firm might be one of two types, α or β. An α type firm is a solvent firm in the sense that its liquidation value is greater than its total obligations. The shareholders of this

[3]These investment opportunities are called discretionary investments by Myers (1977) and firm-specific, intangible investments by Long and Malitz (1985).

type of firm get the residual value after all obligations of the firm are paid. In contrast, the liquidation value of a β type firm's assets is less than the firm's total debt so that shareholders expect to receive nothing upon liquidation. Thus, type β firm is insolvent on a stock basis.[4] However, this is private information to shareholders only, which is the source of asymmetric information in the model. This is the central element of the model in this chapter. Bondholders simply do not know the liquidation value of the firm they are dealing with and know only *a priori* distribution over the firm's type. There is a probability that the firm is an α type firm. It is common knowledge that α type firms always make unobservable investments and choose the low-risk investment option, which are value-maximising decisions, whereas β type firms may find it profitable not to make unobservable investments and to choose the high-risk investment option. Although unobservable investments are assumed to increase the value of the firm as a whole, shareholders of β type firms do not normally have incentives to take these investments since they do not get any positive amount upon liquidation. Naturally, it is assumed that the increase in the value of the insolvent firm arising from taking unobservable investments is not sufficient to make the firm solvent again.

In addition it is assumed that shareholders get various non-pecuniary benefits from their activities in managing the firm. As discussed by Jensen and Meckling (1976), these activities may include the attractiveness of the company office, cars and the secretarial staff, the kind and amount of charitable and political contributions and the purchase of production inputs from friends. They might also take the form of money taken out by shareholders in the form of cash dividend. The optimal level of non-pecuniary expenditures for an α type

[4] We assume that the firm can meet current obligations. Otherwise it would immediately be forced into bankruptcy.

firm is achieved when the marginal utility derived from an additional unit of expenditure on non-pecuniary items is equal to the marginal utility derived from an additional unit of wealth of shareholders. Thus, shareholders have also to take the wealth effect of non-pecuniary expenditures into account. However, additional expenditure of a unit of the firm's resources on non-pecuniary items does not reduce the expected wealth of the existing shareholders of a β type firm. Therefore, they will increase the non-pecuniary expenditures up to the point at which they are unable to take the observable investment.

The existence of the non-pecuniary benefits in the analysis may serve to explain why shareholders might want to get a high-rating from bondholders and delay the legal insolvency. First, shareholders receive non-pecuniary benefits as long as they run the firm. Bondholders take over the firm from shareholders when the insolvency condition of the firm is revealed by shareholders taking the high-risk investment. In this case, all non-pecuniary benefits are lost. When the firm gets high-rating from bondholders all of the proceeds of unobservable investments which are passed up is spent on non-pecuniary benefits. Second, if bondholders give low-rating to the firm's bonds, then shareholders, assuming that they take the investment opportunity, have to finance the investment by raising the required initial outlay internally. The sources of internal finance can be the proceeds of foregone unobservable investments, retained earnings or the proceeds from the sale of assets. Under each case shareholders must cut all non-pecuniary benefits which would have been received otherwise.

Financing decisions of firms are exogenously given. However, each type has its own reason in choosing debt financing. We assume that α type firms choose debt financing by

trading-off tax savings of debt (tax shield of leverage) against the expected bankruptcy costs. So, the main motivation is the tax advantage of debt financing, which arises due to the tax deductibility of interest payments on debt. The reason why β type firms resort to debt financing is that, by doing so, they shift the risk of investment to bondholders and increase non-pecuniary benefits, which would not be possible if the investments were financed by internal funds.

Table 3.1 lists the strategies of bondholders and shareholders and the corresponding payoffs.

Table 3.1 Payoffs to Shareholders and Bondholders of Firms

Decisions		*Payoffs*	
Bondholders	*Shareholders*	*Type α*	*Type β*
high-rate	*low-risk*	2 2	1 2
	high-risk	0 -1	2 -1
low-rate	*low-risk*	1 1	-2 1
	high-risk	-1 0	-1 0

Shareholders might choose either a low-risk or a high-risk investment option, which are respectively shown by *low-risk* and *high-risk* in Table 3.1. Similarly, bondholders might give either a high or a low bond rating represented by *high-rate* and *low-rate* respectively. In each cell shareholders' payoffs are given first. These values have been given on the following grounds. For an α type firm the dominant strategy is to choose the low-risk

investment option. Whatever bondholders play, shareholders' wealth is increased by taking those investments which have positive net present values, i.e., low-risk investment. They have no incentive to take more risky investments since the value of the firm is decreased by undertaking these opportunities.

The best outcome for shareholders of an α type firm is therefore the combination of the low-risk investment with a high bond rating. In this case they enjoy both the tax advantage of debt financing and positive NPV of the investment, which increases the value of the firm. The worst case for shareholders of an α type firm occurs when they take high-risk investment option together with a low bond rating. In this case the firm has to finance the investment by internal funds since bondholders do not buy its bonds at any price. This deprives the firm from increasing its value because of the lost investment opportunity with a positive NPV and tax subsidy of debt financing. We assume the remaining two outcomes, value maximizing decision with a low bond rating and deviating from that with a high bond rating are between these two extreme results in welfare terms. It should be noted that the specific payoff values are not essential for our results. They are only used to make an ordering of different welfare levels under different strategies. The important point is that an α type firm has always an incentive to play a low-risk investment strategy which has a positive effect on the value of the firm.

A β type firm, on the other hand, has different incentives. Its dominant strategy is to play *high-risk* in a single period game, that is to take the high-risk investment. This is because the shareholders of this type firm receive nothing in the event of liquidation and, by limited liability, they are not liable to pay the amount over the liquidation value of the firm.

Shareholders have an incentive to take the high-risk investment opportunity regardless of bondholders' choice. The best outcome occurs when it deviates from value maximizing decision by choosing the high-risk investment but gets a high bond rating. In this case the downside risk of the investment is shifted to bondholders, whereas the upside benefits of risky investment are received by shareholders. Also, by not having to use internal finance, unobservable investments are passed up and non-pecuniary benefits are maximised. The worst, on the other hand, is to take the value maximizing decision with a low bond rating. In this case, they need to raise finance internally, which requires reducing non-pecuniary expenditures substantially. They also lose the chance of getting a positive residual value upon liquidation.

The payoffs of bondholders are determined according to which strategy is played by shareholders and themselves not by the type of the firm. It can be seen from Table 3.1 that there is no dominant strategy for bondholders. As mentioned earlier, bondholders do not provide finance to the firm when they give low-rating. However, if they choose to give high-rating to the firm they buy the firm's bonds and they maximise their payoff if the firm takes the low-risk investment and their payoff is minimised when the high-risk investment is chosen by the firm. That is, if a high rating is given, when it is rational not to do so, they purchase bonds at a higher price than fair market price. If they provide no finance to the firm, they are still better off when the firm chooses to take the low-risk investment option. This is because low-risk investment increases bondholders' expected income since the liquidation value of the firm will be higher as a result of positive NPV investment.

It is clear that the only choice facing a β type firm in a single period game is to pass

up unobservable investments and to choose the high-risk investment since it is insolvent in the sense that its total obligations exceed the liquidation value of its assets. This is because of the limited liability of shareholders, under which their return can not be less than zero. They choose the high-risk investment even if the probability of having extremely high return which enables them to get a positive residual value is very small. The same result holds in a model where the one period game is finitely repeated without an intertemporal linkage.[5]

However, in a dynamic framework with an informational transfer between periods there are different incentives from those of the above one-shot game analysis. As noted earlier bondholders do not know which type of firm they are dealing with but can form an expectation of this on the basis of the observed past actions of its shareholders. Therefore, a β type firm might have an incentive to mimic the behaviour of the α type firm to signal that it will not take high-risk investment options. The motivation in doing so is to make bondholders believe that it is of an α type firm so that they can enjoy a high level of non-pecuniary benefits. That is, the β type firm will try to hide the fact that its liquidation value is less than its total debt obligations. It should be noted that once the identity of a β type firm is revealed it will be impossible for the firm to enjoy non-pecuniary benefits. This occurs because it is assumed that, once the type of the firm is revealed as β type, bondholders take over and run the company until the end of period T when the firm is liquidated. The sequence of events is given in the following.

[5] The intuition behind this result is due to Selten's chain store paradox (see Kreps and Wilson (1982) and Milgrom and Roberts (1982)).

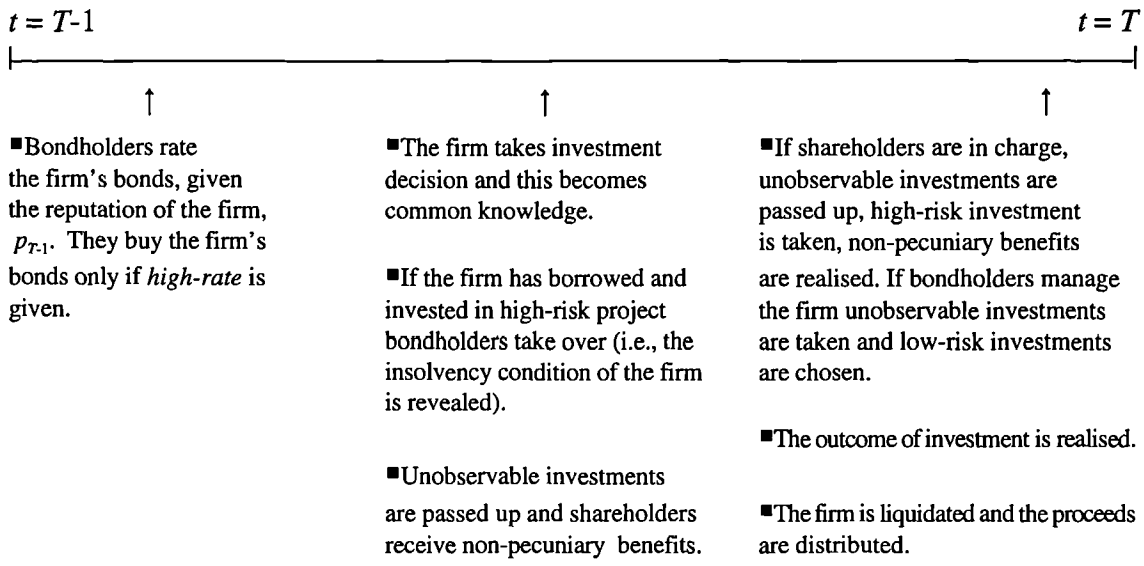

Figure 3.1 *The Sequence of Events*

Bondholders enter the game with a prior probability that the firm is of an α type. This is given by p_t which, in bondholders' perception, is the probability that the firm is of an α type where t=1,2,...,T. p_t can alternatively be interpreted as the reputation of the firm being an α type. Depending upon how shareholders played in the past this perception is updated in each period using the Bayes' rule given in equation 3.1. x_t shows the probability of shareholders playing *low-risk* in a mixed strategy. And, the probability of bondholders playing *high-rate* is given by y_t. Accordingly, $(1-x_t)$ and $(1-y_t)$ are respectively the probabilities of playing *high-risk* and *low-rate* in a mixed strategy for shareholders and bondholders. If shareholders play *low-risk* in period t then the shareholders' reputation entering period $t+1$ becomes

$$p_{t+1} = \frac{p_t}{p_t+(1-p_t)x_t} \tag{3.1}$$

and p_{t+1} is equal to 0 if shareholders play *high-risk* or $p_t = 0$.[6] When shareholders make their decisions they consider the effects of their current behaviour on the future strategy of bondholders. If a β type firm takes the high-risk investment its reputation is blown and bondholders run the firm in the rest of the game. If, on the other hand, it takes the low-risk investment in order to gain reputation it loses the chance of getting a positive residual value upon liquidation. Therefore in making its decision the firm considers costs and benefits of taking a particular action in terms of reputation. The solution concept used here is Kreps and Wilson's (1982) sequential equilibrium. The solution to this game is found by solving recursively starting from the last period. At each point in time each player chooses the best strategy given its information set and expected future moves of the other.

3.2.1 Strategies in Period T

Bondholders' expected payoff in the last period is given by

$$W_B(T,p_T) = y_T[p_T(2)+(1-p_T)(-1)] + (1-y_T)[p_T(1)+(1-p_T)(0)] \qquad (3.2)$$

which gives

$$W_B(T,p_T) = y_T(2p_T-1) + p_T \qquad (3.3)$$

where p_T is the probability in the final period, in bondholders perception, that the firm is of

---

[6] Bayes' rule requires that

$$p_{t+1} = \frac{Prob(low\text{-}risk|type\,\alpha)Prob(type\,\alpha)}{Prob(low\text{-}risk|type\,\alpha)Prob(type\,\alpha)+Prob(low\text{-}risk|type\,\beta)Prob(type\,\beta)}$$

This reduces to give 3.1 since an α type firm always chooses the low-risk investment option.

α type. Since it is known to all parties that a β type firm will play zero in the last period, p_T, instead of x_T, is used to calculate the expected payoff to bondholders. It is clear from (3.3) that shareholders' reputation which is given by p_T is crucial in bondholders' decision making. When $p_T>1/2$ the coefficient of y_T, $(2p_T-1)$, is positive and hence bondholders can increase their expected payoff by setting $y_T=1$, i.e. giving *high-rate* with probability one; when $p_T=1/2$ bondholders are indifferent between playing *high-rate* or *low-rate* and therefore $y_T=1/2$; and when $p_T<1/2$, y_T is set equal to 0, i.e. the probability of playing *high-rate* is zero. 1/2 can be interpreted as a critical value of p_T, $\bar{p}_T$, below which bondholders give low rating. Note that bondholders net p_T from low-rating and $3p_T-1$ from high-rating. Thus, they choose to give low rating if $3p_T-1>p_T$ which gives $p_T>1/2$ as claimed above, i.e. $p_T>\bar{p}_T$. That is, the value to the bondholders is

$$v_b(T,p_T) = \max(3p_T-1,\ p_T) \tag{3.4}$$

In period T the expected payoff to shareholders of an α type firm, given reputation p_T, is

$$W_\alpha(T,p_T) = y_T[x_T(2)+(1-x_T)(0)] + (1-y_T)[x_T(1)+(1-x_T)(-1)] \tag{3.5}$$

which reduces to

$$W_\alpha(T,p_T) = 2x_T + y_T - 1 \tag{3.6}$$

Similarly, the expected payoff to shareholders of a β type firm in the last period is given by

$$W_{\beta}(T,p_T) = y_T[x_T(1)+(1-x_T)(2)] + (1-y_T)[x_T(-2)+(1-x_T)(-1)] \quad (3.7)$$

which in turn gives

$$W_{\beta}(T,p_T) = 3y_T - x_T - 1 \quad (3.8)$$

As discussed earlier the decision variable for shareholders is x_T, i.e. the probability of playing *low-risk* in a mixed strategy. It is clear from equation (3.6) that shareholders of an α type firm will always play x_T=1 since playing *low-risk* yields a positive effect on the expected payoff to shareholders no matter which strategy bondholders play. This is not a surprising result. In fact, an α type firm plays *low-risk* in every period since it does not face a liquidation value which is less than the firm's total debt obligations and the value of the firm increases as it exercises low-risk investment options. On the other hand, equation (3.8) suggests that shareholders of a β type firm will play *high-risk* in the last period of the game since the coefficient of x_T is negative. This is because shareholders' actions have no impact on the firm's reputation in the final period. In other words, there is no next period to be considered. Also, since it is the last period bondholders do not have the option of taking over the firm. Thus, shareholders of a β type firm maximise their payoff by taking the high-risk investment in the last period. The value to the shareholders of a β type for playing the game in period T, $v_s(T,p_T)$, is given as the following

2	if	$p_T > 1/2$	(since bondholders play *high-rate*)
1/2	if	$p_T = 1/2$	(since bondholders are indifferent)
-1	if	$p_T < 1/2$	(since bondholders play *low-rate*)

3.2.2 Strategies in Period T-1

In the second last period we consider only type β firm as it is known that type α firm follows value-maximizing strategy (i.e. low-risk investment) in every period. Now, in calculating the expected welfare one needs to take into account both T-1 and T periods payoffs. The shareholders must consider the impact of their current behaviour on their payoff in the last period, T. The expected wealth of shareholders in T-1 for a β type firm is given by

$$W_{\beta}(T-1,p_{T-1}) = y_{T-1}[x_{T-1}(1)+(1-x_{T-1})(2)] + (1-y_{T-1})[x_{T-1}(-2)+(1-x_{T-1})(-1)] + x_{T-1}[v_s(T,p_T)] + (1-x_{T-1})(-1) \quad (3.9)$$

By rearranging (3.9) one gets the following

$$W_{\beta}(T-1,p_{T-1}) = 3y_{T-1} + x_{T-1}(v_s(T,p_T)) - 2 \quad (3.10)$$

If the firm plays *low-risk* in period T-1, it is entitled to get $v_s(T,p_T)$ in the last period, which is given by the penultimate term in equation (3.9). However, if it fails to take the low-risk investment in T-1 its reputation is blown. Bondholders take over the management of the firm and the payoff of shareholders becomes -1 in the last period since they are deprived of non-pecuniary benefits. As noted earlier $v_s(T,p_T)$ can be different depending upon the reputation of the firm p_T in the last period. Thus, there are three cases to consider.

(i) If $p_{T-1}>1/2$, since the α type firm always takes the low-risk investment, the posterior probability of the β type firm being an α type will be at least p_{T-1} when it chooses

to take the low-risk investment in period T-1, i.e. $p_T=max(p_{T-1},\bar{p}_T)$ where $\bar{p}_T=1/2$. As discussed earlier, when $p_T>1/2$ bondholders give high rating to the firm so that shareholders' payoff becomes 2 by taking the high-risk investment option. Thus, playing *low-risk* in period T-1 leads bondholders to play *high-rate* in the last period. In this case it can be said that the reputation of the firm is too high to destroy. In other words, the cost of deviating from value maximising rule is too high.[7] Therefore, x_{T-1} is chosen to be 1. This can also be seen from equation (3.10) by looking at the coefficient of x_{T-1}. It is known that $v_s(T,p_T)$ is 2 when the firm chooses to take the low-risk investment in period T-1. Therefore, the coefficient of x_{T-1} is certainly positive, which implies that by playing *low-risk* in period T-1 shareholders can increase their total expected wealth.

(ii) If $0<p_{T-1}<1/2$ then x_{T-1} should be strictly less than 1. If x_{T-1} were 1 then, from the Bayes' rule, p_T would be p_{T-1} which is less than 1/2. This, in turn, would imply that $y_T=0$ and $v_s(T,p_T)=-1$. In other words, the probability that the firm is an α type in the last period, p_T, would not be sufficient to make the bondholders play *high-rate* in period T. Also, when $0<p_{T-1}<1/2$, it cannot be an equilibrium strategy to play *low-risk* with zero probability. This is because, if it were the case, it would be possible to make the bondholders believe in period T that the firm is of α type by playing *low-risk* in period T-1. Thus, the β type firm must randomize in a way that makes bondholders indifferent between playing *high-rate* and *low-rate*. This requires that p_T is equal to 1/2 which is the critical level of the probability that the firm is an α type. The value of x_{T-1} at which $p_T=\bar{p}_T$ is derived from the following

[7]Note that if the shareholders play *high-risk* in period T-1, p_T will be 0. As a result, bondholders will play *low-rate* in the last period and shareholders will get a payoff of -1 in the last period instead of 2.

$$\frac{p_{T-1}}{p_{T-1}+(1-p_{T-1})x_{T-1}} = \bar{p}_T \tag{3.11}$$

as

$$x_{T-1} = \frac{p_{T-1}(1-\bar{p}_T)}{\bar{p}_T(1-p_{T-1})} \tag{3.12}$$

which can also be written as

$$x_{T-1} = \frac{p_{T-1}}{1-p_{T-1}} \tag{3.13}$$

since $\bar{p}_T$=1/2. Thus, the firm chooses the low-risk investment with probability p_{T-1}/1-p_{T-1} and the high-risk investment with the complementary probability.[8] It is known that if the β type firm plays *low-risk* in period T-1, since p_{T-1}<1/2, its reputation for being an α type rises to 1/2 in period T. However, this is not high enough to deter bondholders from playing *low-rate* in period T. The probability of playing *high-rate* is the same as that of playing *low-rate*, which is 1/2.

(iii) If p_{T-1}=1/2 then the probability that β type firm takes the low-risk investment, x_{T-1}, is 1.

Now, we can give the strategy of the bondholders in period T-1. Note that the total probability that the low-risk investment option is chosen by shareholders in period T-1 is

[8]Note that when p_{T-1}=0, the probability of playing *low-risk* is zero, and when $p_{T-1}=\bar{p}_T$=1/2 it is equal to one.

given by

$$p_{T-1}(1) + (1-p_{T-1})[\frac{p_{T-1}(1-\bar{p}_T)}{\bar{p}_T(1-p_{T-1})}] \tag{3.14}$$

because the α type firm always chooses the low-risk investment option. Equation (3.14) can be rearranged to give the following

$$p_{T-1}/\bar{p}_T \tag{3.15}$$

The expected payoff to bondholders in period T-1 from playing the game then can be written as

$$\begin{aligned} W_B(T-1,p_{T-1}) &= y_{T-1}[\frac{p_{T-1}}{\bar{p}_T}(2)+(1-\frac{p_{T-1}}{\bar{p}_T})(-1)]+ \\ (1-y_{T-1})[\frac{p_{T-1}}{\bar{p}_T}(1)+(1-\frac{p_{T-1}}{\bar{p}_T})(0)]+ &\frac{p_{T-1}}{\bar{p}_T}v_b(T,p_T)+ (1-\frac{p_{T-1}}{\bar{p}_T})(1) \end{aligned} \tag{3.16}$$

The last term in equation (3.16) reveals that if shareholders choose *high-risk* investment option in period T-1, then the type of the firm is revealed as type β and bondholders take over and run the firm until it is liquidated at the end of period T, which gives them a return of 1 since they are supposed to take value-maximising decision in the last period. The penultimate term, on the other hand, gives the expected payoff of bondholders in period T, $v_b(T,p_T)$, when shareholders choose the low-risk investment option in period T-1. Since $\bar{p}_T$=1/2 equation (3.16) can also be written as

$$W_B(T-1,p_{T-1}) = y_{T-1}(4p_{T-1}-1) + 2p_{T-1}v_b(T,p_T) \qquad (3.17)$$

As in period T the strategy of bondholders is determined according to the firm's reputation in period T-1 for being an α type, p_{T-1}. That is,

$$y_{T-1} = 1 \quad \text{if} \quad p_{T-1} > 1/4$$

$$y_{T-1} = 1/2 \quad \text{if} \quad p_{T-1} = 1/4$$

$$y_{T-1} = 0 \quad \text{if} \quad p_{T-1} < 1/4$$

Note that the critical value of probability in period T-1 is 1/4 which is $(\bar{p}_T)^2$. The total expected value to the shareholders for playing the game in period T-1, $v_s(T-1,p_{T-1})$, is as the following

3	if	$p_{T-1} > 1/2$	(since bondholders play *high-rate* in both periods)[9]
3/2	if	$1/4 < p_{T-1} < 1/2$	(bondholders play *high-rate* in T-1 and are indifferent in T)
0	if	$p_{T-1} = 1/2$	(bondholders are indifferent in both periods)
-3/2	if	$p_{T-1} < 1/4$	(bondholders play *low-rate* in T-1 and are indifferent in T)

3.2.3 Strategies in Period t

The analysis given for periods T and T-1 can be extended to any period (for $t<T$).

[9]Conditional on taking low-risk investment option by shareholders in period T-1.

Strategies of Bondholders

Bondholders consider the reputation of the firm for being an α type, p_t, when rating the firm's bonds in period t. Thus, if $p_t>(\bar{p}_T)^{T-t+1}$, they give high-rating (i.e. $y_t=1$). If, however, $p_t<(\bar{p}_T)^{T-t+1}$, they give low-rating (i.e. $y_t=0$). And if $p_t=(\bar{p}_T)^{T-t+1}$, they randomize giving high-rating with probability 1/2.

Strategies of Shareholders

If the firm is an α type, shareholders always choose the value-maximising decision, i.e, they take the low-risk investment. If the firm is a β type, the decision of shareholders depends on p_t. If $p_t>(\bar{p}_T)^{T-t}$, shareholders choose the low-risk investment option with certainty. If $0<p_t<(\bar{p}_T)^{T-t}$, shareholders choose the high-risk investment option with a positive probability. In other words, they take the low risk-investment with probability

$$\frac{p_t(1-\bar{p}_T)^{(T-t)}}{(1-p_t)\bar{p}_T^{(T-t)}} \qquad \textbf{(3.18)}$$

and chooses the high-risk investment with the complementary probability.[10]

The above argument can be explained by the following figure.

[10] It should be noted that if $p_t=0$, the probability of choosing the low-risk investment is zero, and if $p_t=\bar{p}_T^{(T-t)}$, the probability of choosing the low-risk investment is one.

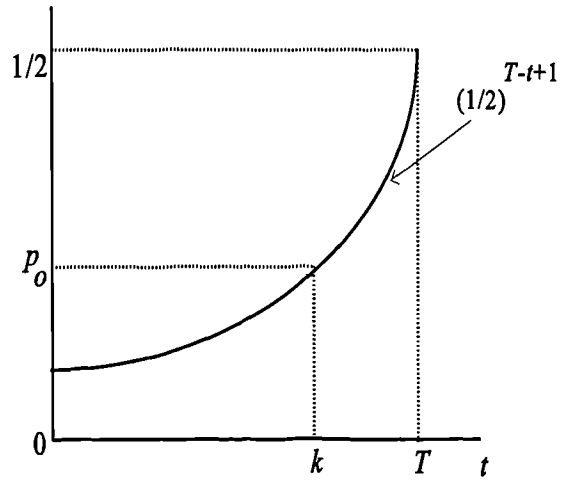

Figure 3.2 *Reputation Acquisition*

Figure 3.2 plots the reputation of shareholders against time. Supposing that the initial probability that the firm is of an α type is p_0, there is a sequential equilibrium in this game where bondholders give high-rating to the firm and the firm chooses the low-risk investment option until period *k*. Afterwards there is always a chance that the bondholders will give low-rating to the firm since in period *k* bondholders are for the first time indifferent between *low-rate* and *high-rate*. Also, there is non-zero probability that the shareholders will choose the high-risk investment option. As noted earlier, the probability of playing *low-risk* must be less than one in order to be able to enhance the reputation when the reputation in the current period is less than the critical value of the next period. In other words, during the reputation building phase, beliefs about the type of the firm are only updated when the firm chooses the low-risk investment option while there is a non-zero probability that it will choose the high-risk investment option. Thus, if shareholders choose the low-risk investment the reputation of the firm advances up the locus shown and the game is repeated.

3.3 Conclusions

This chapter has analysed the distortion in the investment incentives of financially distressed firms. The analysis demonstrates that when there is asymmetric information between shareholders and bondholders about the true financial condition of the firm shareholders may tend to deviate from value maximising decisions if the firm is in financial distress. They may have incentives to invest in negative NPV projects (*risk shifting problem*) and pass up valuable (but unobservable) investment opportunities (*underinvestment problem*). This reduces the value which bondholders expect to get upon liquidation, where shareholders do not receive any payment since the total liquidation value of the firm's assets does not meet its total obligations. The problem of *risk shifting* is curtailed to some extent when bondholders give ratings to the firm's bonds according to its reputation for being a value-maximising firm. This is the positive reputation effect in the sense that shareholders' attempt to gain reputation leads to a reduction in their incentives to invest in risky projects. However, shareholders of a financially distressed firm do still pass up some other investments which are not observable by bondholders. By having a high enough reputation, which leads bondholders to give high rating to the firm's bondholders, shareholders can have a higher level of non-pecuniary benefits by spending the proceeds of foregone unobservable investments. This can be called negative reputation effect. This is because the firm in financially distress will continue to pass up valuable investment opportunities after the bond finance is secured as a result of the firm's reputation.

One important implication of this analysis is that financially distressed firms might follow a different investment strategy from other firms which face the same investment opportunities. They might attempt to delay bankruptcy in order to get benefits from non-

pecuniary expenditures. In order to be able to do this shareholders try to increase their reputation for being a value maximising firm by taking those investments which are observed by the market. As long as they get high rating in the bond market they pass up unobservable investments. In behaving in such a way shareholders transfer wealth from bondholders. This may be regarded as one type of costs of financial leverage.

Another implication is that asset type distinction plays an important role in generating these costs. The games played at the expense of bondholders are more likely to exist when potential *ex post* liquidation costs are high. Given the fact that intangible assets lose a substantial amount of their values when they pass through the bankruptcy procedures firms having more intangible assets and facing an imminent bankruptcy are more likely to deviate from value maximizing decision. Shareholders may not take valuable investments since this means a wealth transfer to bondholders. As a result, bondholders may be reluctant to buy bonds of a firm which is highly levered and has assets which do not have many other alternative uses.

CHAPTER 4

CORPORATE BANKRUPTIES AND THE ROLE OF BANKS

4.1 Introduction

In the previous chapter a reputation model was developed, where shareholders of firms in financial distress have incentives to establish a reputation for being value-maximizer who behave in the interest of all claimholders of the firm. That is, the model in chapter 3 emphasized the role of reputation acquisition on the debtor's side. The present chapter, on the other hand, attempts to explore the role of reputation on the creditor's side and analyses the implications of reputation acquisition by banks for financially distressed firms.

The role of banks in providing finance to firms has been of considerable interest in finance. It has been argued that banks are better informed than other lenders in producing information about borrowers (Leland and Pyle (1977), Diamond (1984), Sharpe (1990), Rajan (1992)). Another argument is that banks are better suited to renegotiate loans and have greater ability to restructure debt contracts. This flexibility of banks is unavailable in the capital market due to coordination problems among multiple public debtholders (Gertner and Scharfstein (1991), and Thakor and Wilson (1995)). Several recent studies have also studied the choice between bank loans and publicly traded loans by using reputation acquisition models. For example, Diamond (1991) analyses the choice between borrowing through banks and borrowing directly by issuing publicly traded bonds or commercial paper. The model shows that borrowers establish reputation by repaying loans from a bank that monitors to alleviate moral hazard in the initial periods and then issue debt directly without monitoring by using their good track record from the monitored borrowing. Chemmanur and Fulghieri (1994a) also develops a reputation model where the focus is on reputation acquisition by banks. They argue that banks' treatment of financially distressed firms might be fundamentally different from that of holders of publicly traded debt (bondholders) since

banks have incentives to develop a reputation for being more flexible to borrowing firms in financial distress since they are long-term players in the debt market.[1] It is shown that, in equilibrium, firms with a relatively high probability of being in financial distress prefer bank loans to publicly traded debt, even though the interest rate on bank loan is higher.[2]

However, the behaviour of banks towards financially distressed firms sometimes becomes a focus of criticism (see Keasey and Watson (1994) for a review of the UK case). From a theoretical perspective, a lender's response to a firm in financial distress is viewed by the banking literature as consisting of two alternatives: liquidation or restructuring the debt (continuation) (e.g., Bulow and Showen (1978), Gertner and Scharfstein (1991)). Banks are criticised for forcing firms into liquidation especially when they have higher continuation values than liquidation values of their assets. Nevertheless, there has been no satisfactory explanation as to how banks benefit from such behaviour. One explanation given by Keasey and Watson (1994) is that banks, being aware of the incentives of financially distressed firms to act in a manner which results in a shift in the distribution of business risk onto the bank, may view liquidation as the preferred course of action even if this decision is seen by firms as an economically irrational decision. Another explanation is due to Asquith et al (1994). They argue that when there are many public creditors, each creditor has an incentive to free ride and not loosen financial constraints on firms by, for example, deferring principle and interest payments and providing new financing. This behaviour, in turn, discourages banks to make concessions because public creditors are

[1]The flexibility of banks towards borrowing firms has been also pointed out by other authors (see, e.g. Gilson, John and Lang (1990), and Hoshi, Kashyap and Scharfstein (1990 and 1991)).

[2]Other studies which use reputation acquisition model in finance include John and Nachman (1985), Webb (1987), Diamond (1989), Maksimovic and Titman (1991), Chemmanur and Fulghieri (1994b).

likely to receive some of the gains from a restructuring between the bank and the firm whereas the bank bears the full cost of such restructuring. Frankel and Montgomery (1991) point out another aspect of the problem. They argue that the form of relationship in banking system between a bank and its customers can influence the resolution of the financial distress. Bankruptcy rules in the UK and the US are compared with those in Germany and Japan to argue that bankruptcy laws in the former two countries discourage banks to form a close relationship with firms in financial distress whereas banks in Germany and Japan are encouraged to participate in informal corporate rescues. Their argument suggests that there will be fewer rescue attempts and more liquidations in those countries where the relationship between banks and firms is not close.

Our objective in this chapter is to provide more insight into the incentives of banks towards financially distressed firms. In doing this, reputation of banks is brought into the analysis. It is argued that banks might have different incentives than those discussed in the existing literature. More specifically, when banks face financially distressed firms sequentially they might have an opportunity and a desire to establish a reputation for being tough against firms in financial distress. They may attempt to develop this reputation by liquidating even those firms that experience temporary financial difficulties and have greater continuation value than their liquidation values. In our model, reputation acquisition provides incentives even for banks which have no immediate advantage from liquidating firms in financial distress. However, the short-term loss from liquidating firms might be weighed by the long-term gain by preventing future defaults. Bankruptcy decisions of banks which face a financially distressed firm which cannot honour its debt obligations are determined by a trade-off between acquiring reputation for being tough by liquidating the

firm (but losing some part of the debt and interest repayments in terms of liquidation costs) and restructuring the debt so as to increase the proportion of repayment (but weakening the position against future defaults). In the model, reputation acts as a commitment device which enables banks to credibly threaten borrowing firms to force them into liquidation in the event that they default on their debt obligations.

Reputational considerations in this context might partly explain why some firms are inefficiently liquidated by banks even when their going-concern values are greater than liquidation values of their assets. To put it differently, some of the company bankruptcies may be caused by the behaviour of the "reputable" banks which liquidate financially distressed firms in response to anticipated higher payoffs when facing other troubled firms. This analysis might also offer an explanation for the relatively high number of voluntary liquidations which are less costly compared to compulsory liquidations. Moreover, the model implies that small-medium firms are more likely to be liquidated when they are in financial distress since the costs they impose on banks upon liquidation are negligible compared to the costs imposed by large firms. Costs of financial distress play an important role when discussing the reputation effects. In particular, it is shown that banks may choose to accept to reduce the current obligations of a financially distressed firm when the costs of liquidating the firm are very high, and wish to let the firm be liquidated and acquire reputation for toughness against financially troubled firms when such costs are low.

The rest of the chapter proceeds as follows. In the next section the reputation model is developed, where one bank faces two financially distressed firms sequentially. In section 4.3 the model is extended to include N firms. Finally conclusions are listed in section 4.4.

4.2 The Model

The basic model comprises an agency relationship between two groups of players: two firms (firm 1 and firm 2) and a bank. In this two date (time 1 and time 2) model, firm *i* which is financially distressed takes decision either to *default* on principal and interest payments, (D_i+rD_i), or to *liquidate voluntarily* (where i=1,2). Following the firm's decision, if it is default, the bank has to choose either to *accept* to reduce the interest and principal payments or to *reject* and *liquidate* it by pursuing legal actions.[3] If, however, firms do not default on their debt obligations the bank does not have to take any action. The game which will be described below starts at time 1 and is repeated at time 2. That is, the bank plays the game against each firm in turn: First, it confronts firm 1, then firm 2. Each firm is assumed to be experiencing temporary financial difficulties. Although they can not meet the current obligations the going-concern value of firm i, θ_i, is greater than its current obligations (D_i+rD_i). In other words, firms are insolvent only on a *flow-basis*, not on a *stock basis*.[4] Firms differ in terms of the costs of financial distress they incur and impose on the bank, which are assumed to be limited to the costs of liquidation[5], and the total obligations.

There are three possible ways of resolving the financial distress. Firstly, the insolvent firm can voluntarily liquidate itself. This is the least costly way since it does not require court involvement and the firm's assets can be sold at a higher price because of a higher

[3]It is assumed that all legal actions against the financially distressed firm lead to liquidation of the firm.

[4]Although they might have different meanings in some other contexts both "insolvent firm" and "financially distressed firm" will be used interchangeably throughout this chapter to mean the same thing.

[5]As discussed in other chapters the liquidation values of insolvent firms might change substantially across firms depending upon the nature of assets they hold. Some assets (e.g. tangible assets) might fetch higher value than others (e.g. intangible assets) when liquidated. (For an extensive treatment of this issue see, e.g., Alderson and Betker (1995) and Shleifer and Vishny (1992)).

chance of being sold as a going concern under the incumbent management. Nevertheless, financial distress is not costless and shareholders of the firm still lose an amount of $\varepsilon_i\theta_i$, and hence receive $(1-\varepsilon_i)\theta_i-(D_i+rD_i)$ upon voluntary liquidation, where ε_i represents the ratio of the costs of liquidation to the value of firm *i*. Secondly, the bank might not pursue legal actions against the insolvent firm and accept to reduce its current obligations. In this case, the shareholders are entitled to have the going-concern value, θ_i, and their payoff will be $\theta_i-(1-\delta_i)(D_i+rD_i)$ where δ_i is the reduction on the total current obligations of firm *i*. Thirdly, the firm's assets can be sold through a compulsory liquidation. Under this procedure, it is assumed that, there will be no value left for shareholders of the firm and, because of the limited liability, their payoff will be 0.

The bank might be of *two possible types, "strong" or "weak". A strong-type bank is* assumed to incur less costs than a weak-type bank when it liquidates financially distressed firms. This might be because, for example, strong-type banks might have more experts than weak-type banks to deal with insolvent firms more efficiently. It is also possible that costs of liquidating firms in financial distress may not be limited to direct costs of liquidation but there might also be indirect costs such as side effects on other customers, losing new customers and so on. It can be argued that these costs might be higher for some banks (weak banks) than others (strong banks). The payoffs of strong and weak type banks are given by $(1-\alpha_i)(D_i+rD_i)$ and $(1-\lambda_i)(D_i+rD_i)$ respectively when they choose to liquidate the insolvent firm *i*, where α_i and λ_i represent the proportional costs of liquidation which strong and weak-type banks have to incur when they liquidate firm *i*. The payoffs of the two types are the same when there is no default or the current obligations of firms are reduced, given by (D_i+rD_i) and $(1-\delta_i)(D_i+rD_i)$ respectively, where $\delta_i(D_i+rD_i)$ gives the amount of the

reduction in the principal and interest payments of firm *i*.

It is assumed that $(1-\delta_i)(D_i+rD_i)$ is less than $(1-\alpha_i)(D_i+rD_i)$ so that it is profitable for the strong-type bank to liquidate the insolvent firm whenever it defaults on its current obligations. However, it is more costly for the weak-type to liquidate the insolvent firm than to reduce its obligations so that $(1-\delta_i)(D_i+rD_i)$ is greater than $(1-\lambda_i)(D_i+rD_i)$. As will be discussed later in this chapter the value of δ_i is determined by firm *i*. It is important to note that the reduction ratio δ_i cannot be less than δ_i^* where $(1-\delta_i^*)$ is the maximum proportion of the firm's current obligations which it can meet. It is assumed that even if $\delta_i=\delta_i^*$ the payoffs are such that $(1-\lambda_i)(D_i+rD_i)<(1-\delta_i^*)(D_i+rD_i)<(1-\alpha_i)(D_i+rD_i)$. The corresponding payoffs to the insolvent firm and the bank which can be of two types, depending upon the actions they choose, are given in Table 4.1.[6]

Table 4.1 Payoffs to an Insolvent Firm and a Bank Which Can be of Two Types

Decisions		*Insolvent Firm$_i$*	*Strong Bank*	*Weak Bank*
Voluntary Liquidation		$(1-\varepsilon_i)\theta_i-(D_i+rD_i)$	D_i+rD_i	D_i+rD_i
Default	*Accept*	$\theta_i-(1-\delta_i)(D_i+rD_i)$	$(1-\delta_i)(D_i+rD_i)$	$(1-\delta_i)(D_i+rD_i)$
	Reject	0	$(1-\alpha_i)(D_i+rD_i)$	$(1-\lambda_i)(D_i+rD_i)$

Notes: $\alpha_i<\delta_i<\lambda_i$ where i=1,2.

[6]It may be argued that debt obligations of financially distressed firms can be rescheduled by banks given that firms are solvent on a *stock basis*. This option can be incorporated into the model by replacing *voluntary liquidation* option by *debt rescheduling* and setting ε_i=0. This would not change the implications of the model substantially and the model could be reinterpreted accordingly. In this case it is still possible that firms can credibly threaten banks to default as long as $(1-\delta_i)(D_i+rD_i)$ exceeds $(1-\lambda_i)(D_i+rD_i)$ and there is a sufficient probability of the bank being of weak-type.

In the model, firms cannot identify which type of the bank they deal with. That is, there is informational asymmetry between the bank and firms about the characteristics of the bank. The bank knows its own type, whereas firms observe only *a priori* distribution over the bank's type. It is common knowledge that the strong-type bank always liquidates firms which default on their obligations. Thus, by assessing the probability of the bank being of strong-type firms attach a credibility to the bank's actions. In this sense, this probability can be interpreted as the *reputation* of the bank. At time 1 firms have a prior probability of p_1, $p_1 \in (0,1)$, of the bank being a strong-type, and $(1-p_1)$ of the bank being a weak-type. At time 2, they update this probability to p_2 depending upon whether additional information is revealed about the bank's type at time 1. If there is no default at time 1, in which case the bank is not called upon to take an action, no additional information is observed by firm 2.

The equilibrium concept used in this model is based on the "sequential equilibrium" of Kreps and Wilson (1982). In the context of this finite horizon game analysed in this chapter, an equilibrium consists of a behaviour strategy by each player that satisfies the following conditions: (i) The choices made by the bank are best response to the firm's choices at each date, given the set of equilibrium beliefs formed by the firms in response to these choices; (ii) The beliefs of the firms are consistent with the bank's strategy, given the history of prior play and that the bank is a strong-type with probability p which is computed using Bayes' rule. Bayes' rule requires that

$$p_2 = \frac{Prob(liquidates \mid strong)\ Prob(strong)}{Prob(liquidates \mid strong)\ Prob(strong) + Prob(liquidates \mid weak)\ Prob(weak)}$$

and, since the strong-type bank always liquidates it reduces to

$$p_2 = \frac{p_1}{p_1 + \beta_1(1-p_1)} \tag{4.1}$$

where β_1 is the probability that weak-type bank liquidates firm 1 at time 1 and p_2 is the updated probability assessment that the bank is of strong-type. One interpretation of Bayes' rule might be that learning takes place in the form of using observation in order to form a better probability estimate of the type of the bank. In other words, by means of evidence, prior beliefs are converted into posterior beliefs. In the context of our model, a prior probability of p_1 at time 1 that the bank is a strong-type is converted to a posterior probability of p_2 after observing that the bank liquidates the insolvent firm at time 1.

The notion behind the game below is that a bank when facing firms in financial distress repeatedly may have incentives to develop a reputation for being tough against these firms. The idea is that if the bank always plays in the same way (liquidates when firms default on their debt), other financially distressed firms will expect the bank to continue to play in the same way in the future and will adjust their own strategy accordingly. The question is then whether and under which conditions it is desirable and possible for the bank to develop the reputation it desires. The rest of this section attempts to answer this question.

We can now outline the game starting by explaining how p_2 is computed. If firm 1 does not default at time 1, no additional information is revealed about the type of the bank and hence p_2 is set to be equal to the initial assessment (reputation) given by p_1. If either p_1=0 or firm 1 defaults and is not liquidated by the bank, this reveals the type of the bank as weak and hence p_2=0. If, however, default is met by legal action and p_1>0, then the initial

probability that the bank is a strong-type is updated by Bayes' rule. Since, given that the bank liquidates firm 1 at time 1, the main motivation of the bank is to deter firm 2 from defaulting one should start by analysing how firm 2's decision is determined at time 2.

4.2.1 Strategy of Firm 2

If firm 2 decides to default it nets from defaulting

$$p_2(0) + (1-p_2)[\theta_2-(1-\delta_2)(D_2+rD_2)] \tag{4.2}$$

where p_2 is the probability at time 2 that the bank is of strong-type. If it defaults and the bank is of strong-type the payoff of firm 2 is zero and $\theta_2-(1-\delta_2)(D_2+rD_2)$ if the bank is of weak-type. p_2 plays a crucial role in decision making of firm 2 since it is common knowledge that, at time 2 which is the last period, the strong-type bank certainly liquidates the insolvent firm whereas the weak-type bank does not since it is more costly to do so and there are no further periods to enjoy the reputation for being of strong-type. Firm 2 defaults if its expected payoff from defaulting, given by (4.2), exceeds its payoff from liquidating itself voluntarily. That is, it defaults if the following inequality holds

$$(1-p_2)[\theta_2-(1-\delta_2)(D_2+rD_2)] > (1-\varepsilon_2)\theta_2-(D_2+rD_2) \tag{4.3}$$

From the above inequality one can derive a critical value of p_2, below which firm 2 decides to default, which is given as

$$\bar{p}_2 = \frac{\varepsilon_2\theta_2 + \delta_2(D_2+rD_2)}{\theta_2-(1-\delta_2)(D_2+rD_2)} \tag{4.4}$$

Thus, financially distressed firm 2 decides to default if

$$p_2 < \frac{\varepsilon_2\theta_2 + \delta_2(D_2+rD_2)}{\theta_2-(1-\delta_2)(D_2+rD_2)} \tag{4.5}$$

and does not default if the inequality is reversed.[7] If $p_2=\bar{p}_2$ the firm 2 randomizes , i.e. it is indifferent between defaulting and liquidating itself voluntarily. In this case the expected payoffs from defaulting and voluntary liquidation are the same. This can be explained referring to Figure 4.1 where the horizontal axis gives the probability of the bank being of strong-type, p_2, and the vertical axis the difference between the expected payoff to firm 2 under default, $(1-p_2)[\theta_2-(1-\delta_2)(D_2+rD_2)]$, and its payoff under voluntary liquidation, $(1-\varepsilon_2)\theta_2-(D_2+rD_2)$. As p_2 increases the expected gain from defaulting decreases and becomes zero when $p_2=\bar{p}_2$. As long as the reputation of the bank for being of strong-type, given by p_2, is less than $\bar{p}_2$, the expected payoff from defaulting exceeds that from voluntary liquidation and hence firm 2 defaults. When $p_2>\bar{p}_2$ firm 2 does not default since its expected payoff from doing so is less than its payoff under voluntary liquidation. If, in the extreme case, $p_2=1$ then the difference between the two payoffs reaches its maximum and becomes $-(1-\varepsilon_2)\theta_2+(D_2+rD_2)$ which shows that by defaulting against the strong bank the insolvent firm loses the amount it would have received under voluntary liquidation.

[7]So far it has been assumed that the firm's payoff from voluntary liquidation is positive, i.e. $(1-\varepsilon_2)\theta_2-(D_2+rD_2)>0$. However, it might be the case that the proceeds of the voluntary liquidation, $(1-\varepsilon_2)\theta_2$, might fall below the firm's total obligations, (D_2+rD_2). This might happen, for example, when the liquidation costs, $\varepsilon_2\theta_2$, or the total obligations of the firm are large enough so that the firm gets nothing upon a voluntary liquidation. Then, the inequality (4.3) always holds since the left hand side is positive as long as p_2 is not one. This is because $[\theta_2-(1-\delta_2)(D_2+rD_2)]$ is always greater than zero (it would not be rational for the firm to ask a reduction which would not lead to a positive payoff). Thus, in this case firm 2 would default even if p_2 is very big. However, in the rest of the chapter we continue to assume that the payoffs to the insolvent firms from liquidating themselves voluntarily are positive.

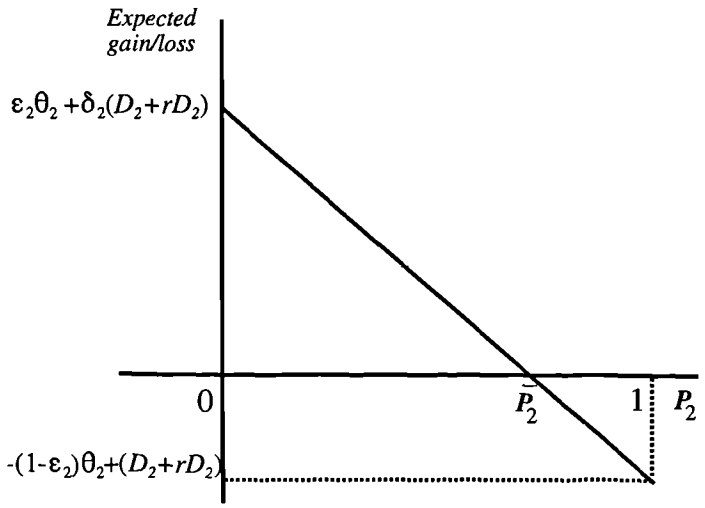

Figure 4.1 *Expected Gain from Defaulting*

It might be useful at this point to discuss the determinants of the critical probability, $\bar{p}_2$. The value of $\bar{p}_2$ changes with changes in the ratio of the costs of voluntary liquidation, ε_2, the going-concern value of the firm, θ_2, and the total of principal and interest payments, (D_2+rD_2). For example, $\bar{p}_2$ increases if ε_2 rises, *ceteris paribus*. This is because the difference between what firm 2 gets under restructuring and what it receives under voluntary liquidation, given by the numerator in (4.4), gets larger.[8] This implies that, given the reputation of the bank being of strong-type, the probability that firm 2 will default increases. This can be seen in Figure 4.1 as $\bar{p}_2$ moves to the right towards 1. It is also clear from Figure 4.1 that the point at which the difference line intersects the vertical axis shifts upwards as ε_2 increases. Similarly, an increase in (D_2+rD_2) or a decrease in θ_2 leads to an increase in the critical probability. In the former case, the numerator increases whereas the

[8]Note that the increase in the difference is due to the decrease in the payoff under voluntary liquidation. The payoff under restructuring, given by the denominator, remains the same.

denominator decreases. This in turn implies that the higher the insolvent firm's debt is the higher the probability is that it will default on its debt in financial distress. In the latter case, a decrease in θ_2 decreases both the numerator and the denominator. However, the change in the value of the numerator is less than that of the denominator so that the overall probability increases. The interpretation of this result might be that financially distressed firms might be more willing to take the risk of being liquidated compulsorily as the continuation value of their assets decreases, *ceteris paribus*. To summarise, default is more likely for those financially distressed firms which have to incur relatively high costs under voluntary liquidation, have low going-concern value and/or large amount of debt.

It is discussed above that one of the determinants of $\bar{p}_2$ is the costs of voluntary liquidation and argued that the probability of firm 2 defaulting rises when ε_2 increases. This is also true for the costs of compulsory liquidation. As will be explained later in this chapter the value of δ_2 is directly related to the ratio of the costs of compulsory liquidation, λ_2. That is, if the costs of compulsory liquidation increases then the reduction asked by firm 2 also increases, which in turn raises $\bar{p}_2$. One important implication of this result is that firms with those assets whose values substantially decrease in liquidation (voluntary or compulsory) are more likely to default when they are in financial distress.

4.2.2 Strategy of the Bank

As mentioned earlier, the strong-type bank always liquidates the insolvent firm which defaults because the return from liquidating the insolvent firm, $(1-\alpha_i)(D_i+rD_i)$, is always greater than the return from accepting to reduce its debt obligations, $(1-\delta_i)(D_i+rD_i)$. If the bank is weak, however, there are several cases to consider when the financially distressed

firm decides to default. The weak bank's response depends on the date, t, and p_t.

(i) If t=2, the weak-type bank does not liquidate the firm which defaults, since the liquidation is more costly, and there are no reputation effects to consider beyond time 2. The weak-type bank always finds it advantageous to reduce the insolvent firm's debt at time 2. It maximizes its payoff in the last period by accepting to reduce the firm's obligations. The weak-type bank liquidates the insolvent firm only if the payoff from liquidation exceeds what it gets when it accepts to reduce the obligations of firm 2 which can be stated as

$$(1-\lambda_2)(D_2+rD_2) > (1-\delta_2)(D_2+rD_2) \qquad (4.6)$$

This condition does not hold since $\lambda_2>\delta_2$. That is why the weak-type bank never liquidates the insolvent firm in the last period. The value to the bank at time 2, $v_b(t=2,p_2)$, depends on the probability that the bank is of strong-type, p_2. It is given as

(D_2+rD_2)	if	$p_2>\bar{p}_2$	(firm 2 voluntarily liquidates)
$(1-\delta_2)(D_2+rD_2)$	if	$p_2<\bar{p}_2$	(firm 2 defaults)
$(1-\delta_2/2)\ (D_2+rD_2)$	if	$p_2=\bar{p}_2$	(firm 2 is indifferent)[9]

(ii) If t=1, the bank must consider the impact of its current action at time 2. Since the bank's return is higher at time 2 if firm 2 believes that it is of strong-type, the weak-type bank has an incentive to act as though it is a strong-type and to liquidate firm 1 at time 1.

[9]It should be noted that when $p_2=\bar{p}_2$ firm 2 is indifferent and defaults with probability 1/2 and hence the value to the weak bank becomes $1/2(D_2+rD_2)+1/2(1-\delta_2)(D_2+rD_2)$ which gives $(1-\delta_2/2)\ (D_2+rD_2)$.

The total expected return to the bank, when firm 1 defaults, takes the form of

$$E_b(t=1,p_1)) = \beta_1[(1-\lambda_1)(D_1+rD_1)] + (1-\beta_1)[(1-\delta_1)(D_1+rD_1)] + \beta_1 v_b(t=2,p_2) + (1-\beta_1)[(1-\delta_2)(D_2+rD_2)] \quad (4.7)$$

The last term in (4.7) shows that if the bank fails to liquidate firm 1 at time 1, which occurs with the probability $(1-\beta_1)$, then the bank's type is revealed as weak and hence the reputation for being strong is lost. It follows that firm 2 chooses to default at time 2 expecting that the bank will reduce its obligations and the bank accepts to reduce. Thus, the payoff to the bank in the last period becomes $(1-\delta_2)(D_2+rD_2)$. The penultimate term, on the other hand, reflects the probability of liquidating the insolvent firm at time 1 and corresponding payoff at time 2 associated with a reputation p_2. Equation (4.7) can be rearranged as the following

$$E_b(t=1,p_1) = \beta_1[v_b(t=2,p_2)+(D_1+rD_1)(\delta_1-\lambda_1)-(1-\delta_2)(D_2+rD_2)] + (1-\delta_1)(D_1+rD_1) + (1-\delta_2)(D_2+rD_2) \quad (4.8)$$

As explained earlier the bank is entitled to get $v_b(t=2,p_2)$ at time 2 when it liquidates the insolvent firm at time 1. Since the value of $v_b(t=2,p_2)$ depends on p_2 the bank is concerned about how its decision at time 1 affects its reputation at time 2, which is given by p_2. Three different cases might arise depending upon the value of the initial probability of the bank being of strong-type, p_1, and its relation to the critical value of the probability, $\bar{p}_2$, above which the insolvent firm at time 2 chooses to liquidate itself voluntarily.

(a) If $p_1 > \bar{p}_2$ the posterior probability of the weak-type bank being of strong-type,

given that it liquidates firm 1, will be at least p_1 (i.e., $p_2=max(p_1,\bar{p}_2)$) since the strong-type bank always liquidates. Liquidating firm 1 prevents firm 2 from defaulting because it is known from the above analysis that firm 2 does not default when $p_2 > \bar{p}_2$ (note that $p_2=p_1 > \bar{p}_2$). Although the reputation of the bank does not change it is sufficient to ensure that firm 2 expects to be liquidated when it defaults. The behaviour of the weak-type bank may be explained as follows. Since p_1, the initial probability that the bank is of strong type, is high enough the insolvent firm at time 2 will believe that it faces a strong-type bank if the bank has liquidated the insolvent firm at time 1. This gives the weak-type bank a strong incentive to maintain its reputation at time 1 when it decides whether to liquidate firm 1. However, although it ensures that firm 2 will not default given that the bank liquidates firm 1, p_1 is not alone sufficient to explain the strategy of the bank at time 1. Whether the bank liquidates the insolvent firm 1 at time 1 also depends on the value inside the square bracket. It must be greater than or equal to zero for β_1 being equal to one since β_1 is chosen to maximise (4.8). That is, the following inequality must hold

$$v_b(t=2,p_2)+(D_1+rD_1)(\delta_1-\lambda_1)-(1-\delta_2)(D_2+rD_2) \geq 0 \qquad (4.9)$$

It is known that $v_b(t=2,p_2)$ is (D_2+rD_2) when $p_2>\bar{p}$. Then, (4.9) can be rearranged as

$$\delta_2(D_2+rD_2) \geq (D_1+rD_1)(\lambda_1-\delta_1) \qquad (4.10)$$

The interpretation of this result is useful.[10] Here, $\delta_2(D_2+rD_2)$ can be interpreted as the

[10]The condition given in (4.10) can alternatively be derived by considering the returns of the bank. The bank's total return is $(1-\lambda_1)(D_1+rD_1)+(D_2+rD_2)$ if it liquidates firm 1 when $p_1>\bar{p}_2$ (since firm 2 voluntarily liquidates at time 2). On the other hand, the weak-type bank receives $(1-\delta_1)(D_1+rD_1)+(1-\delta_2)(D_2+rD_2)$ if it does not liquidate

amount of the loss which the weak-type bank has to incur at time 2 if it fails to liquidate firm 1. This is because firm 2, knowing that the bank is of weak-type and hence does not choose to liquidate the insolvent firm in the last term, certainly defaults on its debt obligations.[11] $(D_1+rD_1)(\lambda_1-\delta_1)$, on the other hand, can be seen as the bank's loss at time 1 from liquidating firm 1. The trade-off which the weak-type bank faces should be now clear. The bank chooses to liquidate the insolvent firm at time 1 in order to keep its reputation towards firm 2 only if the cost of doing so is less than or equal to the cost of not doing. It should be clear from (4.10) that for (D_1+rD_1) and/or λ_1 big enough the bank's loss from liquidating firm 1 exceeds the loss it incurs when it does not liquidate firm 1. In this case the liquidation costs which the weak-type bank has to incur by liquidating firm 1 are more important than its reputation which will prevent firm 2 from defaulting. Therefore, the bank decides not to liquidate firm 1 even though $p_1>\bar{p}_2$. This can be clarified further by rearranging (4.10) as the following

$$\frac{\delta_2}{\lambda_1-\delta_1} \geq \frac{D_1+rD_1}{D_2+rD_2} \tag{4.11}$$

Now, the LHS of the inequality (4.11) is the ratio of the proportional loss incurred at time 2 (if not liquidate firm 1) to the proportional loss incurred at time 1 (if liquidate firm 1). The RHS of (4.11), on the other hand, gives the ratio of total current obligations of firm 1 to firm 2's. It is clear that even if the proportional loss at time 2 is higher than the proportional loss at time 1 the weak-type bank might still not want to liquidate firm 1. This occurs when

---

firm 1. Therefore, the bank decides to liquidate firm 1 at time 1 only if $(1-\lambda_1)(D_1+rD_1)+(D_2+rD_2) \geq (1-\delta_1)(D_1+rD_1)+(1-\delta_2)(D_2+rD_2)$ which also yields (4.10).

[11] $\delta_2(D_2+rD_2)$ can also be interpreted as the gain of the bank from liquidating firm 1 given that firm 2 does not default and liquidates itself voluntarily.

the total obligation of firm 1 is relatively higher enough than that of firm 2 so that the advantage of liquidating firm 1 is offset.[12]

(b) If $0< p_1< \bar{p}_2$, it is not an equilibrium strategy for the weak-bank to liquidate the insolvent firm at time 1 with probability one. This is because, when $\beta_1=1$, the posterior probability that the bank is a strong-type after liquidating would not deter firm 2 from defaulting.[13] In this case, the bank would prefer not to liquidate. Also, it is not the case that if $p_1<\bar{p}_2$ the weak-type bank will always accept to reduce the insolvent firm's debt obligations (i.e. $\beta_1=0$). If this were the case, the gain from liquidating firm 1 would be high since it would make firm 2 believe that the bank is of strong type and the bank would enjoy a higher return at time 2. Therefore, the equilibrium must involve mixed strategies when $0< p_1< \bar{p}_2$. The weak-type bank must randomize in a way that makes firm 2 indifferent between defaulting and voluntary liquidation. This requires that the posterior probability that the bank is strong-type, p_2, conditional on liquidating, be exactly the critical level, $\bar{p}_2$. β_1, the probability that the weak-type bank liquidates firm 1 at time 1, at which the posterior probability p_2 is equal to the critical value $\bar{p}_2$, can be derived from the following

[12]So far it has been assumed that firm 1 and firm 2 are different in terms of the size of their obligations to the bank. It is also worth considering the case under which they are the same. In this case (4.10) becomes $\lambda_1 \leq (\delta_1+\delta_2)$. Now, the size of the firms' debts does not matter. What matters is the proportional liquidation costs together with the reductions from the obligations of the firms required by firm 1 and firm 2, δ_1 and δ_2 respectively. If λ_1 is less than or equal to the total of δ_1 and δ_2 then the bank gains from liquidating firm 1 at time 1. If, on the other hand, λ_1 exceeds $(\delta_1+\delta_2)$ it is not the best strategy for the bank to liquidate firm 1 since the costs of doing it is greater than the costs of not doing so.

[13]From Bayes' rule, recalling that the strong bank liquidates with probability 1, it can be seen that the posterior probability for being a strong-type, p_2, would be equal to p_1 which would not deter the insolvent firm from defaulting in the last period.

$$\frac{p_1}{p_1+\beta_1(1-p_1)} = \bar{p}_2 \tag{4.12}$$

$$\beta_1 = \frac{p_1(1-\bar{p}_2)}{\bar{p}_2(1-p_1)} \tag{4.13}$$

That is, the weak-type bank liquidates firm 1 with the probability $p_1(1-\bar{p}_2)/\bar{p}_2(1-p_1)$ and accept to reduce its obligations with the complementary probability.[14] When the bank liquidates firm 1, its reputation for being of strong-type rises to $\bar{p}_2$ at time 2. It is clear from (4.13) that, since $p_1 < \bar{p}_2$, β_1 is strictly less than one. This implies that reputation is only enhanced ($p_2 > p_1$ given that the bank liquidates) if the weak bank liquidates the insolvent firm with a probability less than one. Nevertheless, it is not certain that liquidating firm 1 will deter firm 2 from defaulting. Firm 2 either defaults or voluntarily liquidates with probability 1/2 since $p_2=\bar{p}_2$. In other words, p_2 is not sufficient to deter firm 2 from defaulting. So, (4.7) which gives the total expected return to the bank, when firm 1 defaults, becomes

$$\begin{aligned} E_b(t=1,p_1) &= (1-\delta_1)(D_1+rD_1)+(1-\delta_2)(D_2+rD_2) \\ &+ \beta_1[(1-\frac{\delta_2}{2})(D_2+rD_2)+(\delta_1-\lambda_1)(D_1+rD_1)-(1-\delta_2)(D_2+rD_2)] \end{aligned} \tag{4.14}$$

since, when $p_2=\bar{p}_2$, $v_b(t=2,p_2)$ is $(1-\delta_2/2)(D_2+rD_2)$. Now, for β_1 given by (4.13) to be an equilibrium solution the following must hold

[14]It follows from (4.13) that when $p_1=0$, the probability of liquidating is zero and one when $p_1=\bar{p}_2$.

$$(1-\frac{\delta_2}{2})(D_2+rD_2)+(\delta_1-\lambda_1)(D_1+rD_1)-(1-\delta_2)(D_2+rD_2) \geq 0 \qquad \textbf{(4.15)}$$

which in turn gives the following

$$\frac{\delta_2}{2}(D_2+rD_2) \geq (\lambda_1-\delta_1)(D_1+rD_1) \qquad \textbf{(4.16)}$$

Once again, the LHS of (4.16) gives the loss which the bank will incur at time 2 if it fails to liquidate firm 1 at time 1. However, this is now less than $\delta_2(D_2+rD_2)$ given in (4.10) because of the uncertainty about whether firm 2 voluntarily liquidates at time 2 when the bank liquidates firm 1 at time 1. Firm 2 randomizes between defaulting and liquidating voluntarily with probability 1/2. The RHS of (4.16) is the same as earlier; the loss of the bank from liquidating firm 1. β_1 which is given by (4.13) is not an equilibrium probability if the inequality (4.16) does not hold. For example, when the loss which the weak-type bank has to incur at time 2 when it fails to liquidate firm 1, given by $\delta_2/2(D_2+rD_2)$, is less than the loss it has to incur by liquidating firm 1, given by $(\lambda_1-\delta_1)(D_1+rD_1)$, then $\beta_1=0$.

(c) If $p_1=\bar{p}_2$ then the bank liquidates firm 1 with probability one, i.e., $\beta_1=1$. Again, β_1 is an equilibrium probability only if the following inequality holds

$$\frac{\delta_2}{2}(D_2+rD_2) \geq (\lambda_1-\delta_1)(D_1+rD_1) \qquad \textbf{(4.17)}$$

It is important to note the difference between the conditions given in (4.10) and (4.17). In (4.10) the gain from liquidating is $\delta_2(D_2+rD_2)$ whereas it is given by $\delta_2/2(D_2+rD_2)$ in (4.17).

The latter is less than the former because of the probability that firm 2 might not default when $p_2=\bar{p}_2$. One should remember that (4.10) is the condition when $p_1>\bar{p}_2$ and (4.17) is the relevant condition when $p_1=\bar{p}_2$. Thus, it follows that as the initial probability that the bank is of strong-type decreases, the loss incurred at time 2 when firm 1 is not liquidated at time 1 when it defaults also diminishes. Alternatively, by defining $\delta_2(D_2+rD_2)$ as the proportional gain from liquidating firm 1, it can be said that the gain from liquidating firm 1 at time 1 in order to get a reputation for being of strong-type diminishes as the initial probability that the bank is of strong-type decreases.

4.2.3 Strategy of Firm 1

The total probability that firm 1 will be liquidated when it defaults is

$$p_1(1) + (1-p_1)[\frac{p_1(1-\bar{p}_2)}{\bar{p}_2(1-p_1)}] \tag{4.18}$$

which reduces to

$$p_1 / \bar{p}_2 \tag{4.19}$$

Then, the expected payoff to the insolvent firm 1 from defaulting at time 1 is given by

$$\frac{p_1}{\bar{p}_2}(0) + (1-\frac{p_1}{\bar{p}_2})(\theta_1-(1-\delta_1)(D_1+rD_1)) \tag{4.20}$$

Firm 1 defaults if its expected payoff from defaulting exceeds what it gets under voluntary liquidation. That is, firm 1 defaults if the following inequality holds

$$(1-\frac{p_1}{\bar{p}_2})(\theta_1-(1-\delta_1)(D_1+rD_1)) > (1-\varepsilon_1)\theta_1-(D_1+rD_1) \tag{4.21}$$

which can alternatively be written as follows

$$p_1 < [\frac{\varepsilon_1\theta_1+\delta_1(D_1+rD_1)}{\theta_1-(1-\delta_1)(D_1+rD_1)}]\,[\frac{\varepsilon_2\theta_2+\delta_2(D_2+rD_2)}{\theta_2-(1-\delta_2)(D_2+rD_2)}] = \bar{p}_1 \tag{4.22}$$

since

$$\bar{p}_2 = \frac{\varepsilon_2\theta_2 + \delta_2(D_2+rD_2)}{\theta_2-(1-\delta_2)(D_2+rD_2)} \tag{4.23}$$

Firm 1 liquidates voluntarily if the inequality in (4.22) is reversed.[15] It can be seen from (4.21) that an increase in $\bar{p}_2$ leads to an increase in the expected payoff to the insolvent firm 1 from defaulting, given by the LHS of the inequality. This is due to the decrease in the probability that the firm will not be liquidated when it defaults, which is given by $(1-p_1/\bar{p}_2)$. This implies that the probability of firm 1 defaulting increases as $\bar{p}_2$ increases. It follows, then, that any factor which increases (decreases) $\bar{p}_2$ also increases (decreases) $\bar{p}_1$. This is not a surprising result and can be explained intuitively as follows. If the critical probability which deters firm 2 from defaulting increases this means that it is now more difficult for the bank to deter firm 2. Therefore, the bank is less willing to establish the reputation. As can

[15] Note that if the two firms are similar in the sense that $(D_1+rD_1)=(D_2+rD_2)$, $\theta_1=\theta_2$, $\varepsilon_1=\varepsilon_2$, $\delta_1=\delta_2$ then the RHS of (4.22) reduces to $(\bar{p}_2)^2$.

be seen from (4.22) the analysis carried out earlier for firm 2 is also valid for firm 1. The critical level of the probability of the bank being of strong-type, below which firm 1 chooses to default is less than $\bar{p}_2$ which is the minimum probability level needed to prevent firm 2 from defaulting. (This is because $\varepsilon_i\theta_i+\delta_i(D_i+rD_i)$ is less than $\theta_i-(1-\delta_i)(D_i+rD_i)$. This implies that as the number of firms which the bank meets sequentially increases the level of probability which defers insolvent firms from defaulting decreases. The important point is that even for very small initial probability, the reputation effect might work in very early periods so that more financially distressed firms choose to voluntarily liquidate themselves. This can be better seen when we extend the analysis to include N firms in section 4.3.

4.2.4 Determination of Debt-reduction Ratio δ_i

So far little has been said about how insolvent firms decide on the reduction of their debt obligations, δ_i. The nature of the decision making about this variable changes between firm 1 and firm 2. It is known that in the last period the strategy of the bank is determined by only its type. That is, the strong-type liquidates firm 2 whereas the weak-type accepts to reduce the firm's obligations when it defaults. Therefore, for firm 2 the best strategy is to choose the highest δ_2 at which $(1-\delta_2)(D_2+rD_2)$ is still greater than $(1-\lambda_2)(D_2+rD_2)$. That is, δ_2 is chosen to be marginally less than λ_2 so that the weak-type bank still prefers not to liquidate firm 2. This choice maximizes the expected payoff of firm 2. The value of δ_2 does not affect the decision of strong-type bank since $(1-\alpha_2)(D_2+rD_2)$ remains to be higher than $(1-\delta_2)(D_2+rD_2)$. However, firm 1's choice of δ_1 is not as straightforward as the choice of δ_2 by firm 2. This is because in some cases the value of δ_1 affects the weak-type bank's decision. For example, as already shown in the analysis above, when $p_1>\bar{p}_2$ the best strategy for the weak-type bank is to liquidate firm 1 with probability one when it defaults, given that

(4.10) holds. It is clear that as long as $\delta_2(D_2+rD_2) \geq \lambda_1(D_1+rD_1)$ inequality (4.10) holds whatever the value of δ_1 is. Since the gain from deterring firm 2 from defaulting is even higher than the maximum loss which the bank can incur the postulated strategy $\beta_1=1$ is the equilibrium strategy. In this case, δ_1 can take any value between δ_1^* and 1, and the firm is liquidated if it defaults. However, if $\delta_2(D_2+rD_2)<\lambda_1(D_1+rD_1)$ then firm 1 has an opportunity to choose δ_1 such that it is not the best strategy anymore for the bank to liquidate with probability one. In fact, the probability becomes zero. In order for this to happen the following must hold

$$\delta_1(D_1+rD_1) < \lambda_1(D_1+rD_1)-\delta_2(D_2+rD_2) \tag{4.24}$$

i.e. the amount of the reduction asked by firm 1 must be less than the difference between the costs of compulsory liquidation of firm 1's assets and the amount of reduction asked by firm 2.[16] Again δ_1 can not be less than δ_1^* and firm 1 chooses the highest value of δ_1 at which (4.24) still holds. As long as this condition holds the strategy of firm 1 is determined in the same way as that of firm 2. That is, the only concern for firm 1 is the initial probability of the bank being of strong-type, p_1. Firm 1 decides to default if the following inequality holds

$$p_1(0)+(1-p_1)[\theta_1-(1-\delta_1)(D_1+rD_1)] > (1-\varepsilon_1)\theta_1-(D_1+rD_1) \tag{4.25}$$

[16]Note that for the cases $0<p_1<\bar{p}_2$ and $p_1=\bar{p}_2$ the inequality in (4.24) takes the form of

$$\delta_1(D_1+rD_1) < \lambda_1(D_1+rD_1)-\delta_2/2(D_2+rD_2)$$

from which $\bar{p}_1$ below which firm 1 decides to default can be derived as

$$\bar{p}_1 = \frac{\varepsilon_1\theta_1 + \delta_1(D_1+rD_1)}{\theta_1-(1-\delta_1)(D_1+rD_1)} \tag{4.26}$$

which is very similar to $\bar{p}_2$ given in (4.6).

For larger λ_1 and (D_1+rD_1) it is more likely that $\lambda_1(D_1+rD_1)$ will be greater than $\delta_2(D_2+rD_2)$. As shown above, if this holds the reputation acquisition towards firm 2 is not worth when firm 1 defaults. The implication of this result is that firms imposing relatively high costs on banks in liquidation and/or having high amount of debt are more powerful in bargaining with banks in financial distress.

4.3 Generalization of the Basic Model

The analysis so far, for simplicity, has considered decisions of the bank facing only two firms at time 1 and 2. The analysis can easily be extended to include more firms. In the following it is assumed that there are N firms and the bank whose type is not known by the firms faces these financially distressed firms sequentially, i.e. it faces firm N at time T, firm N-1 at time T-1 and so on.

4.3.1 Strategy of Insolvent Firms

Insolvent firms take the reputation of the bank into account when deciding whether to default on their obligations or to voluntarily liquidate. That is, financially distressed firm i decides to default at time t if the reputation of the bank for being a strong-type, p_t, is less than $\bar{p}_t$ which is given by

$$\prod_{i=1}^{T-t+1} \left[\frac{\varepsilon_i\theta_i + \delta_i(D_i+rD_i)}{\theta_i-(1-\delta_i)(D_i+rD_i)}\right] \tag{4.27}$$

where t=1,...,T and i=1,...,N. If, on the other hand, $p_t>\bar{p}_t$, then the insolvent firm i liquidates itself voluntarily. And if $p_t=\bar{p}_t$ the firm randomises between defaulting and liquidating.

4.3.2 Strategy of the Bank

It is known that if the bank is a strong-type it always liquidates the insolvent firm. If, however, the bank is a weak-type, its decision depends upon its reputation p_t. If $\bar{p}_{t+1}<p_t<\bar{p}_{t+2}$ so that the reputation is sufficient to deter the insolvent firm from defaulting at time t+1 (i.e. reputation is too high to destroy), then the bank liquidates firm i with certainty (i.e. β_t=1) where

$$\bar{p}_{t+1} = \prod_{i=1}^{T-t} \left[\frac{\varepsilon_i\theta_i + \delta_i(D_i+rD_i)}{\theta_i-(1-\delta_i)(D_i+rD_i)}\right] \tag{4.28}$$

As discussed earlier for β_t=1 to be an equilibrium probability one must compare the returns of the bank under alternative strategies. In deciding whether to liquidate the insolvent firm i at time t the weak bank needs only to compare the return from accepting to reduce the insolvent firm's obligations at t,...,T to the return from liquidating the insolvent firm i at time t and accepting to reduce the obligations of firms at t+1,...,T.[17] If the latter exceeds or equal to the former, then the bank liquidates the insolvent firm. That is, for β_t to be one the following must hold

[17]Note that in later periods when the current reputation p_t is less than the critical level of probability of the next period $\bar{p}_{t+1}$ the bank liquidates with a positive probability less than one at which the return from liquidating is equal to the return from reducing the insolvent firm's obligations.

$$(1-\lambda_i)(D_i+rD_i)+(D_{i+1}+rD_{i+1})+\sum_{s=i+2}^{N}(1-\delta_s)(D_s+rD_s) \geq \sum_{s=i}^{N}(1-\delta_s)(D_s+rD_s) \tag{4.29}$$

which gives

$$\delta_{i+1}(D_{i+1}+rD_{i+1}) \geq (\lambda_i-\delta_i)(D_i+rD_i) \tag{4.30}$$

Now, suppose that $\bar{p}_{t+k}<p_t<\bar{p}_{t+k+1}$. The bank again needs to compare the returns under alternative strategies. In this case, for $\beta_t=1$ to be an equilibrium strategy the following must hold

$$(1-\lambda_i)(D_i+rD_i)+\sum_{s=i+1}^{i+k}(D_s+rD_s)+\sum_{s=i+k+1}^{N}(1-\delta_s)(D_s+rD_s) \geq \sum_{s=i}^{N}(1-\delta_s)(D_s+rD_s) \tag{4.31}$$

which gives

$$\sum_{s=i+1}^{i+k}\delta_s(D_s+rD_s) \geq (\lambda_i-\delta_i)(D_i+rD_i) \tag{4.32}$$

As earlier the LHS of the above inequality can be interpreted as the total gain of the weak bank from liquidating the insolvent firm *i* at time *t* given that the insolvent firms from time *t*+1 to *t*+*k* do not default on their debt obligations and liquidate themselves voluntarily. They voluntarily liquidate because the reputation of the bank at time *t* for being a strong

type, p_t, is sufficient to deter firms from defaulting.

If $0<p_t<\bar{p}_{t+1}$, the weak bank randomizes in a way that makes the insolvent firm at time $t+1$ indifferent between defaulting on its debt obligations and liquidating itself voluntarily. That is, it liquidates the insolvent firm i with the following probability

$$\beta_t = \frac{p_t(1-\bar{p}_{t+1})}{\bar{p}_{t+1}(1-p_t)} \tag{4.33}$$

Now the following must hold for β_t to be an equilibrium strategy

$$\begin{aligned}(1-\lambda_i)(D_i+rD_i)+\frac{1}{2}(D_{i+1}+rD_{i+1})+\frac{1}{2}(1-\delta_{i+1})(D_{i+1}+rD_{i+1})\\ +\sum_{s=i+2}^{N}(1-\delta_s)(D_s+rD_s) \geq \sum_{s=i}^{N}(1-\delta_s)(D_s+rD_s)\end{aligned} \tag{4.34}$$

which in turn gives

$$\frac{\delta_{i+1}}{2}(D_{i+1}+rD_{i+1}) \geq (\lambda_i-\delta_i)(D_i+rD_i) \tag{4.35}$$

Finally if $p_t=\bar{p}_{t+1}$ the weak bank liquidates the insolvent firm i with probability one, i.e. $\beta_t=1$. In this case $\beta_t=1$ is an equilibrium strategy only if

$$\frac{\delta_{i+1}}{2}(D_{i+1}+rD_{i+1}) \geq (\lambda_i-\delta_i)(D_i+rD_i) \tag{4.36}$$

4.4 Conclusions

This chapter has analysed the incentives of banks which face financially distressed firms by incorporating the reputation acquisition of banks. The analysis demonstrates that some banks (the weak-type ones which do not benefit from liquidating financially distressed firms in the short-run) have an opportunity and desire to establish a reputation for being tough against firms having financial difficulties. While the strong-type banks always choose to liquidate insolvent firms since this minimizes their loss, the weak-type banks determine their action against financially distressed firms by a trade-off between the costs of liquidating firms and the benefits of reputation acquisition. In response to higher expected payoffs from other troubled firms the "reputable" banks might liquidate firms inefficiently. That is, some firms which have continuation values greater than their liquidation values might be prematurely liquidated. This is one of the important implications of the analysis of this chapter.

Another implication is that small and medium firms are more likely to be liquidated when they have financial problems since the liquidation costs they impose on banks are negligible compared to those imposed by large firms. Thus, one should expect relatively more rescue attempts for large firms and more compulsory liquidations for small firms. It is important to note that although some small-medium firms might have very high leverage ratios, and some large firms low leverage ratios, the important aspect of debt for the present analysis is the size of debt, not its ratio.

This analysis might also shed some light on the relatively high number of voluntary liquidations. Firms expecting to be forced into liquidation by banks may choose to liquidate

themselves voluntarily since voluntary liquidations are less costly compared to compulsory liquidations. The analysis of this chapter also suggests that the costs of liquidation are crucial for the outcome of financial distress. Firms whose assets fetch relatively a low price under liquidation are more likely to default in financial distress and have more chance of their debt being restructured. This in turn implies that banks are less willing to lend to firms having mostly intangible assets (less marketable, firm-specific, growth opportunities, etc.) and tangible assets can support more debt in capital structure of firms.

The model has also implications for capital structure of firms. While the traditional theory of capital structure, which is based on the trade-off between the tax advantage of debt financing and the costs of financial distress, emphasizes the level of debt, the analysis of this chapter also points to the structure of debt. Although it has not been the main concern of the present analysis it is implied that the composition of debt (private vs public debt) can influence firms' default decisions. Since the possibility of renegotiation of bank loans is greater than that of public loans and there is a chance that banks respond to default by forgiving some part of the debt instead of imposing costly liquidation firms can strategically decide to default as a result of value maximising behaviour.

CHAPTER 5

ECONOMICS OF INSOLVENCY PROCEDURES AND INEFFICIENT COMPANY LIQUIDATIONS

5.1 Introduction

In the last two chapters we analysed the conflicting interests between firms and their creditors and their implications for financially distressed firms. This chapter, on the other hand, considers the incentives of the creditors of financially distressed firms and the role of insolvency procedures in creating these incentives. The procedures applied to business failures are thought to be at the centre of bankruptcy cost discussion for two reasons. Firstly, they might involve large direct costs such as fees paid to insolvency practitioners and expenses made during the formal procedures.[1] This aspect is important as the efficiency of any insolvency procedure should require that the procedure is not wasteful in terms of money and its length, which determines the ultimate costs borne by firms' claimants. Secondly, the insolvency law may lead to inefficient and premature liquidations of financially distressed but efficient companies. This might happen, for instance, under the existing UK procedures which emphasize the rights of creditors by giving them the right to recover their claims at the expense of other claimants.

This chapter focuses on the second aspect of the problem. More specifically, the main objective of this chapter is to extend the understanding of the role of insolvency procedures in the bankruptcy decision of the creditors of a financially distressed firm. In doing this, two main UK insolvency procedures; receivership and administration, are brought into the analysis. It is shown that the nature of these two insolvency procedures gives incentives to

[1] In recent years, there have been many examples of high insolvency fees in the UK. One of these is the collapse of the Bank of Credit and Commerce International (BCCI). The UK liquidation costs alone amounted to $133 million between July 1991 and January 1993. The liquidation of BCCI is an example of international liquidation and requires complex and long procedures. BCCI's liquidators estimated that creditors might have to accept to be paid only 30-40 per cent of their claims (Financial Times, 15 June 1993). Polly Peck International, the fruit, leisure, and electronics group, is another example where high professional fees have been charged by insolvency practitioners. To date, the administrators of Polly Peck have taken for themselves and lawyers at least £16 million in fees since October 1990 when the administrators were appointed (Financial Times, 15 May 1993).

the creditors of a distressed firm to choose receivership, which in most of the cases leads to the liquidation of the firm, even when the administration is a more efficient option. We also derive the conditions under which the above mentioned inefficient outcome takes place.

This chapter also stresses the importance of the type of assets owned by firms in the bankruptcy decision process. Although a number of authors (see, e.g., Titman and Wessels (1988), Williamson (1988), Shleifer and Vishny (1992) and Alderson and Betker (1995)) have argued the effects of the asset structure of a firm on its financial structure decision, to the best of our knowledge, no consideration has been given to the relationship between the asset structure and the bankruptcy decision of creditors. It is argued in this chapter that firms with a larger proportion of intangibles to total assets are more likely to be liquidated when they experience financial difficulties. This result largely derives from the view that under administration the probability of realising a higher value is not significant enough.

The remainder of this chapter proceeds as follows. Section 5.2 briefly discusses the importance of insolvency procedures in an economy and reviews the existing UK insolvency practices. Section 5.3 develops a model to show how the UK insolvency procedures might lead to premature and inefficient liquidations of distressed firms and discusses the determinants of an inefficient outcome as well as the role of asset structure. Finally, section 5.4 concludes the chapter.

5.2 Role of Bankruptcy Law and Existing UK Procedures

5.2.1 Role of Bankruptcy Law

It is argued that the general purpose served by a bankruptcy law is to help to complete very incomplete debt contracts by specifying contingencies in the event of insolvency (see, e.g., Aghion *et al* (1992, 1993)). Bankruptcy law determines the reallocation of claims to a debtor's assets in the event of default. It also specifies whether and how the control of assets is transferred by defining rights to future income streams. More specifically, a good insolvency procedure might achieve two main outcomes. First, by defining more precisely the creditors' property rights, they can lower the cost of writing contracts, which in turn should smooth the functioning of financial markets and increase the supply of funds relative to the supply in the absence of bankruptcy law. Second, an ideal insolvency law can improve the efficiency of resource allocation by limiting the debtor's rights to control the assets in all states of the world. This happens because it is believed that creditors, upon default, may force assets to be reallocated to more productive activities, which implies that firms with higher continuation values should continue and those with higher liquidation values should liquidate (value-maximising decision). However, it is also argued by Aghion *et al* (1992) that bankruptcy laws are far from achieving these goals in the sense that they either cause premature liquidations of healthy firms (as in Chapter 7 of the US Bankruptcy Code) or they are biased towards reorganisation under incumbent management (as in Chapter 11 of the US Bankruptcy Code).[2]

---

[2]At this point it might be useful to compare briefly the UK insolvency procedures and the US bankruptcy procedures. Two codes are similar in that creditors are paid the proceeds of the liquidation according to *the absolute priority rule* under which administrative expenses of the insolvency are paid first, claims for unpaid taxes and wages second, and the unsecured creditors third. Equity gets the residual, if any. Since the secured creditors have the claim on a particular asset of the company, they are outside the priority ordering. The main difference between the two codes is related to the objectives. In the US, the main objective is to maintain the business as a going concern, and hence the code has been designed to be highly *debtor-oriented.* If the company files under Chapter 11, managers remain in control of the firm and run the business while a reorganization plan is being

5.2.2 The UK Insolvency Procedures

The insolvency procedures in the UK must be supervised or implemented by an insolvency practitioner with one exception. This is "schemes under section 425 of the Companies Act" under which a company may institute a rescue plan with its creditors. Creditor agree not to take any legal action to recover their debts. The advantage of this arrangement is that once a three-quarters majority in value of the creditors vote in favour of it and the court sanctions the scheme it binds all creditors and hence the agreement cannot be upset by any dissenting creditor. However, it is complex and expensive since it involves an application to court, a calling of meetings of creditors and passing of resolutions. The UK insolvency procedures fall into four main categories: liquidation, receivership, administration, and company voluntary arrangement.

5.2.2.1 Liquidation

Liquidation is the process whereby the company's assets are sold and distributed to claim holders according to their legal entitlements. Liquidators can be appointed by the directors of the company. This is known as *creditors' voluntary liquidation* which is the most commercially effective and hence the most resorted corporate insolvency procedure. There is no need for an application to court and it is the best alternative if there is little or no possibility of rescuing the business and selling it as a going concern. If the directors fail to

---

prepared. Most importantly, all payments of principal and interest on debt cease once in Chapter 11. The directors of the company can also decide to liquidate the firm by filing under Chapter 7. In the US it is up to the firm's managers to decide whether to file for bankruptcy reorganization or liquidation. By contrast, insolvency proceedings in the UK normally are initiated with a creditor (or a group of creditors) whose claim has not been paid. The main objective of the insolvency code is the repayment of creditors' claims. An insolvency practitioner represents the interests of creditors, and in some cases only secured creditors. This makes the UK Code a highly *creditor-oriented* code, which encourages premature liquidation (also see Franks and Torous (1992) for a comparison of the efficiency of the UK and US codes and Rajan and Zingales (1995) for the salient features of the bankruptcy code in the G-7 countries).

pass the necessary resolution for a voluntary liquidation, creditors can liquidate the firm by obtaining a court order, which is known as *compulsory liquidation.* It is more expensive because the court application and supervision are necessary. The liquidator's primary duty is to recover the company assets for the benefit of the creditors and to distribute funds to them in accordance with their statutory entitlement. The liquidation procedure terminates after the liquidator, having paid his fees and the costs of the liquidation, sends his final accounts to the Registrar of Companies.

5.2.2.2 Receivership

Receivers can be appointed either by a floating charge holder, or a fixed charge holder[3] when the company defaults in payment of the principal and/or interest due under the loan. It is also possible to appoint a receiver if the administration petition is presented and the chargee wishes to appoint a receiver. No court action is necessary for the appointment and it becomes effective when it is accepted by the qualified insolvency practitioner (receiver). Since receivership is primarily a recovery procedure for the secured creditor (or group of secured creditors) the receiver's main responsibility is to protect the interests of the creditor who appointed him. Therefore, if a rescue plan is not in the interests of such a secured creditor, the receiver should not pursue it even if unsecured creditors, shareholders and employees would benefit from this.

---

[3]A *floating charge* is a charge on the company's property which is constantly changing in nature and not specifically identified such as its stock in trade. A *fixed charge*, on the other hand, attaches to a specific item of corporate property such as its freehold or buildings. A fixed charge places limitation on the company's dealing with the assets comprised in it, and hence the firm needs the permission of the debenture holder to deal with the assets, which is not needed under a floating charge. A fixed charge gives the chargee the power to appoint a receiver whose role is to take possession of and sell the assets and repay the proceeds before the repayment of any other creditor. Under a floating charge, the chargee can appoint an administrative receiver with an extensive powers of management such as managing the company's business, borrowing money and hiring staff. Whereas a receiver appointed by a fixed charge holder has no power to continue the business and thus cannot implement a rescue plan, an administrative receiver has adequate powers to achieve a turnaround.

5.2.2.3 Administration

The administration procedure was introduced by the Insolvency Act 1986, which is a formal court-driven procedure and also available to an unsecured creditor or to the company itself. The main purpose of administration is to provide a breathing space during which a rescue plan for the survival of the company can be pursued or the sale of the business as a going concern can be negotiated. This might provide more advantageous realisation of the company's assets than would be achieved under liquidation. Administration might be the preferred option when a company which has a healthy balance sheet and is basically sound is currently experiencing a cash-flow crisis which makes the company unable to pay its debts as they fall due (Campbell and Underdown (1991)). Administration is not the end of the insolvency procedure so far as the company and the creditors are concerned. It is only a breathing space protected by a legal suspension of payments and may be followed either by the return of the company in solvent to the control of the company's directors or by the liquidation of the business.

5.2.2.4 Company Voluntary Arrangements (CVAs)

It is an insolvency procedure under which the management puts up a restructuring proposal to creditors and continues to run the company. It is different from "schemes under section 425 of the Companies Act" in that it is made under the Insolvency Act and must be implemented by an insolvency practitioner. Although the procedure involves a practitioner and the preparation of a report to the court the involvement of court is minimal and once the proposal is approved by creditors, it is binding on every creditor of the company. Any CVA proposal needs 75 per cent by value of its creditors to approve it.

5.3 Economic Analysis of UK Insolvency Procedures and Asset Structure of Firms

The purpose of this section is to demonstrate how individualistic behaviour of the creditors of a financially distressed firm might affect the resolution of the financial distress. This is done in the framework of a game theoretic model. A similar analysis has recently been carried out by Webb (1991) where he illustrates how creditors of a financially distressed firm might race to be the first to put the firm into receivership that leads to liquidation of the firm. In his model, if the payment which is due is not made there are two alternatives for the two creditors: putting a receiver for the claim or waiting until the next period. It is shown that both creditors choose to appoint a receiver, which is a Pareto inferior outcome since they both would be better off when they hold on to the next period. In other words, the result is a prisoner's dilemma game in which the inefficient outcome of both creditors resorting to receivership mechanism is an equilibrium. However, this conclusion heavily relies on the assumption that the creditor who appoints a receiver is fully paid when the other does not appoint a receiver.

In the following model we relax this assumption and instead focus our attention on the case under which no creditor is fully paid under receivership even if he alone appoints a receiver. This case might be more relevant for firms which have few large creditors (such as banks) rather than those firms having many small creditors. Developing the model in this framework enables us to derive richer implications and to identify the circumstances under which the inefficient outcome is more likely to be realised.

5.3.1 The Model

In our set up we consider the appointment of an administrator, instead of waiting, as an alternative strategy to appointing a receiver. There are several reasons for doing this. First, there is a crucial distinction between waiting until the next period and appointing an administrator. In the former the existing management of the firm and in the latter the appointed administrator carries out the firm's businesses. If the incumbent management remains in control of the firm the existence of potential actions which might be taken against the interests of creditors might prompt creditors to liquidate the firm rather than wait and risk the depreciation of their collateral. Administrators, however, are assumed to be acting in the interests of the existing creditors. Thus, compared with the option of waiting until the next period, administration yields a greater chance of realising higher value for creditors. Second, it is important to evaluate administration as an alternative to receivership since the primary concern when it was introduced in 1986 was to counter some of the weaknesses of the receivership system under which the receiver acts for a creditor (or a group of creditors).

It is assumed that the company issues only ordinary shares and debenture capital to finance the investments undertaken at date $t=0$, where debt is secured by a floating charge against the firm's assets. As discussed earlier, a floating charge gives creditors the right to appoint a receiver to enforce security over the firm's assets by selling those assets if necessary or to appoint an administrator with the approval of the court. It is also assumed that there are no fixed charge holders who are senior to floating charge creditors in the order of distribution of a liquidated firm's assets. For simplicity it is assumed that there are only two creditors, i and j, where both creditors have equal priority. It is important to note that an administrator can only be appointed if these two creditors agree together to do so. Any

of the two can prevent the appointment of an administrator by appointing a receiver before the court makes a decision on the administration petition.

An interest payment of I_1 must be made to creditors at date t=1 and at date t=2 they must be paid D_2 which is the sum of the face value of the loan and interest. Creditors consider to take action against the firm if the payment of I_1 is not made in full at date t=1. Each creditor has two different strategies. Namely, he can *appoint a receiver* to pursue his claim on the company's assets, or can *appoint an administrator.* Moreover, it is common knowledge that if receivership is chosen at date t=1 a liquidation value of L_R is realised. It is assumed that receivership results in the liquidation of the firm's assets. If, on the other hand, administration is chosen at date t=1 the firm continues to operate under administration and at date t=2 the value of the company will be V with probability of P_a, or L_A with probability of $(1-P_a)$; with $V>L_A$ where L_A is the liquidation value of the company's assets. The administration procedure has a large cost while this is assumed to be negligible for receivership. This cost is given by C_A and shared by both creditors when they both decide to appoint an administrator and when only one of the creditors appoints an administrator it is equal to a fixed amount of C_F and is fully born by the creditor who petitions for the appointment. $C_A>C_F$ because C_F which is involved in the application process of administration is only a part of C_A. Furthermore, at date t=2, $V>(D_2+I_1)=D$, $D>L_R$, and $\alpha D>L_R$ and $(1-\alpha)D>L_R$ where α is the proportion of the total value of the proceeds received by creditor i and $(1-\alpha)$ by creditor j. That is, no creditor is fully paid at the end of the receivership process under any circumstances and under administration if the company can not achieve to realise the value of V. However, both creditors are fully paid under administration if the company is successful so that its value at date t=2 is V.

Table 5.1 Payoffs to Creditors *i* and *j*

		j	
		R	***A***
i	***R***	αL_R $(1-\alpha)L_R$	L_R $-C_F$
	A	$-C_F$ L_R	$\alpha P_a D+\alpha(1-P_a)L_A-\alpha C_A$ $(1-\alpha)P_a D+(1-\alpha)(1-P_a)L_A-(1-\alpha)C_A$

Table 5.1 specifies: (1) the creditors: *i* and *j*; (2) the strategies available to each creditor: *R* and *A* representing *Receivership* and *Administration respectively; and (3) the payoffs* received by each creditor for each combination of strategies. The first line of each cell gives the creditor *i*'s payoff and the second line gives the creditor *j*'s.

At date $t=1$, when they are not paid the amount of I_1 in full, if both creditors decide to put in a receiver for their claims they expect to get the corresponding proportions of the liquidation value of the firm's assets, L_R. That is, the payoffs of the pure strategy (*R*, *R*) are as follows

$$(\alpha L_R,\ (1-\alpha)L_R) \tag{5.1}$$

where αL_R and $(1-\alpha)L_R$ represent the payoffs of creditors *i* and *j* respectively. However, it is possible that one of the creditors might choose to appoint a receiver to pursue his claim while the other chooses to appoint an administrator. For example, if creditor *i* calls in a

receiver while creditor *j* decides to appoint an administrator, then the firm is forced to liquidate its assets at price L_R to meet the claim of creditor *i*. In this case the corresponding payoffs take the form of

$$(L_R, -C_f) \tag{5.2}$$

where all the proceeds of the liquidation L_R goes to creditor *i* and hence creditor *j* has to bear the fixed cost of appointing an administrator, C_f. If the opposite occurs, where creditor *i* appoints an administrator and creditor *j* calls in a receiver, the payoffs are given by

$$(-C_f, L_R) \tag{5.3}$$

Finally, if both creditors decide to appoint an administrator, in the absence of discounting, the total expected value of debentures (the total expected value of the proceeds received by creditors) is given by the following

$$B_A = P_a D + (1 - P_a) L_A - C_A \tag{5.4}$$

A proportion of α of B_A goes to creditor *i* and the complement $(1-\alpha)$ to creditor *j*. In this case, creditors expect to get

$$[(\alpha P_a D + \alpha(1 - P_a) L_A - \alpha C_A),\ ((1-\alpha) P_a D + (1-\alpha)(1 - P_a) L_A - (1-\alpha) C_A)] \tag{5.5}$$

It is assumed that both $(\alpha P_a D + \alpha(1-P_a)L_A - \alpha C_A)$ and $((1-\alpha)P_a D + (1-\alpha)(1-P_a)L_A - (1-\alpha)C_A)$ are greater than the liquidation value of the firm's assets L_R. That is, both creditors are assumed to do better under administration when they both agree to appoint an administrator

than under liquidation even when the creditor who forces the firm into liquidation gets the whole proceeds of liquidation L_R. This assumption can be justified as follows. First, there is a possibility that both creditors will be fully paid and second it can be expected that the liquidation value of the firm's assets at the end of the administration procedure will be higher than that realised under receivership.

5.3.2 Equilibrium of the Game

It is clear that there is no dominant strategy for any creditor and there are two pure-strategy Nash equilibria of this model: (*R*, *R*) and (*A*, *A*). For example, if creditor *i* thinks that creditor *j* will put in a receiver he will always prefer to put in a receiver since the payoff of playing this strategy is αL_R compared with the loss of C_F under the alternative strategy of choosing to appoint an administrator. However, creditor *i* will prefer to appoint an administrator if he thinks that creditor *j* will do so as well since $\alpha P_a D+\alpha(1-P_a)L_A-\alpha C_A$ is greater than L_R. (Note that the same argument can be given for creditor *j*). Of these two equilibria, equilibrium (*A*, *A*) Pareto-dominates the other pure-strategy Nash equilibrium (*R*, *R*), since it yields higher expected payoffs for both creditors. This raises the question of why both creditors then do not choose *Administration*, i.e. (*A*, *A*). To put it differently, why is (*A*, *A*) not the most reasonable prediction of how this game will be played? This can be explained by the concept of *risk dominance* following Harsanyi and Selten (1988). Although (*A*, *A*) might be seen as the reasonable outcome of the game choosing *R* is safer for creditor *i* (creditor *j*) as it guarantees αL_R ($(1-\alpha)L_R$) regardless of what creditor *j* (creditor *i*) chooses. By choosing *A* instead of *R* he risks of losing C_f when creditor *j* (creditor *i*) decides to appoint a receiver. However, he should play *A* with a positive probability if he assesses that creditor *j* (creditor *i*) might also choose *A* with a positive

probability. This brings us to the equilibrium strategy of this game.

Suppose that creditor i believes that creditor j will choose *Receivership* with probability q and *Administration* with probability $(1-q)$. Similarly, creditor j believes that creditor i will choose *Receivership* with probability k and *Administration* with probability $(1-k)$. In other words, creditor i believes that creditor j will play the mixed strategy $(q,1-q)$ and creditor j believes that creditor i will play the mixed strategy $(k,1-k)$. Given this belief, creditor i's expected payoff from playing the mixed-strategy $(k,1-k)$ is given by

$$\begin{aligned}\pi_i = {} & kq\alpha L_R + k(1-q)L_R \\ & + (1-k)q(-C_f) + (1-k)(1-q)(\alpha P_a D + \alpha(1-P_a)L_A - \alpha C_A)\end{aligned} \tag{5.6}$$

which can also be written as

$$\begin{aligned}\pi_i = {} & k[q\alpha L_R + (1-q)L_R + qC_f - (1-q)(\alpha P_a D + \alpha(1-P_a)L_A - \alpha C_A)] \\ & - qC_f + (1-q)(\alpha P_a D + \alpha(1-P_a)L_A - \alpha C_A)\end{aligned} \tag{5.7}$$

Note that creditor i's expected payoff is increasing in k if the value inside the square bracket is positive. That is

$$[q\alpha L_R + (1-q)L_R + qC_f - (1-q)(\alpha P_a D + \alpha(1-P_a)L_A - \alpha C_A)] > 0 \tag{5.8}$$

from which the critical probability of creditor j choosing *Receivership*, above which creditor i chooses *Receivership* as well, can be derived as

$$q \rangle \frac{\alpha P_a D+\alpha(1-P_a)L_A-\alpha C_A-L_R}{[\alpha P_a D+\alpha(1-P_a)L_A-\alpha C_A-L_R]+[C_f+\alpha L_R]} = q' \qquad (5.9)$$

Thus, creditor *i*'s best response is k=1 (i.e. *Receivership*) if $q>q'$ and k=0 (i.e. *Administration*) if $q<q'$. If $q=q'$, then creditor *i* is indifferent between choosing *Receivership* and *Administration*. He is also indifferent among all mixed strategies $(k,1-k)$ since his expected payoff given by (5.7) is independent of k when $q=q'$. In other words, for $q=q'$ the mixed strategy $(k,1-k)$ is the best response for any value of k between 0 and 1. The behaviour of creditor *i* is summarised in Figure 5.1 where *Receivership* and *Administration* are given by upper and lower horizontal segments of $k^*(q)$ respectively, whereas the vertical segment of $k^*(q)$ shows the behaviour of creditor *i* when he is indifferent between all (pure and mixed) strategies.

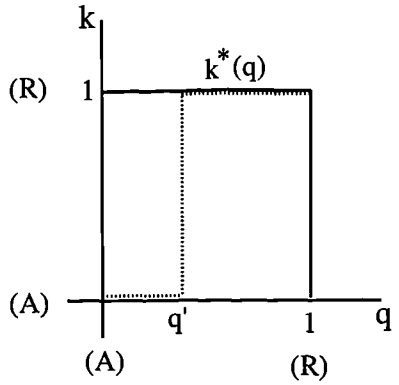

Figure 5.1 *Creditor i's Response*

At this point the interpretation of the expression in (5.9) might be useful. The numerator

of (5.9) can be interpreted as the gain to creditor *i* from choosing *Administration* when creditor *j* also chooses *Administration*. Note that the first square bracket in the denominator is the same as the numerator. On the other hand, the term inside the second bracket denotes the gain from choosing *Receivership* when creditor *j* also chooses *Receivership*. As a result, the denominator of (5.9) gives the total gain from playing the right strategies i.e. two Nash equilibria mentioned earlier. Then, it is obvious that the probability of choosing *Administration* increases as the proportion of the gain from playing *Administration* in the total gain increases. It is simply the difference between the two payoffs of creditor *i* under administration and receivership procedures when creditor *j* chooses to appoint an administrator. Note that as the numerator decreases or the second term in the denominator increases q' decreases, i.e. moving towards the origin in Figure 5.1, so that the probability of creditor *i* choosing *Receivership* (*Administration*) increases (decreases).

It is also possible to interpret (5.9) as the ratio of the loss from playing *Receivership* when creditor *j* plays *Administration* to the total loss which consists of the numerator plus the loss from playing *Administration* when creditor *j* plays *Receivership*. This intuition also results in the same conclusion that if the potential loss from playing *Receivership* increases the probability of playing *Receivership* (*Administration*) decreases (increases).

Similarly creditor *j*'s best response to creditor *i*'s mixed-strategy is derived from his expected payoff which is given by

$$\begin{aligned}\pi_j &= qk(1-\alpha)L_R + q(1-k)L_R + (1-q)k(-C_f) \\ &+(1-q)(1-k)((1-\alpha)P_a D + (1-\alpha)(1-P_a)L_A - (1-\alpha)C_A)\end{aligned} \tag{5.10}$$

Equation (5.10) can be re-written as

$$\pi_i = -kC_f + (1-k)((1-\alpha)P_aD + (1-\alpha)(1-P_a)L_A - (1-\alpha)C_A) + q[k(1-\alpha)L_R + (1-k)L_R + kC_f - (1-k)((1-\alpha)P_aD + (1-\alpha)(1-P_a)L_A - (1-\alpha)C_A)] \quad (5.11)$$

In this case, the expected payoff to creditor j is increasing in q if

$$[k(1-\alpha)L_R + (1-k)L_R + kC_f - (1-k)((1-\alpha)P_aD + (1-\alpha)(1-P_a)L_A - (1-\alpha)C_A)] > 0 \quad (5.12)$$

$$k > \frac{P_a(1-\alpha)D + (1-P_a)(1-\alpha)L_A - (1-\alpha)C_A - L_R}{[(1-\alpha)P_aD + (1-\alpha)(1-P_a)L_A - (1-\alpha)C_A - L_R] + [C_f + (1-\alpha)L_R]} = k' \quad (5.13)$$

So, creditor j's best response is q=1 (i.e. *Receivership*) if $k>k'$ and q=0 (i.e. *Administration*) if $k<k'$. He is indifferent between *Receivership* and *Administration* and also among all the mixed strategies $(q, 1-q)$ when $k=k'$. The interpretation of (5.13) is similar to that of (5.9). That is, the numerator of (5.13) gives the expected loss to creditor j from choosing *Receivership* when creditor i chooses *Administration*. The denominator, on the other hand, gives the potential loss which consists of the loss given in the numerator and the expected loss from choosing to appoint an administrator when creditor i chooses to put in a receiver. Consequently, since creditor j decides to call in a receiver when $k>k'$, the probability of playing *Receivership* (*Administration*) decreases (increases) when the expected loss when playing *Receivership* with creditor i playing *Administration* increases. Creditor j's response

is illustrated in Figure 5.2.

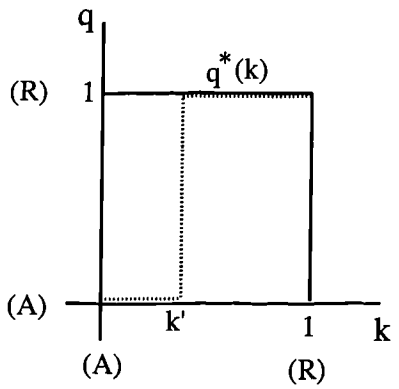

Figure 5.2 *Creditor j's Response*

Figures 5.1 and 5.2 can be combined to produce Figure 5.3. The intersection of $k^*(q)$ and $q^*(k)$ yields the mixed-strategy Nash equilibrium of the game between creditors: if *i* plays (1-q',q') then *j*'s best response is (1-k',k'). The other two intersections (q=0,k=0) and (q=1, k=1) represent the pure-strategy Nash equilibria (*A*, *A*) and (*R*, *R*) as explained earlier.

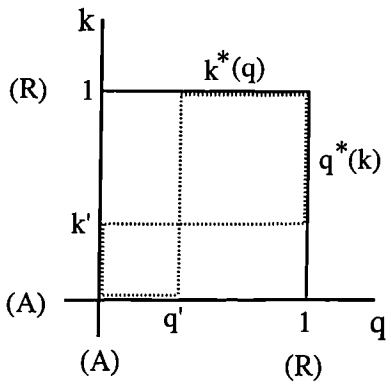

Figure 5.3 *Mixed-strategy Equilibrium*

5.3.3 Discussion

It is important to note that the mixed-strategy solution of the model is derived from two conditions. First, the current liquidation value does not meet either of creditors' claims, i.e. both αD and $(1-\alpha)D$ are greater than L_R. Second, both creditors are better off under administration, i.e. both $(\alpha P_a D+\alpha(1-P_a)L_A-\alpha C_A)$ and $((1-\alpha)P_a D+(1-\alpha)(1-P_a)L_A-(1-\alpha)C_A)$ exceed L_R. It is clear that five factors are crucial for the equilibrium of the game between creditors to be a mixed-strategy equilibrium. First, the value of α which determines the share of each creditor is important in the sense that smaller creditors may find it beneficial to call in a receiver since it is more likely that the current liquidation value of the firm's assets L_R will be higher than what they would get under administration. Second, the higher the costs of administration procedure C_A are the less likely that expected payoff of each creditor will be higher than L_R. Third, as the possibility that the firm will realise a value of V at date t=2 increases, the probability of having higher expected payoffs under administration also increases. Fourth, the liquidation value of the firm 's assets at date t=2 is clearly positively related to each creditor's payoff under administration. Finally, the higher the current liquidation value of the firm's assets L_R is the lower the probability is that the condition necessary for a mixed-strategy solution will hold.

Among these five factors, we argue that, P_a is closely related to the asset structure of firms. The probability of realising a value of V under administration might depend on taking some valuable investment opportunities. Taking investment opportunities would in turn require firms to raise money from financial markets to finance these investments. It is relatively more difficult to find new finance for firms having mostly intangible assets. This is simply because they can not be used as collateral. In contrast, tangible assets can easily

be used as collateral and firms having more of these assets raise money from the markets relatively more easily. Therefore, for firms which have a significant proportion of their assets tied in intangible assets receivership is a more likely outcome even if the cooperative outcome (A, A) yields greater returns for both creditors than the noncooperative outcome (R, R). Moreover, it should be noted that the asset structure of firms affects the liquidation values both under receivership and administration, L_R and L_A. For example, for firms having relatively more tangible assets both L_R and L_A are expected to be larger. However, since L_R and L_A have opposite effects on the condition which leads to a mixed strategy equilibrium the effect of asset structure through these variables is negligible.

It might still be useful to examine the determinants of probability of playing one of the strategies supposing that the conditions required for a mixed-strategy equilibrium hold. As can be seen in Figure 5.3 the levels of q' and k' are important for the mixed-strategy outcome. Notice that (1-q') and (1-k') give the equilibrium probabilities of creditors i and j choosing *Receivership* respectively. It can be seen from (5.9) and (5.13) that these probabilities change depending upon P_a, α, L_A, L_R, C_A and C_F given D. For example, it can be seen from (5.9) that q' which is the critical level of probability for creditor i increases (decreases) when P_a and L_A (α, C_A, L_R and C_F) increase. If q' increases (decreases) then the probability of creditor i choosing *Administration* increases (decreases), too.

It may be argued that inefficient liquidations can be prevented by creditors reaching an agreement not to liquidate the company prematurely, or by the company raising new money to pay off all the creditors. However, it should be noted that the nature of the bankruptcy decision of creditors can be considered as a one-shot game. Therefore, the

cooperation among the creditors of a financially distressed firm is unlikely to materialise. Also, the stability of such agreements is highly questionable when the number of creditors is large (Aivazian and Callen (1980)). Moreover, as also discussed by Webb (1991), the company might have limited access to new funds and have exhausted its available lines of credit. As discussed earlier in this chapter the ability of financially distressed firms, which face inefficient liquidations, to raise new finance also depends on their asset characteristics. Firms with assets which can not easily be used as collateral find it difficult to have access to new funds in financial markets and hence to pay off the creditors. Moreover, as we discussed in chapter 3 of this thesis, owners of financially distressed firms have incentives to pass up valuable investment opportunities and take risky (negative Net Present Value) projects. This in turn would discourage the creditors to allow the firm which is in financial distress to continue its operations under the incumbent management and with the existing shareholders.

5.4 Conclusions

This chapter has discussed the implications of insolvency procedures for corporate bankruptcies with special reference to the UK applications. In particular, by using a game theoretic model, it has been shown that individualistic behaviour of creditors may lead to premature and inefficient liquidations of financially distressed firms. In the model, liquidation which is a consequence of receivership procedure is an inefficient result because creditors are better off under the administration alternative. This was previously shown by Webb (1991) where the alternative strategy is waiting until the next period and receivership is shown to be the dominant strategy. One important contribution of this chapter has been to show that inefficient liquidations are still possible even when the receivership is not the

dominant strategy for creditors. The equilibrium of the model analysed in this chapter is a mixed-strategy outcome, in which creditors choose administration or receivership with certain probabilities. It has also been demonstrated that the mixed-strategy solution and these probabilities depend upon the liquidation values of the firm's assets realised under administration and receivership, the proportion of each creditor's claim in the total value of claims, the probability of achieving a value which exceeds the total claims of creditors, and the costs of the administration procedure.

Moreover, this chapter suggests that the asset structure of financially distressed firms plays an important role for the bankruptcy decision. It is argued that firms which hold most of their assets in intangible rather than tangible assets are more likely to be liquidated when they experience financial difficulties. This is mostly due to the lower probability of achieving a value for the firm's assets which exceeds the total value of creditors' claims under administration when the firm's assets comprise relatively more intangible assets.

CHAPTER 6

A MODEL OF CAPITAL STRUCTURE THEORY

6.1 Introduction

The main purpose of this chapter is to examine the role of bankruptcy-related costs in determining an optimal capital structure. It is well known in finance literature (as surveyed in chapter 2) that the existence of bankruptcy costs implies an optimal debt-equity ratio. We also argued in previous chapters that asset characteristics of firms have important implications for the capital structure. This chapter relates bankruptcy costs to asset characteristics of firms in a capital structure framework. More specifically, liquidation costs which form a substatial part of total bankruptcy costs are assumed to be related to the tangibility of assets owned by firms. Incorporating this relationship into a multi-period capital structure model enables us to derive an optimal leverage ratio. This framework also allows us to study the impact of firms' asset characteristics on their borrowing decisions. Moreover, we also include non-debt tax shields in developing the multi-period capital structure model. This is important because non-debt tax shields act as a substitute for debt for tax purposes, which reduces the attractiveness of debt financing. In this modified framework we analyse several determinants of capital structure. In particular, it shown that non-debt tax shields, the nature of assets owned by firms, corporate tax rate and business risk of firms affect financial decisions of companies.

The remainder of this chapter is organised as follows. In the next section we first present a single period model in which bankruptcy condition is determined by the end-of-period earnings. Secondly, we present a standard multi-period model where the bankruptcy condition takes into account the ability of firms to raise new finance to avoid bankruptcy. We then develop this multi-period model by incorporating the asset structure of firms and non-debt tax shields in section 6.3, as explained above. In addition, determinants of capital

structure of firms are analysed in the framework of this modified model. Finally, section 6.4 lists the main conclusions of this chapter.

6.2 Optimal Capital Structure Theories

6.2.1 Single-period Framework

In a basic single period model the value of the firm, V, can be written as[1]

$$V=\frac{1}{1+r}\left[\int_{-\infty}^{\infty} Ef(E,R)dE-\int_{D}^{\infty} TEf(E,R)dE+\int_{D}^{\infty} TDf(E,R)dE-\int_{-\infty}^{D} Cf(E,R)dE\right] \qquad (6.1)$$

where

r : one period riskless interest rate,

E : earnings before debt and taxes,

R : business risk parameter of earnings probability distribution,

$f(E,R)$: probability of earnings level E, given R,

T : constant corporate tax rate,

D:face value of debt (leverage decision variable, assumed fully deductible in calculating taxable income)[2], and

C:costs incurred in the event of bankruptcy.

The value of the firm in equation (6.1) is derived by adding up the value of equity, Q, and the value of risky debt, D', which are given by the following equations

[1]For single-period approach see, for example, Castanias (1983), Bradley *et al* (1984).

[2]Corporate tax is based on end-of-period wealth. Therefore, debt payments are assumed to be fully deductible to capture the idea of a perpetuity analysis in a single-period setting.

$$Q = \frac{1}{(1+r)} \int_{D}^{\infty} (1-T)(E-D)f(E,R)dE \tag{6.2}$$

$$D' = \frac{1}{(1+r)} \left[\int_{D}^{\infty} Df(E,R)dE + \int_{-\infty}^{D} (E-C)f(E,R)dE \right] \tag{6.3}$$

The bankruptcy condition in a single-period model is as follows: the firm is declared bankrupt if it fails to meet, in full, the end-of-period obligations promised to its creditors. The value of debt is derived by subtracting bankruptcy costs from the value of debt in no-bankruptcy case because of the fact that creditors bear these costs. The firm's optimal leverage decision must involve D such that it maximizes the value of the firm. The optimal leverage is derived by taking the derivative of equation (6.1) with respect to D. Doing this yields

$$\frac{\partial V}{\partial D} = \frac{1}{1+r}[T(1-F) - Cf(D,R)] = 0 \tag{6.4}$$

where F is probability of bankruptcy, which is given by

$$F = \int_{-\infty}^{D} f(E,R)dE \tag{6.5}$$

The first term on the right hand side in (6.4) gives the marginal expected tax savings while the last term is the marginal expected bankruptcy costs. That is, any change in the level of

debt D has both a positive and a negative effect on the value of the firm. On the one hand, an increase in D leads to tax savings which decrease as D increases since it raises the probability of bankruptcy which is, in turn, endogenously determined by the choice of D, *ceteris paribus*. On the other hand, an increase in D leads to an increase in the expected bankruptcy costs. For low levels of debt an increase in debt causes a greater increase in tax savings than in bankruptcy costs, and hence the value of the firm increases. However, as D increases the probability of bankruptcy also increases, which lowers tax savings and raises the expected bankruptcy costs. Although the change in the firm value is positive it decreases with increasing debt. Thus there must be a certain amount of debt at which dV/dD equals zero and V attains a maximum, V^*. Therefore a shareholder-wealth maximizing firm, instead of maximizing its borrowing, will search for its optimal capital structure to attain V^*.

6.2.2 Multi-period Framework

The above analysis is not appropriate for an on-going firm. As Stiglitz (1972, 1974) points out, even if an on-going firm is unable to meet its obligations to its creditors the firm may not be declared bankrupt because it can simply borrow more. Firms have the option of borrowing more or issuing new shares to meet their obligations when their returns in a particular period in a particular state are low. The bankruptcy criterion in a multi-period setting is therefore quite different.[3] A firm is usually said to be bankrupt if the value of its equity is zero (it can not be negative because of limited liability) or if the value of its

[3]The reason why the model in this chapter and similar models of others (Stiglitz (1972 and 1974), Scott (1976)) are called multi-period is that we do not restrict ourselves to a finite period model in the sense that there is no terminal date in our setting. In a model with a terminal date it would be difficult to incorporate into the model the option of borrowing more or issuing new equity if the firm is unable to meet its current obligations in the last period since new finance would normally be available provided that future prospects of returns of the firm are sufficiently good.

expected future income streams, assuming it does not go bankrupt, is less than the value of its outstanding debt. Therefore as long as the firm can obtain new funds to pay its current obligations it can not be declared bankrupt. In this section this definition of bankruptcy is used and the valuation formulas are derived accordingly.

Scott (1976) presents a multi-period model of firm valuation to show that the value is a function not only of the level of debt but also of expected future earnings. In his model bankruptcy costs arise because the market for real assets is imperfect, which implies that the liquidation value of the firm's assets is always less than the market value of a non-bankrupt firm. It is assumed that upon bankruptcy the assets are sold and the earnings cease. The proceeds are distributed to creditors according to their order of priority where the claims of the bondholders are equal to the face value of debt plus interest currently due. It is shown that the total value of the firm, V, is given by

$$V = D+Q = \frac{1}{r+F}\left[\int_{b}^{\infty}(1-T)Ef(E)dE+\int_{b}^{\infty}TIf(E)dE+\int_{-\infty}^{b}LAf(E)dE\right] \qquad (6.6)$$

where

D : the market value of debt,

Q : the market value of equity,

I : contractual interest payments,

LA : the liquidation value of the firm's assets, r: the default free rate of interest,

F : the probability of bankruptcy, and

$b=I-Q/(1-T)$ is the bankruptcy condition which follows from the argument that stockholders' wealth is given by $Q+(1-T)(E-I)$ and when there is a current loss (i.e., $(E-I)<0$) the firm can

raise money as long as the wealth of equity holders is positive. If they can not raise enough money to pay the firm's creditors it is declared bankrupt. From equation (6.6) the level of contractual interest payments which maximizes the total value of the firm's debt plus its equity is found by taking the derivative with respect to I, which gives

$$\frac{\partial V}{\partial I} = \frac{1}{(r+F)}\left[T(1-F)-(D+I-LA)\frac{(1+r)}{(r+F)}f(b)\right] = 0 \qquad (6.7)$$

With positive tax rate an optimal capital structure exists and $\partial V/\partial I$ will be zero at that I which maximizes V. Comparative statics of the model yield that the optimal level of debt is positively related to the liquidation value of the firm's assets and the corporate tax rate.

6.3 The Model

The model of this chapter follows a similar line of argument as Scott (1976). Specifically, a model of firm valuation is derived in a multi-period framework with corporate income tax and costly bankruptcy. However, the present model differs from Scott (1976) in several aspects. First, in Scott (1976), no distinction is made between different types of assets owned by firms. As discussed in other chapters, the level of borrowing is determined, among other things, by the nature of assets firms hold.[4] In this study we argue that not all

[4]Myers (1984) argues that firms holding *tangible assets-in-place* having active second-hand markets will borrow more than firms holding intangible assets or growth opportunities. Chung and Smith (1987) use the terms *salvageable* and *nonsalvageable* to make the distinction between different type of assets and argue that the firm's optimal leverage ratio is an increasing function of the ratio of salvageable to nonsalvageable asset value. Williamson (1988) explores the interaction between debt capacity and the liquidation value of assets by arguing that assets which have alternative uses (*redeployable*) also have high liquidation values and hence are good candidates for debt finance because creditors can take the assets away and redeploy them when the firm defaults. In a more recent work, Harrris and Raviv (1990) also argue that firms with more tangible assets having higher

assets have the same degree of marketability. Assets such as intangible assets generally lose more of their value in a distress sale whereas others, tangible assets, lose relatively less from their value. So the significance of the decrease in the value of the firm's assets when they are sold in liquidation changes substantially from one firm to another depending upon the nature of the assets. Without making this distinction it would not be very clear why and how much firms lose when they sell their assets in liquidation.

Second, the model of this chapter captures the essence of the substitution effect between the tax benefits of corporate leverage and the level of non-debt tax shields such as depreciation. DeAngelo and Masulis (1980) argue that there is a possibility of losing the tax advantage of debt in non-default states because of the existence of other deductions which are available to shelter all or some of the firm's earnings. This is important in the sense that taking these alternative tax shields into consideration the tax advantage of debt in some states is reduced. As will be explained later, the bankruptcy condition also changes as a result of incorporating the substitution effect into the analysis.

Finally, in Scott (1976), bankruptcy costs are narrowly defined where the definition of these costs is limited to costs of liquidation. However, in addition to these costs, there are also costs arising from the fact that creditors have to pay to third parties such as insolvency practitioners and lawyers. These costs are called direct administrative costs of bankruptcy and have to be paid before any creditor is paid upon bankruptcy. Since they directly affect the bondholders' wealth it will also change the value of the firm. Therefore, we also include these costs in our model. In what follows we shall first give the assumptions

liquidation value will have more debt.

of the model. We then define bankruptcy conditions for an on-going firm and derive the market values of equity, risky debt and the firm as a whole.

To examine the relationship between the value of a firm and its leverage it is assumed that firms issue only debt and equity, both of which have limited liability (i.e., the security holders' wealth can not be negative). All investors who maximise expected future wealth in the securities market are assumed to be risk neutral, and to have equal and costless access to all relevant information. The risk free rate of interest, r, is assumed to remain constant. Also, investors expect that the firm will not change the current financial policy which is measured by the contractual interest payments, I. Interest payments are deductible from the firm's income and firms are subject to a constant income tax rate, where the personal tax rates for investors are zero. It is assumed that firms are not allowed to carry their losses backward or forward and to sell these losses via a leasing agreement or in any other way. This assumption is necessary to capture the substitution effect between the corporate leverage and non-debt tax shields. If firms were allowed to carry these unused tax credits backward or forward this effect would disappear because there would be no complete or partial loss of the advantage of debt.

As long as the firm's net operating earnings before depreciation, interest and tax, which is given by the random variable E (assumed to be identically and temporally independently distributed and be the same in all future periods as long as the firm remains solvent)[5] is greater than the contractual interest payments, I, the firm can meet its current

[5]The firm's investment decision is fixed by the assumption that the earnings distribution remain the same in all future periods.

obligations to creditors and remains solvent. If, however, E is less than its obligations then the firm must finance this deficit by raising new finance to avoid bankruptcy. Otherwise the firm is declared bankrupt.[6] The amount of equity which will be sold must be equal to the current loss, $(E\text{-}I)$.[7] Nevertheless, there is a limit on which additional equity can be issued and sold. A firm can sell additional equity so long as the stockholders' total wealth which is given by $(E\text{-}I)+Q$ is positive, where Q represents the present value of expected future earnings. When the current loss, $(E\text{-}I)$, is so large that the total wealth of stockholders becomes zero or negative, it will be impossible for the firm to raise any money by selling additional equity to pay the firm's creditors, and hence the firm goes bankrupt. Thus, within a multi-period framework, the bankruptcy criterion is as follows: an on-going firm is declared bankrupt if

$$E \leq I - Q \tag{6.8}$$

This condition simply states that even the total wealth of stockholders, given by $E+Q$, can not meet the current obligations, and hence no investor in an efficient and perfect securities market would buy the equity of the firm.

---

[6]Scott (1976) discusses that although there are basically three ways of raising money the firm chooses to sell additional equity in an efficient and perfect securities markets. The other two alternatives, selling additional debt and selling some of the firm's assets, are more costly for the existing stockholders. It is assumed that the protective covenants included in the bond indenture specifies that changes in financial or investment policy of the firm, which would decrease the value of existing debt are not allowed without adequate compensation to debt holders. In this case they would sell enough new debt not only to meet current obligations, but also to find money to meet the amount of compensation paid to bondholders. Similarly the sale of assets is also problematic. This is because it is assumed that secondary markets for assets are imperfect, which implies that the firm's assets are worth more in the firm. This reduces the value of the existing bonds, which, in turn, requires compensation by stockholders. Thus the sale of assets will cost stockholders more than the issuing additional equity.

[7]In Scott (1976) this amount is given by $(1\text{-}T)(E\text{-}I)$ since it is assumed that the firm is able to carry back its tax loss immediately and the government pays the firm a rebate of $-T(E\text{-}I)$ to pay the bondholders. As explained earlier, this chapter relaxes this assumption in order to incorporate the non-debt tax shields effect into the model.

6.3.1 The Market Value of Equity

Under the assumptions of the model, the wealth of the firm's stockholders W_e at the end of any period can be summarised as follows

$$W_e = \begin{cases} Q + (1\text{-}T)(E\text{-}I) + T\Delta & \text{if} \quad E > I+\Delta \\ Q + (E\text{-}I) & \text{if} \quad I\text{-}Q < E \leq I+\Delta \\ 0 & \text{if} \quad E \leq I\text{-}Q \end{cases}$$

If the firm's net operating earnings are larger than the sum of the interest payments, I, and non-debt tax shields ,Δ, so that it fully utilizes this sum, then there are two sources of wealth for stockholders. First, the amount of current after-tax earnings, $(1\text{-}T)(E\text{-}I)+T\Delta$,[8] is paid to stockholders as dividends.[9] Second, apart from the current after-tax profits, stockholders' wealth also consists of the market value of equity, Q, which is the current expected dividend value of equity.[10] However, if the firm's earnings are such that $I\text{-}Q<E\leq I+\Delta$, the firm's tax liability is zero and stockholders get the amount of $(E\text{-}I)$ and their wealth is found by summing up $(E\text{-}I)$ and Q. Here there are two cases to consider. Firstly, earnings might be less than or equal to the sum of tax deductions, $I+\Delta$, but greater than or equal to the interest payments, I. In this case all corporate tax shield in excess of

[8]Note that after-tax earnings are given by $(E\text{-}I) - T(E\text{-}I\text{-}\Delta) = (1\text{-}T)(E\text{-}I) + T\Delta$.

[9]It is assumed that dividend policy is irrelevant and investment policy does not change in all future periods, and hence it does not affect the current value of equity whether after-tax earnings are distributed to stockholders or the firm repurchases shares. The important point is that after-tax earnings are positive.

[10]Since it is assumed that the distribution of E, T and R do not change over time and the term structure of interest rates is flat, the value next period of expected dividends payable to stockholders will also be equal to Q.

earnings are unutilized as the sum of tax deductions ($I+\Delta$) might be greater than the earnings.[11] Secondly, there is a possibility that earnings might not cover the interest payments but might be enough to raise money to finance the current loss, ($E-I$), (i.e., $I-Q<E<I$). Similar to the first case all corporate tax deductions in excess of earnings remain unutilized. As already stressed above, however, whether the firm goes bankrupt depends on the ability of the firm to borrow enough money to finance the current loss, ($E-I$). If $E \leq I-Q$ then the firm is unable to raise money from the market and is declared bankrupt. If this happens stockholders receive nothing. Nevertheless, if they can raise sufficient cash by selling new equity to pay the creditors their wealth is given by $Q+(E-I)$, where ($E-I$) is the firm's current loss.[12] The total market value of the equity of the solvent firm, Q, in any period is found by discounting W_e by the default-free rate of interest, r, which is given by

$$Q = \frac{1}{(1+r)}\left[\int_{I-Q}^{I+\Delta}[Q+(E-I)]f(E,R)dE + \int_{I+\Delta}^{\infty}[Q+(1-T)(E-I)+T\Delta]f(E,R)dE\right] \qquad (6.9)$$

which in turn gives

$$Q\left[1-\frac{1-F}{1+r}\right] = \frac{1}{1+r}\left[\int_{I-Q}^{\infty}(E-I)f(E,R)dE - \int_{I+\Delta}^{\infty}TEf(E,R)dE + \int_{I+\Delta}^{\infty}T(I+\Delta)f(E,R)dE\right] \qquad (6.10)$$

[11]This is one of the points where our analysis diverges from that of Scott(1976). In Scott's analysis the tax advantage of debt occurs so long as the firm remains solvent whereas in our analysis it occurs only if earnings are greater than the sum of tax deductions, $I+\Delta$. That is, in our model, there are states in which, although it does not go bankrupt, the firm can not utilise all tax shields, which, in turn, results in less tax advantage than that in Scott's analysis.

[12]Note that the total market value of the equity is still given by Q, the present value of expected future earnings. However, since new equity is sold, the wealth of the original stockholders is reduced by *(E-I)* (the current loss).

The value of equity can finally be written as

$$Q = \frac{1}{r+F}\left[\int_{I-Q}^{\infty}(E-I)f(E,R)dE - \int_{I+\Delta}^{\infty}TEf(E,R)dE + \int_{I+\Delta}^{\infty}T(I+\Delta)f(E,R)dE\right] \qquad (6.11)$$

where

$$F = \int_{-\infty}^{I-Q} f(E,R)dE \qquad (6.12)$$

Equation (6.11) illustrates that the value of equity is given by the expected per period earnings available to the firm's stockholders discounted by the default-free rate of interest and the probability of bankruptcy. Since investors are assumed to be risk-neutral F should be interpreted as a *default premium* not as a *risk premium* which would be required by *risk averting* investors. One interesting feature of equation (6.11) is that Q appears in the limit of integration. As a result of the assumption that the firm can sell only equity to raise enough money to meet the current obligations the probability of bankruptcy is determined by the value of the equity. Since the ability of the firm to sell new equity is dependent upon the value of equity and the firm is declared bankrupt when it can not raise money the value of equity is crucial in the analysis. It is clear from the definitions of the bankruptcy condition, (6.8), and the probability of bankruptcy, (6.12), that if the value of equity, Q, decreases the probability of bankruptcy will increase. Thus the equation does not define Q explicitly but only implicitly.

6.3.2 The Market Value of Debt

Throughout this chapter it is assumed that upon bankruptcy the firm's assets are liquidated and proceeds are paid to the firm's creditors.[13] This chapter considers two types of costs associated with the liquidation of the firm. First, there are direct administrative costs paid during the bankruptcy proceedings to the various third parties such as lawyers, insolvency practitioners and court. Second, there are costs arising from the fact that the sale of the firm's assets will be a forced sale at a price which reflects the state of insolvency. The magnitude of these costs changes from one firm to another depending upon the structure of assets the firm owns. Firms have generally two types of assets. Tangible assets are physical assets like plant, machinery, equipment, vehicles and stocks that have a monetary value. These assets are generally not firm-specific and can be easily used in other alternative areas. Intangible assets, on the other hand, include goodwill, patents, trade marks, copyrights and research and development investments. They are generally firm-specific assets and have relatively higher values when they are sold as a part of an on-going firm. Their marketability is much more difficult than that of tangible assets. Therefore it is important to point out this difference when debt is valued. Both of these costs, as mentioned above, are born by bondholders when the firm is liquidated.

As long as the company remains solvent the wealth of bondholders is given by $D+I$, where D is the market value of the bond.[14] However, if the firm is declared bankrupt and

[13] Although there are other alternatives to the liquidation of assets such as reorganization in the US and administration in the UK this is not essential for our analysis as long as there are costs incurred during the bankruptcy proceedings. We also do not make any distinction between compulsory and voluntary liquidations.

[14] In analyzing the market value of the debt, it is assumed that the interest payments are set so that the bonds continue to sell at their face values. This assumption is reasonable given that r, T, I, liquidation of the firm's assets, and the earnings distribution remain fixed over time.

its assets are liquidated then the bondholders' claims can not be fully met because of the incurred bankruptcy costs and hence they receive the net proceeds from the liquidation of assets. That is, they get an amount which equals $[iL(1-c_i)+(1-i)L(1-c_t)-C]$ where L is the liquidation value of the firm's assets on a solvent basis, i is the ratio of intangible assets to total assets, c_i and c_t are respectively proportional liquidation costs of selling intangible and tangible assets in distress, where $c_i > c_t$ and C is the fixed costs of bankruptcy. The above discussion can be summarized as follows

$$W_d = \begin{cases} D+I & \text{if} \quad E > I-Q \\ iL(1-c_i)+(1-i)L(1-c_t)-C & \text{if} \quad E \le I-Q \end{cases}$$

where W_d represents the value of debt or bondholder wealth at the end of the period. Then, the market value of the firm's risky debt, D, is given by

$$D = \frac{1}{1+r}\left[\int_{I-Q}^{\infty}(D+I)f(E,R)dE + \int_{-\infty}^{I-Q}(iL(1-c_i)+(1-i)L(1-c_t)-C)f(E,R)dE\right] \qquad (6.13)$$

which reduces to

$$D = \frac{1}{r+F}\left[\int_{I-Q}^{\infty} If(E,R)dE + \int_{-\infty}^{I-Q}(L(1-ic_i-(1-i)c_t)-C)f(E,R)\right] \qquad (6.14)$$

As is seen from equation (6.14) the value of debt is given by the sum of the expected coupon payment in non-bankruptcy states and the expected proceeds payable to

bondholders upon liquidation discounted by the default-free rate of interest plus the probability of bankruptcy. F again should be interpreted as the default premium which bondholders require against the probability that the firm will be unable to meet its promised payments.

It should be noted that when we relax the assumption that firms are allowed to carry their losses forward there would be some additional costs to bondholders. Upon bankruptcy the interest payments are eliminated, i.e., there is no coupon payment to bondholders. This, in turn, means the elimination of tax subsidy which has a positive effect on the value of the firm. Even if interest payments were made there would be no tax subsidy due to the termination of the accounting period as a result of the liquidation. Similarly, bondholders also lose tax credit on operating losses. If firms have a large amount of operating losses to carry over, then they lose substantially when they are liquidated. This loss, too, is incurred because of the termination of the business. Finally, there is an important difference between two different insolvency procedures, namely liquidation and administration, regarding the capital gains tax liability.[15] Under administration, if any capital gains arise from the sale of the firm's assets, then these gains can be offset against the trading losses in the same year, as administration is not a cessation for corporation tax purposes. On the other hand, if the company is liquidated, a set-off would not be possible and the sale of the firm's assets may lead to a capital gains tax liability.

6.3.3 The Market Value of the Firm

The total market value of the levered firm, V, is derived by adding up Q in (6.11) and D

[15]Campbell and Underdown (1991).

in (6.14). It is given by

$$V = \frac{1}{r+F}\left[\int_{I-Q}^{\infty} Ef(E,R)dE - \int_{I+\Delta}^{\infty} TEf(E,R)dE + \int_{I+\Delta}^{\infty} TIf(E,R)dE + \int_{I+\Delta}^{\infty} T\Delta f(E,R)dE + \int_{-\infty}^{I-Q} (L(1-ic_i-(1-i)c_t)-C)f(E,R)dE\right] \quad (6.15)$$

Equation (6.15) is the present value of the sum of five expected values. The first four integral represent no-bankruptcy situation in which the firm's bondholders are fully paid either by earnings (when $E>I$) or by selling new equity (when $I-Q<E<I$). The corporate tax bill is zero when the level of earnings is such that it is less than the sum of interest payments and depreciation expenses. Corporate tax is paid only if the firm's earnings exceed the sum of these deductions. The last integral shows the bankruptcy state in which earnings are so low that the firm is unable to raise enough money to pay bondholders and is declared bankrupt and liquidated. Earnings may be either negative or positive. Under this case the payment to the firm's bondholders is less than that amount if the firm remains solvent because of the fact that bankruptcy is a costly procedure.

6.3.4 The Optimal Capital Structure

The decision variable for the firm is the level of contractual coupon payments, I. The firm chooses I to attain the optimal mix of debt and equity, which maximizes the total value of the firm which is the sum of the values of the firm's debt and equity. This is found by taking the derivative of (6.15) with respect to I. It is shown in Appendix 6.3 that this yields

$$\frac{\partial V}{\partial I} = \frac{1}{r+F}\Big[\int_{I+\Delta}^{\infty} Tf(E,R)dE - f(b,R)\Big(\frac{1+r}{r+F} - \frac{1}{r+F}\int_{I+\Delta}^{\infty} Tf(E,R)dE\Big)(D+I-(L(1-ic_i-(1-i)c_t)-C)\Big] = 0 \tag{6.16}$$

Inspecting equation (6.16) reveals that an increase in interest payments, I, has both a positive and a negative effect on the value of the firm. In order to examine these effects note that the first term within the square brackets is the product of the tax rate and the probability that the firm utilizes the tax deductions.[16] Holding the probability constant, the term gives the marginal increase in the expected per period tax savings resulting from an incremental increase in contractual interest payments. The second term, on the other hand, represents the marginal increase in the expected bankruptcy costs resulting from an increase in I. In other words, it gives the effect of an increase in the probability of bankruptcy on the total value of the firm. The second part of this term, $(D+I-L(1-ic_i-(1-i)c_t)-C)$, represents the liquidation costs which will be born by bondholders, whereas the first part gives the resulting change in the probability of bankruptcy due to a unit increase in the contractual interest payments. Here, $f(b,R)(1+r)/r+F$ can be interpreted as the direct effect (increase) of an increase in interest payments on the probability of bankruptcy, whereas $f(b,R)T(1-F(I+\Delta))/(r+F)$ can be seen as the indirect effect (decrease) on the probability. The indirect effect arises due to the fact that tax savings decrease the probability that the firm will be declared bankrupt when its earnings fall short of its current interest payments.

[16] As pointed out earlier, this is different from what Scott (1976) has in his analysis in which the tax rate is multiplied by the probability that the firm does not go bankrupt in a given period. Since we also include non-debt tax shields in the model the tax benefit of debt is reduced. When the firm does not go bankrupt this does not necessarily mean that debt will always be utilised so that it has a positive effect on the value of the firm.

As explained earlier, upon bankruptcy the value of equity is zero and the creditors of the firm get the proceeds from the liquidation of the firm's assets. The outstanding equity is worthless not because of the fact that the firm is bankrupt. On the contrary, bankruptcy occurs because the equity is worthless. Thus, equityholders do not face any costs because of the bankruptcy process *per se*. Creditors, however, suffer the costs of the firm's bankruptcy because, first, the bankruptcy procedures involve administrative costs which are assumed to be fixed and, second, the firm's assets are sold under their real values. The magnitude of the costs change depending upon the asset structure of the firm. If there were no costs involved in selling the firm's assets in distress the loss of creditors would be only limited to the direct costs of the liquidation process, as represented by C. For low levels of debt an increase in interest payments leads to a greater increase in tax savings than in bankruptcy costs, thus the value of the firm increases, i.e., $\partial V/\partial I$ is positive. Nevertheless, as debt increases further both the probability of bankruptcy and the probability that the firm does not utilise tax deductions increase, which, in turn, reduce the marginal tax savings and raise the marginal bankruptcy costs. Therefore, with increasing debt level, the positive change in the firm value becomes smaller and smaller. As a result, there must be a certain level of interest payments at which $\partial V/\partial I$ equals zero and V attains a maximum, V^*. Hence a shareholder-wealth maximizing firm will search for its optimal capital structure to attain V^*.

6.3.5 Comparative Statics

In what follows, we conduct comparative statics analysis by differentiating the optimality condition, $(\partial V/\partial I)=0$, with respect to a number of exogenous variables. Specifically, we examine the effects of changes in the liquidation value of the firm's assets, L; the ratio of

intangible assets, i; the level of depreciation expenses,Δ; the level of fixed bankruptcy costs,C; the tax rate,T; and the earnings business risk parameter, R. Differentiating (6.16) with respect to I and some exogenous parameter, for example δ, yields (see also Scott (1976))

$$\frac{\partial^2 V}{\partial I^2} dI + \frac{\partial^2 V}{\partial I \partial \delta} d\delta = 0 \tag{6.17}$$

We will first find $\partial^2 V/\partial^2 I$ in order to examine the sign of $\partial^2 V/\partial I\, \partial \delta$. It can be shown that

$$\frac{\partial^2 V}{\partial I^2} = \frac{1}{r+F}\left[-Tf(I+\Delta)\left(1+\frac{f(I-Q,R)(BC)}{(r+F)}\right)-\frac{T(1-F(I+\Delta))}{f(I-Q,R)}f'(I-Q,R)\right.$$
$$\left. - \frac{T(1-F(I+\Delta))}{(BC)}\left[\frac{1+r}{r+F}-\frac{2T(1-F(I+\Delta))}{r+F}\right]\right] \tag{6.18}$$

where $BC=V-Q+I-[L(1-ic_i-(1-i)c_t)-C]$. It can be shown that, given $f'(I-Q,R)\geq 0$, (6.18) will be negative if

$$T < \frac{1+r}{2(1-F(I+\Delta))} \tag{6.19}$$

It can be seen from (6.17) that since $\partial^2 V/\partial^2 I$ is negative the sign of $\partial I/\partial \delta$ will be the same as that of $\partial^2 V/\partial I \partial \delta$. Therefore, in the following, we will examine the changes in the optimal capital structure given by I, by differentiating the first order condition with respect to the relevant exogenous variables.

The first prediction of this chapter is determined by totally differentiating (6.16) with

respect to L which gives the liquidation value of the firm's assets. This yields

$$\frac{\partial^2 V}{\partial I \partial L} = \frac{1}{(r+F)}[-f(b)[Z](\frac{\partial D}{\partial L}-(1-ic_i-(1-i)c_t))] \tag{6.20}$$

where

$$\frac{\partial D}{\partial L} = \frac{1}{r+F}[\int_{-\infty}^{I-Q}(1-ic_i-(1-i)c_t)f(E,R)dE] \tag{6.21}$$

and

$f(b) = f(I-Q,R)$,

$$Z = [(\frac{1+r}{r+F}-\frac{T(1-F(I+\Delta))}{r+F})]$$

Since $f(b)$, Z and $\partial D/\partial L$ are all positive as long as $(1-ic_i-(1-i)c_t)$ is greater than $\partial D/\partial L$ $\partial^2 V/\partial I \partial L$ will always be positive. For this condition to hold $r+F$ must be greater than F which holds for all $r>0$. Therefore $\partial^2 V/\partial I \partial L$ is positive. This implies that an increase in the liquidation value of the assets leads to an increase in the optimal level of contractual interest payments. This is not a surprising result because any incremental increase in the value of the liquidated assets will reduce the liquidation related bankruptcy costs. That is, the cost of going bankrupt decreases so that the firm may increase its debt until it gets a new optimal level which maximizes the firm value. This also implies a negative relationship between bankruptcy costs and the level of interest payments.

The second prediction is obtained by differentiating (6.16) with respect to the ratio

of intangible assets; i, which is given by

$$\frac{\partial^2 V}{\partial I \partial i} = \frac{1}{r+F}[-f(b)[Z](\frac{\partial D}{\partial i} + L(c_i - c_t))] \tag{6.22}$$

where

$$\frac{\partial D}{\partial i} = \frac{1}{r+F}[-\int_{-\infty}^{I-Q} L(c_i - c_t) f(E,R) dE] \tag{6.23}$$

Given that $c_i > c_t$, $\partial^2 V/\partial I \partial i$ is negative only if

$$L(c_i - c_t) > \frac{1}{r+F}[L(c_i - c_t)F] \tag{6.24}$$

(6.24) in turn holds if $r>0$. Therefore $\partial^2 V/\partial I \partial i$ is negative. This means that an increase in the ratio of intangible assets to total assets will lead to an increase in the expected costs of bankruptcy since these assets lose more compared to tangible assets when they are liquidated. The cross-sectional implication of this result is that firms with relatively more intangible assets will borrow less. By the same token, firms with relatively higher ratio of tangible assets to total assets will borrow more.

The third comparative statics is related to the level of non-debt tax shields to leverage, which is obtained by totally differentiating (6.16) with respect to Δ, which after simplification yields

$$\frac{\partial^2 V}{\partial I \partial \Delta} = \frac{1}{r+F}[-Tf(d)-[Z][f'(b)(BC)+\frac{\partial D}{\partial \Delta}f(b)+\frac{f(b)^2(BC)\partial Q/\partial \Delta}{(r+F)} - \frac{f(b)(BC)Tf(d)}{(r+F)}] \quad (6.25)$$

where $f(d) = f(I+\Delta,R)$ and $BC = D+I-(L(1-ic_i-(1-i)c_t)-C)$ and all other variables are as defined above. Also, it can be shown that $\partial Q/\partial \Delta$ and $\partial D/\partial \Delta$, given by the following equations, are both positive.

$$\frac{\partial Q}{\partial \Delta} = [\frac{T(1-F(I+\Delta))}{r+F}] \quad (6.26)$$

$$\frac{\partial D}{\partial \Delta} = \frac{1}{r+F}[\frac{f(b)T(1-F(I+\Delta))(BC)}{r+F}] \quad (6.27)$$

Therefore, $\partial^2 V/\partial I \partial \Delta$ is negative; an increase in the level of non-debt tax shields will lead to a reduction in the optimal level of interest payments. This is a predictable result since debt and non-debt tax shields are substitutes of each other. Thus the cross-sectional implication is that firms with higher levels of non-debt tax shields need less debt to shelter against corporate tax.

The fourth variable of concern is the non-variable cost of bankruptcy, which is denoted by C. Differentiating the optimality condition with respect to C result in

$$\frac{\partial^2 V}{\partial I \partial C} = \frac{-f(b)Z}{(r+F)}\left[1 - \frac{F}{r+F}\right] \tag{6.28}$$

It follows that (6.28) is negative. That is, an increase in the cost of bankruptcy deters firms from further borrowing.

The next prediction is found by differentiating (6.16) with respect to T. This yields

$$\frac{\partial^2 V}{\partial I \partial T} = \frac{1}{r+F}\left[\int_{I+\Delta}^{\infty} f(E,R)dE + \frac{f(b)(BC)}{r+F}\int_{I+\Delta}^{\infty} f(E,R)dE + [Z][-f'(b)(BC)]\right] \tag{6.29}$$

It can be shown that (6.29) is positive. That is, an increase in T increases the tax savings that result from higher level of debt, and hence raises the optimal level of interest payments.

The last prediction is found by totally differentiating (6.16) with respect to the variability of the firm's end-of-period earnings, which is given by R in the model (this is derived in Appendix 6.4). Intuitively, the greater the variability of earnings, the greater the probability of bankruptcy and of incurring the leverage related costs. That also means a greater probability of wasting interest and non-interest tax shields. However, as shown in the Appendix, the implication of the model is not unambiguous as this intuitive explanation.

6.4 Conclusions

This chapter has developed a multi-period model of optimal capital structure so as to discuss the determinants of firms' financial structure decisions. It has been shown that an optimal

capital structure of firms, at which the value of firms is maximised, is attained when the marginal tax savings equal to the marginal expected bankruptcy costs. In the model, the costs of bankruptcy include both direct administrative expenses and the costs of liquidation of the bankrupt firms' assets. Both costs are incurred in the bankruptcy state. Tax savings are simply due to the fact that interest payments are tax-deductible financial expenses.

One of the main contributions of the model of this chapter has been to incorporate non-debt tax shields into the optimal capital structure analysis in a multi-period setting. It is important to include non-debt tax shields in the model since they are substitutes for interest payments for the tax purpose and hence reduce the tax advantage of debt financing. Another important contribution of this chapter has been to explore the liquidation costs of the firm's assets by incorporating the firm's assets structure into the analysis. Doing this enables us to identify the firms whose values are more likely to decline substantially when liquidated. Finally, in addition to the costs of liquidation, direct costs of bankruptcy process is introduced in the model.

The main implications of the model presented in this chapter are as follows. It is shown that there is a negative relationship between leverage and the ratio of intangible assets to total assets. This negative relationship arises from the fact that expected bankruptcy costs rise as a result of an increase in the ratio of intangible assets since these assets lose more than tangible assets when they are liquidated. It is also shown that there is a negative relationship between leverage and non-debt tax shields which act as substitutes for tax deductible interest payments. This implies that firms with higher levels of non-debt tax shields need less debt to shelter their taxable income against corporate tax. The model also

predicts a negative relationship between leverage and fixed costs of bankruptcy and a positive association between leverage and tangible assets, corporation tax rate and liquidation value of insolvent firms' assets. However, the impact of the variability of firms' earnings on the borrowing decisions of firms is shown to be ambiguous.

CHAPTER 7

EMPIRICAL EVIDENCE ON CAPITAL STRUCTURE OF FIRMS

7.1 Introduction

In this chapter we investigate the determinants of capital structure decisions of firms. Despite the growing theoretical work, the existing empirical studies provide relatively little evidence on the determinants of the firm's financial structure.[1] Much previous empirical work has tended to concentrate on cross-sectional variations in leverage at firm or industry level. The common result of these studies is that firms in the same industry, facing similar conditions and risk characteristics, have similar leverage ratios. Moreover, on balance the evidence from these studies lends support to the negative impact of business risk faced by firms on their borrowing decisions. However, they have reached conflicting conclusions on the presence of significant effect of some other firm-specific variables. For example, Bowen *et al* (1982) and Kim and Sorensen (1986) provide evidence on the negative relationship between non-debt tax shields and leverage. However, Bradley *et al* (1984), Titman and Wessels (1988), Homaifar *et al* (1994) are unable to find such evidence. There are also conflicting results on the relationship between size and leverage. Ferri and Jones (1979), Kim and Sorensen (1986), Cheng (1993) show that there is no systematic association between firm size and capital structure. On the other hand, Homaifar *et al* (1994) and Titman and Wessels (1988) report results which are consistent with the notion that larger firms have higher debt ratios.

The major objective in developing the empirical model of this chapter is to gain further insight into the determinants of financial structure of firms. Unlike previous cross-section

[1]Empirical studies of capital structure include Bayless and Diltz (1994), Bowen, Daley and Huber (1982), Bradley, Jarrell and Kim (1984), Castanias (1983), Chung (1993), Ferri and Jones (1979), Homaifar, Zietz and Benkato (1994), Kim and Sorensen (1986), Long and Malitz (1985), Titman and Wessels (1988). The findings of these studies are also summarised in chapter 2.

studies this empirical work tests the implications of the theoretical capital structure models by using a *panel* data set of U.K. firms. The econometric technique used in this chapter incorporates both cross-section and time-series information on variables which various theories predict to be significant in determining the financial structures of firms. In the context of our empirical work, *panel data* is used to refer to a data set which is constructed with observations on a cross-section of firms over several time periods. Thus, panel data set provides us multiple observations on each firm in our sample. By providing a large number of data points and blending characteristics of both cross-sectional and time series-data, panel data improves the efficiency of econometric estimates and enables the use of more reliable research methods (Hsiao (1985)). Panel data also allows us to use estimation techniques which effectively control for unobservable firm specific fixed influences, including industry effects. Moreover, compared to cross-section data, panel data is more flexible in the choice of variables used as instruments to control for endogeneity. It also allows us to control for macroeconomic influences which have a common effect on all companies by including year dummies in the estimated models. Hence, panel data estimation provides a more satisfactory basis for our purpose which is to examine the empirical determinants of companies' borrowing decisions.[2]

Our empirical model captures at least two important features of corporate borrowing behaviour. First, it assumes that firms have a long-run optimal (target) debt ratio which is

[2]To the best of our knowledge there has been no rigorous empirical study using panel data estimation in the corporate borrowing context. Other panel data work in this area of finance include Auerbach (1985) and Chowdhury et al (1994). Auerbach (1985) attempts to explain the determinants of corporate borrowing by using a panel data set for the U.S. firms. His work does not take the endogeneity problem into account and hence is subject to criticism. For example, Gordon (1985) argues that most of the variables used in Auerbach (1985) (such as lagged debt, cash flow deficit, variance of earnings, tax loss carry-forward) are likely to be statistically endogenous. Chowdhury et al (1994), on the other hand, uses a panel of U.K. firms to investigate the determinants of short-term financial decisions of firms.

assumed to be a function of several firm-specific variables. Second, it is assumed that an adjustment process takes place, which involves a lag in adjusting to changes in this optimal debt ratio. Put it differently, firms cannot immediately eliminate the effects of random events which take them away from the long-run target debt ratio. A partial adjustment model is utilised to investigate the role of the adjustment process. In order to estimate our dynamic model consistently from a short and unbalanced panel the Generalised Method of Moments estimation procedure is used.

The rest of the chapter is organised as follows. In the next section we discuss the key determinants of leverage ratios of companies used in our model. In section 7.3 the empirical model is presented and a brief description of the data is given. In section 7.4 we present the estimation results. Finally, section 7.5 provides concluding remarks.

7.2 Determinants of Capital Structure

In what follows we discuss and motivate the choice of variables which are thought to determine leverage ratios of firms.[3]

7.2.1 Size

It has been suggested by a number of authors that size of the firm is positively related to leverage ratio. The rationale for this belief is the evidence provided by Warner (1977) and Ang, Chua, and McConnell (1982) that the ratio of direct bankruptcy costs to the value of the firm decreases as the value increases. This suggests that the direct costs of bankruptcy are less important for larger firms when they take their borrowing decisions. It is also

[3]A full description of the variables used in the empirical model is given in the Appendix 7.1.

argued that larger firms are more diversified (Titman and Wessels (1988)), enjoy greater debt capacity and have easier access to the capital markets, and borrow at more favourable interest rates (Ferri and Jones (1979)). Also, Chung (1993) argues that larger firms have lower agency costs associated with the *asset substitution* and the *underinvestment* problems, which mostly arise from the conflicting interests of shareholders and bondholders. Since larger firms tend to be the manager-controlled firms these costs are relatively less than those associated with smaller firms. A further reason for smaller firms to have lower leverage ratios is that, as discussed in chapter 4, smaller firms are more likely to be liquidated when they are in financial distress. The above discussion leads us to predict a positive relationship between firm size and the leverage ratio.

7.2.2 Growth Opportunities

Myers (1977) suggests that the amount of debt issued by a firm is inversely related to the growth opportunities which consists of future investment opportunities, which would increase the value of the firm when undertaken. With greater growth opportunities, a substantial part of the current value of the firm derives from the anticipated earnings from future investment opportunities rather than its existing assets. It is argued that firms financed with risky debt pass up some of these valuable investment opportunities in some states of nature. Naturally, it can be expected that this problem will be greater for firms with a wide range of investment opportunities from which to choose. Titman and Wessels (1988) also point out that firms in growing industries imply higher agency costs since they have more flexibility in taking future investments. It is also suggested that although growth opportunities are capital assets which add value to a firm they cannot be collateralized and do not generate current income. Moreover, as discussed in the previous chapters, growth

opportunities which are intangible in nature are valuable as long as the firm is "alive". The value of these assets will fall precipitously if the firm faces bankruptcy, which suggests that expected bankruptcy costs for firms with greater growth opportunities will be higher. Larger expected bankruptcy costs would in turn imply lower financial leverage.

7.2.3 Non-debt Tax Shields

Some investments may generate non-debt tax benefits which are unrelated to how firms finance these investments. Although these investments do not consist of any debt related costs they act as substitutes for tax shields. DeAngelo and Masulis (1980) presents an optimal capital structure model where non-debt tax shields serve as a substitute for the interest expenses which are deductible in the calculation of the corporate tax. Since they are substitutes for the tax benefits of debt financing an inverse relationship is expected to exist between the amount of the non-debt tax shields and leverage: the higher the value of non-debt tax shields the lower the firm's incentive to issue debt for tax avoidance purposes since it is more likely that the tax benefits of debt can go unused. In other words, the prospect of not being able to exploit all future tax deductions provided by interest payments makes the use of debt less attractive, and may cause firms to rely on less debt in their capital structures.

7.2.4 Profitability

Myers (1984) points out that firms prefer retained earnings as their main source of financing investment (*pecking order theory* of capital structure). The second preference is debt financing, and last comes new equity issuing, which might be due to the significant transaction costs of issuing new equity. It is suggested that observed capital structure of

firms will reflect the cumulative requirement for external financing. An unusually profitable firm with a slow growth rate will end up with an unusually low leverage ratio compared to the industry average in which it operates. On the other hand, an unprofitable firm in the same industry will end up with a relatively high debt-to-equity ratio. In this sense, profitability of a firm gives the ability of the firm to use retained earnings over external finance and one should expect a negative association between the profitability of a firm and its debt ratio.

7.2.5 Liquidity

Liquidity ratios are mostly used to judge a firm's ability to meet its short-term obligations. They provide information about the ability of the firm to remain solvent in the event of adversities. There might be different effects of the liquidity ratio on the capital structure decision working in opposite directions. First, firms with higher liquidity ratios might support a relatively higher debt ratio. This is due to greater ability to meet short-term obligations when they fall due. Even if the profitability ratio of a company is satisfactory, the company may find it difficult to survive for very long when there are insufficient funds to meet its immediate obligations. From these effects one should expect a positive relationship between a firm's liquidity position and its debt ratio. However, firms with greater liquid assets may use these assets to finance their investments. If this happens there will be a negative relationship between the firm's liquidity ratio and its debt ratio. Moreover, as also pointed out by Prowse (1990), the liquidity of the company's assets can be used to show the extent to which these assets can be manipulated by shareholders at the expense of bondholders.

7.2.6 Operating Leverage

Operating leverage is related to business risk of a firm. It refers to the employment of assets which generate fixed operating costs. These costs must be met regardless of the volume of firm's activities (sales). These fixed costs include things such as insurance, a portion of the costs of management, and depreciation of buildings and equipment. With a high degree of operating leverage, the break-even point of a firm occurs at a relatively high level of sales, and changes in sales have a magnified impact on earnings before interest and taxes (EBIT). It is argued that (see, e.g., Weston and Copeland (1988)) operating leverage has the same kind of effects on profit as financial leverage: the higher the leverage factor, the higher the break-even sales volume and the greater impact of a change in sales on profit. Therefore, firms are likely to make trade-offs between their financial and operating leverages. Other things being equal, firms with higher operating leverage ratios are likely to have lower financial leverage ratios. However, it should also be noted that operating leverage is only one component of the overall risk of the firm. The business risk of a company is primarily determined by the variability and uncertainty of its sales and costs. Operating leverage is not the source of the variability. Instead, it magnifies the impact of the changes in these variables.[4]

7.3 Empirical Model and Data

7.3.1 Empirical Model

Myers (1984) argues that firms' observed debt ratios cannot be their optimal ratios given that there are costs, and therefore lags, in adjusting to the optimum. Firms cannot

[4]One commonly used variable in cross-sectional studies is business risk of firms, which is generally measured by the standard deviation of firms' earnings. Given the short-time series nature of our data set, we are unable to include this variable since it is impossible to calculate the standard error (variability) of earnings for each firm in each year.

immediately offset the effects of random events which take them away from the optimal ratio. He argues that large adjustment costs could be an important factor to explain the observed variation in actual debt ratios across firms, since large costs involved in adjusting to the optimal ratio would cause long delays to achieve their optimal ratios. Therefore, he claims, it would be difficult to obtain an accurate test of the effects of variables on the financial structure of firms by taking a cross-section of firms in a particular year. Even if the selected variables are truly the determinants of the optimal target debt ratio, they may not explain the actual debt ratio, since firms may be away from their target ratios.

In this chapter, we investigate the role of adjustment costs by adapting a partial adjustment model. We assume that the long-run debt ratio of firms is taken to be a function of several variables outlined in the previous section. The desired long-term debt ratio of the firm can be written as

$$D_{it}^{*} = \sum_{k} \beta_k x_{kit} + \alpha_i + \alpha_t + \varepsilon_{it} \qquad (7.1)$$

where firms are represented by subscript $i=1,...,N$, and time by $t=1,...,T$. In the model leverage ratio, D, is explained in terms of K explanatory variables $x_1,...,x_k$, time-invariant unobservable firm and/or industry specific fixed effects α_i, firm-invariant time specific fixed effects α_t and a disturbance term ε_{it} which is assumed to be serially uncorrelated with mean zero and but is possibly heteroscedastic. β_k's which are common to each firm are the unknown parameters of interest.

It is worth emphasizing at this stage the role of variables α_i and α_t. α_i, time-invariant

firm specific effects, captures various characteristics of the firm which are not observable but have a significant impact on the firm's capital structure decisions. They change across firms but are assumed to remain unchanged for a given firm through time. Examples of these effects include attributes of the managers of firms such as ability and motivation, or their attitudes toward taking risk (risk lover or risk averse). They might also include time-invariant industry specific effects which are specific to the industry in which the firm operates. These might involve those structural characteristics such as entry barriers, factor market conditions and industry-wide business risk.[5] On the other hand α_t, firm-invariant time specific effects, are the same for all firms at a given point in time but vary through time. These effects are mainly macroeconomic effects such as prices and interest rates. However, including α_t controls for both observable and unobservable aggregate influences that have a common effect on all firms.

Firms adjust their borrowing in order for their current leverage ratio to be close to the desired one. This leads to a partial adjustment mechanism which is given by

$$D_{it} - D_{i,t-1} = \lambda(D_{it}^{*} - D_{i,t-1}) \qquad (7.2)$$

where $0<\lambda<1$, D_{it} is the actual debt ratio and D^{*}_{it} is the desired debt ratio of firm i at time t. $(D^{*}_{it}-D_{i,t-1})$ can be interpreted as the desired change whereas only a fraction λ of the

[5]A number of empirical studies has included variables such as R&D and advertising expenditures as potential determinants of leverage ratio. The data for these variables is rarely available for our sample of firms. However, to the extent that they are constant over time, the effects of these factors are controlled for by incorporating firm specific fixed effects into the analysis.

desired change is achieved, which is equal to $(D_{it}-D_{i,t-1})$.[6] Combining (7.1) and (7.2) yields

$$(D_{it}-D_{i,t-1}) = \lambda(\sum_{k} \beta_k x_{kit}+\alpha_i+\alpha_t+\epsilon_{it}-D_{i,t-1}) \qquad (7.3)$$

which gives

$$D_{it} = (1-\lambda)D_{i,t-1}+\sum_{k} \lambda\beta_k x_{kit}+\lambda\alpha_i+\lambda\alpha_t+\lambda\epsilon_{it} \qquad (7.4)$$

Equation (7.4) can also be written as

$$D_{it} = \gamma_0 D_{i,t-1}+\sum_{k=1} \gamma_k x_{kit}+\eta_i+\eta_t+u_{it} \qquad (7.5)$$

where $\gamma_0=1-\lambda$, $\gamma_k=\lambda\beta_k$, $\eta_i=\lambda\alpha_i$, $\eta_t=\lambda\alpha_t$ and $\lambda\varepsilon_{it}=u_{it}$ (where u_{it} has the same properties as ε_{it}).

---

[6]Following Maddala (1988) a simple explanation can be given on the partial adjustment to the desired debt ratio firms are assumed to make. Firms can be assumed to have two different costs: costs of making adjustment and costs of being in disequilibrium. Assuming that the two costs are quadratic and additive, total costs can be written as

$$C_{it} = a_1(D_{it}-D_{i,t-1})^2 + a_2(D_{it}^*-D_{it})^2$$

D_{it} is chosen to minimise the total cost C_{it}. $dC_{it}/dD_{it}=0$ gives

$$2a_1(D_{it}-D_{i,t-1}) = 2a_2(D_{it}^*-D_{it})$$

$$2a_1(D_{it}-D_{i,t-1}) = 2a_2[D_{it}^*-D_{i,t-1}-(D_{it}-D_{i,t-1})]$$

which gives

$$(D_{it}-D_{i,t-1}) = \lambda(D_{it}^*-D_{i,t-1})$$

where $\lambda=a_2/a_1+a_2$. Noting that $0<\lambda<1$, λ will be close to 1 if the costs of being in disequilibrium are much higher than the costs of adjustment. Alternatively, λ will be close to 0 if the costs of adjustment are much higher than the costs of disequilibrium.

In the presence of firm specific effects OLS coefficients are biased assuming that α_i is unobservable and covariances between x_{kit} and α_i are nonzero (Hsiao (1985)). In a dynamic model which we wish to consider it can be shown that OLS estimation leads to inconsistent estimation. The estimation of equation (7.5) by OLS will result in inconsistent estimation of γ_0 and γ_k since $D_{i,t-1}$ are correlated with η_i which does not vary through time. Taking first differences in order to eliminate the unobservable firm specific effects α_i gives the following

$$(D_{it}-D_{i,t-1}) = \gamma_0(D_{i,t-1}-D_{i,t-2})+\sum_k \gamma_k(x_{ikt}-x_{ik,t-1})+(u_{it}-u_{i,t-1}) \qquad (7.6)$$

Again OLS regression does not consistently estimate γ_0 and γ_k because $(D_{i,t-1}-D_{i,t-2})$ and $(u_{it}-u_{i,t-1})$ are correlated through terms $D_{i,t-1}$ and $u_{i,t-1}$.

Anderson and Hsiao (1981) suggested a consistent estimation technique which requires to use of an instrumental variable (IV) estimation method. This requires first differencing the model to eliminate the firm specific fixed effects and then using the first difference or the level of the dependent variable lagged twice, $\Delta D_{i,t-2}=(D_{i,t-2}-D_{i,t-3})$ or $D_{i,t-2}$ respectively, as instruments for the first difference of the lagged dependent variable. Both $\Delta D_{i,t-2}$ and $D_{i,t-2}$ are correlated with $(D_{i,t-1}-D_{i,t-2})$, but uncorrelated with $(u_{it}-u_{i,t-1})$. The IV estimation will result in consistent estimate of γ_0 and γ_k as long as the error term u_{it} in levels are not serially correlated. This (IV) estimation does not necessarily lead to efficient estimates of the parameters in the model because it does not make use of all the available moment conditions. Arellano and Bond (1991) proposes an alternative estimation method, generalised method of methods (GMM), which utilizes additional instruments which can be

obtained by utilizing the orthogonality conditions that exist between the lagged values of the dependent variable and disturbances. The set of valid instruments changes depending upon the assumption concerning the correlation between explanatory variables x_{ikt} and disturbances u_{it}. It is suggested that the valid instruments for period t for equation in first differences will be

$$z_{it} = [D_{i1},...,D_{i,t-2},x_{ik1},...,x_{ik,t-1}] \quad (7.7)$$

under the assumption that u_{it} is serially uncorrelated, and x_{ikt} is predetermined. That is, $E(x_{kit}u_{is})\neq 0$ for $s<t$ and zero otherwise. If, on the other hand, x_{ikt} is strictly exogenous, i.e. $E(x_{ikt}u_{is})=0$ for all t,s, then all x's are valid instruments for all equations in first differences. In this case z_{it} becomes

$$z_{it} = [D_{it},...,D_{is},x_{ik1},...,x_{ikT}] \quad (7.8)$$

where $s=1,...,T-2$.[7]

7.3.2 Data

The main data source for our analysis is EXSTAT database which provides accounting data on firms. The market value of equity was drawn from London Business School's London Share Prices Data (LSPD) database which consists of market data for quoted companies. Our sample consists of quoted firms operating in the U.K. The panel data has been constructed as follows. First, all the firms which are not currently "alive" were extracted

[7]Note that the first period for which the relationship given by equation (7.5) is observed is when $t=3$. In this case D_{i1}, x_{ik1} and x_{ik2} are valid instruments for ΔD_{i2} and Δx_{ik3} (if x_{ikt} is predetermined) because D_{i1}, x_{ik1}, x_{ik2} are not correlated with $(u_{i3}-u_{i2})$. For $t=4$, however, D_{i2}, and x_{ik3} as well as D_{i1}, x_{ik1} and x_{ik2} are valid instruments since now D_{i1}, D_{i2}, x_{ik1}, x_{ik2}, x_{ik3} are not correlated with $(u_{i4}-u_{i3})$. Continuing with this fashion, adding an extra valid instrument with each forward period, the set of valid instruments given by (7.7) and (7.8) can be attained.

from the data set. Firms which operate in the financial sector (banks, insurance companies, investment trusts,etc) and utilities (companies providing a public service such as electricity, gas, telephone,etc) were also excluded. We have dropped all firms which have any missing observations for any variable in the model during the period. From these, we have chosen those firms which have at least five continuous time series observations during the period 1981-1991. The firms have been then aggregated into eight one-digit SIC industries to give us the final sample of 195 firms. This sample is unbalanced in the sense that not all firms are observed in each year, although they are all observed for at least five years.[8]

7.4 Empirical Results

Table 7.1 reports different estimates of the following empirical specification

$$D_{it}=\Phi[D_{i,t-1},(Size)_{it},(Liquidity)_{it},(Ndts)_{it},(Profit)_{it},(Growth)_{it},(Fixast)_{it}]+\alpha_i+\alpha_t+\varepsilon_{it} \qquad (7.9)$$

where D_{it} is the leverage ratio of company i in year t, and Φ allows for lags in both dependent and explanatory regressors. α_i and α_t represent time-invariant firm specific and firm-invariant time specific fixed effects respectively. Columns (1) and (2) present Generalised Method of Moments (GMM) and Anderson-Hsiao (AH) type estimates respectively, both in first differenced form. Column (3) gives OLS estimates of leverage equation 7.9 in levels. Columns (1) and (2) differ in that the GMM estimator allows the instruments used in each period to increase as one moves through the panel, whereas the AH type estimator uses only $\Delta D_{i,t-3}$ to instrument $\Delta D_{i,t-1}$. The estimation period is 1984-91 for

[8]A more detailed account of our data set including summary statistics is given in Appendix 7.

the GMM estimates as a result of losing three cross-sections in constructing two lags for each variable and taking first differences. One further cross section is lost for the AH estimator since it requires the use of $(D_{i,t-3}-D_{i,t-4})$ as instrument, so that the estimation period becomes 1985-91. In both models all variables other than the lagged dependent variable (which is by construction necessarily correlated with the error term through fixed effects) is taken to be strictly exogenous in the sense that they are assumed to be uncorrelated with the fixed effects and errors. This assumption is relaxed later in this chapter. It is because of this assumption that only the lagged dependent variable is instrumented. Moreover, the fixed effects are eliminated by first differencing in both the GMM and AH estimators. However, in model (3) which gives the OLS estimates, the lagged dependent variable is also treated as exogenous and the unobservable firm specific fixed effects remain. In all models the sample contains 195 firms and 1321 observations although usable observations vary according to the estimation method.

Turning to the estimation results and comparing the GMM and AH estimates it can be seen clearly that the coefficient estimates under AH are poorly determined. The AH results reveal substantially larger variances than those associated with the GMM estimates. This is consistent with the findings of Arellano and Bond (1991) who study the performance of these estimators and conclude that the GMM estimates result in smaller variance than those associated with the AH type instrumental variable estimators. Column (3) shows that there is evidence of an upward bias on the coefficient of the lagged dependent variable in this OLS level specification. This is not a surprising result since the lagged dependent variable is expected to be biased upwards due to correlation with the unobservable fixed effects. This result can also be seen as an indication of the presence of firm-specific effects.

Table 7.1 Alternative Estimates

Dependent Variable: D_{it}

Independent Variables	(1) GMM	(2) AH	(3) OLS
$D_{i,t-1}$	0.707 (0.092)	1.154 (0.935)	0.792 (0.038)
$D_{i,t-2}$	0.021 (0.042)	0.099 (0.113)	0.002 (0.037)
$Size_{it}$	0.178 (0.053)	0.145 (0.073)	0.205 (0.063)
$Size_{it-1}$	-0.242 (0.090)	-0.225 (0.238)	-0.082 (0.087)
$Size_{it-2}$	0.001 (0.060)	-0.054 (0.130)	-0.154 (0.061)
$Liquidity_{it}$	-0.026 (0.009)	-0.024 (0.018)	-0.021 (0.007)
$Liquidity_{it-1}$	0.000 (0.007)	0.010 (0.018)	0.004 (0.006)
$Liquidity_{it-2}$	0.004 (0.012)	0.008 (0.016)	0.004 (0.006)
$Ndts_{it}$	-0.075 (0.026)	-0.068 (0.042)	-0.052 (0.018)
$Ndts_{it-1}$	0.046 (0.022)	0.097 (0.086)	0.032 (0.022)
$Ndts_{it-2}$	-0.008 (0.025)	0.015 (0.038)	0.008 (0.015)
$Profit_{it}$	-0.069 (0.042)	-0.037 (0.097)	-0.094 (0.036)
$Profit_{it-1}$	0.081 (0.035)	0.018 (0.125)	0.117 (0.034)
$Profit_{it-2}$	0.036 (0.026)	0.050 (0.038)	0.029 (0.023)
$Growth_{it}$	-0.027 (0.012)	-0.028 (0.029)	-0.041 (0.012)
$Growth_{it-1}$	0.033 (0.010)	0.046 (0.036)	0.032 (0.014)
$Growth_{it-2}$	0.003 (0.007)	-0.004 (0.009)	-0.008 (0.007)
$Fixast_{it}$	-0.019 (0.112)	-0.087 (0.179)	-0.018 (0.090)
$Fixast_{it}$	-0.052 (0.155)	0.054 (0.223)	0.059 (0.122)
$Fixast_{it-2}$	0.188 (0.106)	-0.057 (0.123)	-0.007 (0.078)
Correlation 1	-6.168	-1.407	1.400
Correlation 2	1.126	1.111	2.529
Wald test 1 (df)	139.42 (20)	41.51 (20)	1958.20 (20)
Wald test 2 (df)	15.09 (8)	7.99 (7)	19.14 (7)
Wald test 3 (df)	-	-	5.93
Sargan test (df)	36.22 (32)	-	-

(i) Time dummies are included in all models. Industry dummies are included only in model 3.
(ii) Asymptotic standard errors robust to heteroscedasticity are reported in parentheses.
(iii) Model 1 gives the GMM estimates in first differences where $D_{i,t-2},...,D_{i,t-6}$ are used as instruments and the estimation period is 1984-91. In Model 2 Anderson-Hsiao type estimates in first differences are reported where $\Delta D_{i,t-3}$ is used as instrument for $\Delta D_{i,t-1}$ and the effective sample starts from 1985.
(iv) Model 3 gives OLS estimates in levels, where the estimation period is 1984-91.
(v) Six test statistics are reported: (1) First order autocorrelation of residuals which is asymptotically distributed as standard normal N(0,1) under the null of no serial correlation (see Arellano and Bond (1991)); (2) Second order autocorrelation of residuals which is distributed as standard normal N(0,1) under the null of no serial correlation; (3) Wald test 1 is a Wald test of joint significance of the estimated coefficients which is asymptotically distributed as chi-square under the null of no relationship; (4) Wald test 2 is a Wald test of the joint significance of the time dummies; (5) Wald test 3 is a Wald test of the joint significance of the industry dummies; (6) Sargan test of overidentifying restrictions which is asymptotically distributed as chi-square under the null of instrument validity.
(vi) All estimations were carried out using the DPD program written in GAUSS (Arellano and Bond(1988)).

As noted earlier, in a panel data analysis, the impact of unobserved firm specific effects can be controlled for by first differencing the levels model. When these firm specific effects exist and are unobservable OLS estimation in levels leads to an omitted variables bias because of the correlation which is likely to occur between the fixed effects and the included regressors. Notice that the serial correlation tests suggest some degree of misspecification although the Wald tests confirms the joint significance of the estimated coefficients. These results would have misled us to conclude that most variables included in the regression equation are significant in determining the leverage ratio.

Comparing these three models given in Table 1 our preferred model is the GMM estimator. Under this model, none of the test statistics show evidence for the existence of misspecification. More specifically, Correlation 2 test for the absence of second order autocorrelation of residuals is satisfied. Also, the Wald tests of the joint significance of the regressors and the time dummies are both satisfied. The Sargan test reveals that the instruments used in the GMM estimation are valid.

Table 7.2 reports only the GMM estimates, where the insignificant coefficients are omitted. Now, one further cross-section is available because the maximum length of the lag in the model is one, so that the estimation period starts from 1983. In the first column (model 1), it is again assumed that all variables other than the lagged dependent variable are strictly exogenous. This model shows little difference with the GMM estimator in the previous table in terms of the estimated coefficients and the test-statistics. That is, the Sargan test provides no evidence for the invalidity of the instruments. First-order serial correlation is observed. However, evidence for the absence of second-order correlation of

residuals is not very strong.[9] The specification tests for the joint significance of the estimated regressors and dummy variables are both clearly satisfied. Omitting the insignificant variable (fixed asset ratio) and dynamics results in the following basic model.[10]

$$\begin{aligned}\Delta D_{it} = {} & \beta_1 \Delta D_{it-1} + \beta_2 \Delta Size_{it} + \beta_3 \Delta Size_{it-1} + \beta_4 \Delta Liquidity_{it} \\ & + \beta_5 \Delta Ndts_{it} + \beta_6 \Delta Ndts_{it-1} + \beta_7 \Delta Profit_{it-1} + \beta_8 \Delta Growth_{it} \\ & + \beta_9 \Delta Growth_{it-1} + \Delta u_{it}\end{aligned} \qquad (7.10)$$

As mentioned earlier, the GMM estimator provides consistent estimates even when endogenous regressors include the lagged dependent variable. However, this occurs if a valid instrument set is used. The form of the instrument set depends on the relationship between regressors and u_{it}. If one relaxes the assumption of strict exogeneity of regressors with respect to the firm-specific unobservable fixed-effects and errors u_{it} then the instruments used in model 1 are no more valid instruments. Assuming that one regressor (say x_{it}) is correlated with the fixed effects and u_{it} is serially uncorrelated, one must consider whether x_{it} is predetermined or strictly exogenous with respect to u_{it}. As explained earlier, if x_{it} is strictly exogenous, i.e. $E(x_{it}u_{is})=0$ for all t and s, then all x's are valid instruments. If x_{it} is predetermined with respect to u_{it}, i.e. $E(x_{it}u_{is})=0$ if and only if $s \geq t$, the earliest instrument

[9]Note that, if u_{it} are serially uncorrelated in the model in levels first differences transformation induces first-order serial correlation in the differenced residuals, but second order serial correlation should be absent. That is, as explained in Arellano and Bond (1991), $E(u_{it}u_{it-1})$ need not be zero, but the consistency of the GMM estimators relies heavily on the assumption that $E(u_{it}u_{it-2})=0$.

[10]Fixed assets ratio has also been included to test the hypothesis that tangible assets can easily be collateralised and hence firms with more tangible assets can support higher leverage ratios. This variable has been defined as the ratio of tangible assets to total assets. Degree of operating leverage (Dol_{it}) is added to the existing variables in a different sample because by doing so one more cross-section was lost due to the definition of this variable, using percentage changes in profit and sales. We also had to drop those firms whose number of observations fell to four, which originally had five. The test statistics are still satisfactory in the sense that we observe first-order serial correlation in residuals but not second order, and the Wald test of joint significance of regressors and the Sargan test of instrument validity are both satisfied. Although the sign of the degree of operating leverage is negative as expected it is quite insignificant. This result is not surprising given the fact that operating leverage is only a part of the overall business risk which is the crucial factor in determining the debt ratio of firms. We therefore do not include this variable in our basic model and do not report the results.

available is $x_{i,t-1}$. These possibilities are investigated following a similar approach to Blundell *et al* (1992). In order to test for the possibility that x_{it} is predetermined with respect to u_{it} we start using instruments dated t-2 for each variable included in the instrument set. Due to the limitations of the software program, only one instrument for each cross-section is included. Ideally, the instrument set would include all the instruments dated t-2 and earlier. Later, $x_{i,t-1}$ is added to the existing instruments to investigate the potential biases which arise from the correlation between $x_{i,t-1}$ and the first-differenced error term Δu_{it}. In the presence of the measurement error the estimate of the coefficients of x is expected to fall, which suggests a downward bias due to the simultaneous determination of $x_{i,t-1}$ and $u_{i,t-1}$ (Blundell *et al* (1992)). This procedure was carried out for each variable and concluded that size and profit are predetermined with respect to u_{it}. Thus for these variables instruments dated t-1 are chosen. For liquidity, non-debt tax shields and growth downward biases were observed in the coefficients when their lagged values dated t-1 were included in the instrument set. As discussed by Blundell et al (1992), the presence of measurement error in x precludes the use of lagged values of x dated t-1 and t-2. Therefore, for those variables for which there is evidence of measurement error instruments dated t-3 are chosen. The effect of choosing these instruments is an increase in the coefficients of liquidity, non-debt tax shields and growth as one would expect in the presence of measurement error. [11]

[11]We also investigate the possibility of strict exogeneity of variables with respect to u_{it} by including current values. The effect is a fall in the estimates of the coefficients so that we conclude that no variable is strictly exogenous with respect to u_{it}.

Table 7.2 GMM Estimation Results

Dependent Variable: D_{it}		
Independent Variables	(1) GMM1	(2) GMM2
$D_{i,t-1}$	0.753 (0.075)	0.527 (0.082)
$Size_{it}$	0.175 (0.067)	0.104 (0.028)
$Size_{it-1}$	-0.188 (0.071)	-0.073 (0.033)
$Liquidity_{it}$	-0.026 (0.008)	-0.021 (0.011)
$Ndts_{it}$	-0.085 (0.023)	-0.093 (0.057)
$Ndts_{it-1}$	0.049 (0.022)	-0.017 (0.052)
$Profit_{it}$	0.059 (0.039)	0.149 (0.058)
$Growth_{it}$	-0.026 (0.010)	-0.091 (0.028)
$Growth_{it-1}$	0.024 (0.011)	0.016 (0.021)
Correlation 1	-7.169	-5.896
Correlation 2	1.175	0.846
Wald test 1 (df)	164.75 (9)	104.19 (9)
Wald test 2 (df)	18.13 (9)	18.81 (9)
Sargan test (df)	36.41 (36)	58.129 (49)

Notes:
(i) Model 1 uses $D_{i,t-2},...,D_{i,t-6}$ as instruments where other variables are assumed to be strictly exogenous.
(ii) In model 2, $D_{i,t-2}$, $Size_{i,t-1}$, $Liquidity_{i,t-3}$, $Ndts_{i,t-3}$, $Profit_{i,t-3}$, $Growth_{i,t-3}$ are used as instruments.
(iii) The estimation period is 1983-91 for both models.
See also notes to Table 1.

Model 2 in Table 7.2 reports the results of our preferred model. Correlation 1 test for serial correlation in residuals provides evidence for negative first-order serial correlation. However, Correlation 2 test suggests that second-order serial correlation is absent, which is essential for the validity of our estimation procedure. Note that in model 1 in Table 7.2, the absence of second-order serial-correlation is marginally accepted which might also justify the use of instruments for some variables dated t-3. The Wald test of the joint significance of the regressors is satisfied. Time dummies are jointly significant suggesting

that aggregate factors exert a significant influence on borrowing decisions of firms. The Sargan test also indicates that the instruments used in the GMM estimation are valid, which shows that the instruments used are not correlated with the error term.

Turning to the GMM estimates of the coefficients, majority of the estimated coefficients have the expected signs and are significant. As expected, the coefficient of the lagged leverage is positive and relatively large showing that the dynamics implied by our model are not rejected and firms adjust their leverage ratios relatively quickly in an attempt to have their target debt ratios. One possible explanation for this adjustment speed would emphasise that the costs of being far away from the target debt ratio are significant so that firms wish to reach their target ratios as quickly as possible. The positive coefficient of the lagged leverage ratio also shows that firms' leverage ratios are persistent over time.

The coefficient of growth opportunities is negative and significant. The negative impact of growth on leverage might reveal several features of borrowing behaviour of companies. First, to the extent that it proxies the value capitalised by investors into firm value over the present value of cash flows accruing from the firm's fixed effects, our measure of growth opportunities can be interpreted as investments in intangible assets. As discussed earlier, these assets cannot be readily collateralized and their value falls substantially in the event of financial distress (especially in a liquidation). Therefore, the negative coefficient of growth opportunities gives support to the view that firms which have a relatively large proportion of their intangible assets cannot support a high leverage ratio. Second, firms with greater growth opportunities might have lower leverage ratios due to the fear of debtholders that firms might pass up valuable investment opportunities. This is also

related to the first point raised above because *underinvestment problem* intensifies when firms are in financial distress. In this sense, the decline in the value of the firm due to the incentives of shareholders of firms, (which is likely to be born by debtholders), can be seen as the expected costs of financial distress.

The evidence also indicates that size of firms has a positive effect on their leverage ratios suggesting that large firms can better support higher debt ratios than smaller firms. This evidence may reflect several features. First, large firms might have better access to financial markets to raise long-term debt. Second, as discussed earlier, the ratio of bankruptcy costs to the firm value is higher for smaller firms since these costs include fixed costs which can be negligible for large firms. Since bankruptcy risk increases with borrowing small firms borrow less than large firms. Finally, the positive coefficient of the size variable is in line with the prediction of the model developed in chapter 4. It is discussed in that chapter that small firms are more vulnerable to a liquidation risk when they are in financial distress since banks are generally tougher against small firms. The coefficient of the lagged size is negative and significant. The explanation for the opposite sign of the lagged size might be that size of firms do not have a persistent effect on their leverage ratios. We also investigated the possibility that the change in size rather than size of firms itself may be the determinant of leverage but could not find any such evidence.

As noted earlier firms with high level of non-debt tax shields which can be deducted from the taxable income are expected to have less debt than other firms *ceteris paribus*. This prediction is confirmed by the negative coefficient of the non-debt tax shields variable. However, the level of significance for the estimated coefficient of this variable is marginally

above 10 percent. Similarly, the coefficient of the lagged non-debt tax shields yields an insignificant result.

The negative sign of liquidity might be taken as evidence for the *pecking order theory* which predicts that internal financed is preferred over external finance. The negative effect of the liquidity ratio on firms' borrowing decisions might also be due to potential conflicts between debtholders and shareholders of firms. As noted earlier, the liquidity of firms' assets can be taken as evidence to show the extent to which these assets of companies can be manipulated by shareholders at the expense of bondholders. The positive effect of liquidity position of the firm on its leverage ratio is not realised. The significance level at which the hypothesis that the coefficient of liquidity is zero is rejected is marginally above 5 percent.

Some evidence emerges that profitability of firms exerts a positive influence on firms' borrowing decisions. The coefficient on the lagged profit is positive and significant. This might be due to the tax advantage of debt. Profitable firms may reveal a high demand for interest tax shield. Also, more profitable firms may be seen by debtholders as less risky (i.e. profitability of bankruptcy is low). As a result, these firms can get more debt relatively easily.[12]

[12]We also carried out the GMM estimation with alternative definitions of the dependent variable (leverage). Firstly, we defined leverage as the ratio of the sum of long-term and short-term debt to the sum of long-term debt, short-term debt and book value of equity. The rationale behind including short-term debt is the argument that short-term bank loans and overdrafts are often renewable and, therefore being effectively a source of long-term finance. Secondly, we included preferred capital as well in the definition of total debt. Preferred capital were included in the numerator since preference shareholders are entitled to a fixed rate of dividend. The results using these definitions of the dependent variable were very similar to those reported here.

7.5 Conclusions

This chapter has investigated the determinants of firms' borrowing decisions. Compared to most of the empirical work which has been done in this area, a different approach has been taken. There are several important features of the data set and the estimation technique used in this chapter. First, a panel data set for 195 U.K. companies was constructed. This allows us to take both cross-section and time-series variations in leverage ratios of firms. One of the advantages of this is that we have been able to adapt a dynamic model (partial adjustment mechanism) which sheds some light on the issues of long-term target debt ratio of firms and adjustment process to this target. Second, panel data analysis and the Generalised Methods of Moments (GMM) estimation procedure have allowed us to effectively control for firm specific fixed effects which are unobservable yet important in affecting financial decisions of firms. Third, the analysis of this chapter has dealt with the endogeneity problem by allowing us the choice of more efficient instruments to control for endogeneity.

Our investigation has provided the following insights into the empirical determinants of corporate borrowing. Our results suggest that firms have long-term target leverage ratios and firms adjust to the target ratio relatively fast. However, as revealed by the coefficient of the lagged leverage ratio being the half way between 0 and 1, this adjustment process is costly. In other words, the costs of being away from their target ratios and the costs of adjustment are equally important for firms. The results provide support for a positive effect arising from size of firms, possibly reflecting the better access of large firms to financial markets, the relatively low proportion of bankruptcy costs to the value of firms or the flexibility of banks to larger firms when they are in financial distress. The evidence also

indicates that past profitability exerts a positive effect on the capital structure choice of firms. This contradicts with the view that internal finance is preferred to external finance. However, one possible explanation for the positive influence of profitability on leverage might be that more profitable firms might support a higher leverage ratio. There is no evidence to show that current profitability is an important determinant of capital structure. The results also indicate that liquidity may be a determinant of capital structure choice. Some evidence emerges that there is a negative relationship between leverage ratio and the liquidity of firms, lending support to the *pecking order theory*. It seems that there is no positive impact of the liquidity position of firms on their borrowing decisions (or abilities). Our results provide support for various theories which predict that growth opportunities have a negative impact on financial leverage. This evidence is important since it might suggest that the various leverage-related costs may be particularly significant in determining the capital structure choice of companies. Our results do not support the prediction of the theory that non-debt tax shields serve as substitutes for the interest payment and hence there exists an inverse relationship between these expenses and borrowing ratio of firms. Although the expected negative sign is observed the coefficient of this variable is insignificant.

There are several possible extensions of the resent analysis, which might provide more insight into the determinants of borrowing decisions of firms. First, ownership and control issues are known to be related to the existence and magnitude of indirect costs of bankruptcy. The explanatory power of the empirical analysis can be increased if, for example, particular control mechanisims are identified and incorporated into the empirical analysis. Second, our estimation procedure assumes that the unknown parameters are

common to all firms included in the sample. This assumption is restrictive and if it is not valid it may lead to biased estimated parameters (see Pesaran and Smith (1994)). Therefore, a natural extension of this work is to investigate whether there are significant differences in the estimated slope parameters as well as intercepts by carrying out a seperate regression by disaggregating the sample by industries and by time periods. Data limitations and methodological difficulties precluded us from doing so.

CHAPTER 8

CONCLUSIONS

The main purpose of this study has been to explore the impact of costly financial distress and bankruptcy on the capital structure of firms. Following the corner-solution result of Modigliani and Miller (1963) which implies a 100 percent of debt finance, the topic of bankruptcy costs has gained a great deal of attention in an attempt to fill the gap between the practical experience and the theoretical prediction. According to the *trade-off* theory the tax advantage of debt finance, which arises from the deductibility of interest payments in the calculation of tax amount, is reduced by expected bankruptcy costs. Thus, firms issue debt until, at the margin, the tax advantage of extra debt is offset by higher expected bankruptcy costs. However, despite the popularity which the subject has gained, there has not been a general agreement on the role and significance of bankruptcy costs.

The above mentioned lack of agreement has been one of the main motivations of this thesis. In attempting to provide further insights into these issues the present analysis has focused on the interactions between costs of financial distress and corporate capital structure policy. Our study has emphasised three aspects of these interactions as summarised below. The first aspect is related to the conflicting interests of different agents of the firm. Chapter 3 has explored the *underinvestment* and *risk shifting* problems by developing a reputation acquisition model employing the notion of sequential equilibrium which is following on from Kreps and Wilson (1982). It has been shown that when there is asymmetric information between shareholders and bondholders about the true financial condition of the firm, shareholders may tend to deviate from value maximising decisions when the firm lands in financial distress. That is, financially distressed firms might follow a different investment strategy from financially sound firms which face the same investment opportunities. Also, it has been discussed that shareholders might attempt to delay legal

insolvency in order to get benefits from non-pecuniary expenditures. They achieve this by establishing reputation for being a value maximising firm by taking observable investment opportunities. However, they pass up investment opportunities which are not observed by the market. In behaving in such a way shareholders transfer wealth from bondholders, which may be regarded as the costs of financial leverage. In contrast to the existing literature on the underinvestment problem, which analyses the distortionary effects of debt financing, this chapter has explored the distortions in the investment incentives which arise from the insolvency condition of firms. This has enabled us to focus our attention on the costs of financial distress which are incurred before the firm's actual insolvency. Also, the distinction between *observable* and *unobservable* investment opportunities leads to the conclusion that the underinvestment problem is not curtailed to the extent discussed in the literature (e.g., John and Nachman (1985), Webb (1991)) even if the reputation acquisition incentives of firms is taken into account.

Chapter 4 has also developed a reputation model to consider the incentives of banks which face financially distressed firms. In contrast to the previous chapter, the focus is on reputation acquisition by creditors (banks). It has been shown that, in response to higher expected payoffs from other troubled firms in future the "reputable" banks might liquidate firms which have higher going-concern values than liquidation values. One important implication of this analysis is that reputation acquisition provides incentives even for those banks which have no immediate advantage from liquidating financially distressed firms. This implication partly provides an answer to the question as to why banks force financially distressed firms into liquidation even if the liquidation decision is seen economically irrational. In the model, reputation of banks acts as a commitment device which enables

banks to credibly threaten borrowing firms that they will be forced into bankruptcy in the event that they default on their obligations.

Chapter 5 has discussed the importance of the insolvency code of conduct for the survival of financially distressed firms. The two UK insolvency procedures, receivership and administration, have been analysed in a game-theoretic framework to show that the nature of these procedures gives incentives to the creditors of the distressed company to choose receivership even when the administration is a more efficient option. This is due to the individualistic behaviour of creditors who race to be the first to get the proceeds of liquidation. One important contribution of the analysis of this chapter has been to show that inefficient liquidations are still possible even when the receivership is not a dominant strategy for creditors. The mixed strategy equilibrium outcome of the model has also enabled us to identify the factors which affect the outcome of the financial distress. More specifically, the probability of achieving an efficient outcome increases with higher expected liquidation value under administration and lower costs of administration and expected liquidation value under receivership.

The second aspect of the interaction between the costs of financial distress and corporate financial policy analysed in this study is related to the asset characteristics of firms. The importance of the type of assets owned by firms for the capital structure has been addressed in several chapters. For example, it has been argued in chapter 3 that the games played at the expense of bondholders are more likely to take place when expected liquidation costs are high. Given the fact that certain type of assets such as intangible assets lose a substantial proportion of their values in liquidation (or going through any insolvency

procedures) firms with a large proportion of these assets and facing an imminent bankruptcy are more likely to deviate from value maximising decision. This leads us to conclude that banks are less willing to lend to companies having relatively a large proportion of intangible assets. Also, chapter 4 has shown that firms having mostly intangible assets are more likely to default when they are in financial distress expecting that their debt will be restructured. This is because banks agree to restructure the current obligations of a financially distressed firm when the costs of liquidating the firm are high enough, and wish to let the firm be liquidated and acquire reputation for being tough against financially troubled firms when such costs are low. Another important implication of this chapter in this context is that small-medium firms are more likely to be liquidated when they are in financial distress since the costs they impose on banks upon liquidation are relatively negligible compared with the costs imposed by large firms. Chapter 5 has argued that firms which hold a high proportion of their assets in intangible rather than tangible assets are more likely to be forced into liquidation when they experience financial difficulties. This is due to the fact that it is less likely to realise a value which exceeds the total value of creditors' claims under administration when the firm's assets comprise a higher proportion of intangible assets. Finally, chapter 6 developed a capital structure model by incorporating the assertion that intangible assets lose more value compared to tangible assets when liquidated. It is shown that there is an inverse relationship between the ratio of intangible assets and the level of corporate borrowing.

The third aspect which has been addressed is related to the significance of indirect costs of financial distress in determining the capital structure decisions of firms. The importance of indirect costs has been emphasized in several chapters. More specifically,

chapter 3 has argued that there might be indirect costs incurred before bankruptcy actually occurs. In contrast to direct and indirect costs of bankruptcy, which are *ex post* in nature, these costs are *ex ante* costs of financial distress and borne by creditors of the firm. There are also costs of financial distress in terms of premature and inefficient liquidations, which have been discussed in chapters 4 and 5. It has been shown in chapter 4 that shareholders lose the difference between the going-concern value of the firm and its obligations when banks liquidate the firm's assets prematurely although it should not on efficiency grounds. Chapter 5, on the other hand, has shown that creditors of financially distressed firms might race to be the first in putting the firm in receivership. In doing so they might cause efficient firms to be liquidated prematurely and hence lose a proportion of their claims.

This study has also empirically investigated the determinants of capital structure decisions of firms. This is done in chapter 7 by using a panel data set for UK companies and Generalised Method of Moments (GMM) estimation procedure, which allow both cross-section and time-series variations to be taken into account. The findings of the analysis of this chapter are such that the size of firms and past profitability exert a positive effect on the borrowing decision of companies. The results also provide support for the negative relationship between leverage and growth opportunities of firms. Also, there is some evidence on the negative relationship between liquidity of firms and leverage which supports the *pecking order theory*. However, the findings of the analysis of this chapter do not lend support to the theories which predict a negative relationship between non-debt tax shields and the level of borrowing.

The main conclusions and implications of this study can be summarised as follows.

First, asset characteristics of firms and expected liquidation costs play an important role for both the outcome of the financial distress and the capital structure of firms. The more intangible assets firms have, the larger the difference between going-concern and liquidation values is, and hence the less debt firms include in their capital structures in order to avoid financial distress which may lead to liquidation of the firm's assets. Second, costs of financial distress are not limited to the costs of bankruptcy. Even if direct costs of bankruptcy such as administrative and legal expenses during the bankruptcy process are not significant enough to determine capital structure decisions of companies there might be other indirect costs which should also be taken into account. Third, costs (direct and indirect) induced by financial distress might well comprise a substantial portion of the firm's value. Fourth, banks are less willing to lend to firms having assets with high liquidation costs. This is because both expected costs of financial distress are high and firms with a larger proportion of intangible assets are more likely to default under financial distress.

Several lines for future research can be suggested. Firstly, there is a need to further develop the empirical specifications of capital structure theories. This is necessary because the progress in the empirical relevance of these theories has not kept pace with the progress made on the theory of capital structure. This progress can be made, we believe, by obtaining more detailed data so as to find more accurate proxies for the factors identified by capital structure theories. Secondly, the differences in the tax and bankruptcy code, the market for corporate control, the relationship between banks, securities markets and firms, the characteristics of assets markets might well affect the degree of the relationship between leverage and factors such as profitability, firm size and bankruptcy-related costs. Empirical specifications using different countries data can lead to different conclusions without

controlling these effects. Therefore, when investigating the determinants of capital structure choice, the impacts of institutional differences across countries should be taken into account. Finally, in order to have a more complete theory which investigates the role of bankruptcy costs one should also address the divergence between private and social costs of corporate bankruptcies. Socially desirable level of corporate debt might differ from the private one which is determined, in the context of the trade-off theory, by considering only the expected decrease in the value of the firm if bankruptcy occurs, not social costs such as unemployment.

APPENDICES

APPENDIX 6.1 Leibnitz' Rule

Leibnitz' rule handles the task arising from the fact that Q is only implicitly defined (see, e.g., Sydsæter and Hammond (1995), p.547-49). Let us define $f(t,x)$, $a(t)$ and $b(t)$ as differentiable functions. Let us also define

$$F(t) = \int_{a(t)}^{b(t)} f(t,x)dx \tag{A6.1}$$

Then the derivative of F is given by

$$\frac{dF(t)}{dt} = f(t,b(t))\frac{db(t)}{dt} - f(t,a(t))\frac{da(t)}{dt} + \int_{a(t)}^{b(t)} \frac{\partial f(t,x)}{\partial t}dx \tag{A6.2}$$

APPENDIX 6.2 Derivation of ∂Q/∂I

Define the value of equity Q, given by equation (6.11) as p/q where

$$p = \int_{I-Q}^{\infty} (E-I)f(E,R)dE - \int_{I+\Delta}^{\infty} TEf(E,R)dE + \int_{I+\Delta}^{\infty} T(I+\Delta)f(E,R)dE \qquad \textbf{(A6.3)}$$

and

$$q = r+F \qquad \textbf{(A6.4)}$$

If we differentiate Q with respect to I, according to the new definition (i.e., $Q=p/q$) we get

$$\frac{\partial Q}{\partial I} = \frac{1}{q}\left[\frac{\partial p}{\partial I} - \frac{p}{q}\frac{\partial q}{\partial I}\right] \qquad \textbf{(A6.5)}$$

Thus, in order to find $\partial Q/\partial I$ we need to derive both $\partial p/\partial I$ and $\partial q/\partial I$. From Leibnitz' rule $\partial p/\partial I$ can be written as

$$\frac{\partial p}{\partial I} = -(I-Q-I)f(I-Q,R)\frac{\partial b}{\partial I} - \int_{I-Q}^{\infty} f(E,R)dE + T(I+\Delta)f(I+\Delta,R) + \\ +T\int_{I+\Delta}^{\infty} f(E,R)dE - TIf(I+\Delta,R) - T\Delta f(I+\Delta,R) \qquad \textbf{(A6.6)}$$

which reduces to

$$\frac{\partial p}{\partial I} = Qf(I-Q,R)\frac{\partial b}{\partial I} - (1-F) + T\int_{I+\Delta}^{\infty} f(E,R)dE \qquad \textbf{(A6.7)}$$

Similarly $\partial q/\partial I$ is defined as

$$\frac{\partial q}{\partial I} = f(I-Q,R)\frac{\partial b}{\partial I} \qquad \textbf{(A6.8)}$$

Substituting (A6.7) and (A6.8) into (A6.5) and utilising Q=p/q yields

$$\frac{\partial Q}{\partial I} = \frac{1}{(r+F)}\left[Qf(I-Q,R)\frac{\partial b}{\partial I} -(1-F) +T\int_{I+\Delta}^{\infty} f(E,R)dE -Qf(I-Q,R)\frac{\partial b}{\partial I}\right] \qquad \textbf{(A6.9)}$$

which finally gives

$$\frac{\partial Q}{\partial I} = \frac{1}{(r+F)}\left[T\int_{I+\Delta}^{\infty} f(E,R)dE -(1-F)\right] \qquad \textbf{(A6.10)}$$

APPENDIX 6.3 Derivation of the Optimality Condition; $\partial V/\partial I$

Define the value of the firm, V, as m/n where

$$m = \int_{I-Q}^{\infty} Ef(E,R)dE - \int_{I+\Delta}^{\infty} TEf(E,R)dE + \int_{I+\Delta}^{\infty} TIf(E,R)dE + \int_{I+\Delta}^{\infty} T\Delta f(E,R)dE + \int_{-\infty}^{I-Q} (L(1-ic_i-(1-i)c_t)-C)f(E,R)dE \quad \text{(A6.11)}$$

$$n = r+F \quad \text{(A6.12)}$$

$\partial V/\partial I$ can then be written as

$$\frac{\partial V}{\partial I} = \frac{1}{n}\left[\frac{\partial m}{\partial I} - \frac{m}{n}\frac{\partial n}{\partial I}\right] \quad \text{(A6.13)}$$

In order to find $\partial V/\partial I$ one needs to first obtain both $\partial m/\partial I$ and $\partial n/\partial I$, which are derived in the following (where $b=I-Q$) by use of the Leibnitz' rule.

$$\frac{\partial m}{\partial I} = -(b)f(b,R)\frac{\partial b}{\partial I} + T(I+\Delta)f(I+\Delta,R) - TIf(I+\Delta,R) + \int_{I+\Delta}^{\infty} Tf(E,R)dE - T\Delta f(I+\Delta,R) + (L(1-ic_i-(1-i)c_t)-C)f(b,R)\frac{\partial b}{\partial I} \quad \text{(A6.14)}$$

$$\frac{\partial m}{\partial I} = -bf(b,R)\frac{\partial b}{\partial I} + T\int_{I+\Delta}^{\infty} f(E,R)dE + (L(1-ic_i-(1-i)c_t-C)f(b,R)\frac{\partial b}{\partial I}) \quad \text{(A6.15)}$$

and

$$\frac{\partial n}{\partial I} = f(b,R)\frac{\partial b}{\partial I} \tag{A6.16}$$

Substituting (6.15) and (6.16) into (6.13) yields the following result

$$\frac{\partial V}{\partial I} = \frac{1}{(r+F)}\left[-(b)f(b,R)\frac{\partial b}{\partial I} - (D+Q)f(b,R)\frac{\partial b}{\partial I} + \int_{I+\Delta}^{\infty} Tf(E,R)dE + (L(1-ic_i-(1-i)c_t)-C)f(b,R)\frac{\partial b}{\partial I}\right] = 0 \tag{A6.17}$$

which can also be written as (by using $b=I-Q$)

$$\frac{\partial V}{\partial I} = \frac{1}{(r+F)}\left[\int_{I+\Delta}^{\infty} Tf(E,R)dE - f(b,R)\frac{\partial b}{\partial I}(D+I-(L(1-ic_i-(1-i)c_t)-C)\right] = 0 \tag{A6.18}$$

Substituting $\partial b/\partial I$ and simplifying yields

$$\frac{\partial V}{\partial I} = \frac{1}{r+F}\left[\int_{I+\Delta}^{\infty} Tf(E,R)dE - f(b,R)\left(\frac{1+r}{r+F} - \frac{1}{r+F}\int_{I+\Delta}^{\infty} Tf(E,R)dE\right)(D+I-(L(1-ic_i-(1-i)c_t)-C)\right] = 0 \tag{A6.19}$$

since

$$\frac{\partial b}{\partial I} = 1 - \frac{\partial Q}{\partial I} \tag{A6.20}$$

and

$$\frac{\partial Q}{\partial I} = \frac{1}{(r+F)}\left[T\int_{I+\Delta}^{\infty} f(E,R)dE - (1-F)\right] \tag{A6.21}$$

as derived in Appendix 6.2.

APPENDIX 6.4 The Sign of $\partial^2 V/\partial I \partial R$

It can be shown by differentiating equation (6.16) with respect to R that $\partial^2 V/\partial I \partial R$ is given as the following

$$\frac{\partial^2 V}{\partial I \partial R} = \frac{1}{r+F}\Big[\int_{I+\Delta}^{\infty} T\frac{\partial f(E,R)}{\partial R}dE + f(b)(BC)\Big[\frac{\partial F/\partial R}{r+F}[Z] + \int_{I+\Delta}^{\infty} T\frac{\partial f(E,R)}{\partial R}dE\Big] - [Z][f'(b)(BC) + f(b)\frac{\partial D}{\partial R}]\Big] \tag{A6.22}$$

where

$$\frac{\partial F}{\partial R} = -f(b)\frac{\partial Q}{\partial R} - \int_{I-Q}^{\infty} \frac{\partial f(E,R)}{\partial R}dE \tag{A6.23}$$

$$\frac{\partial Q}{\partial R} = \frac{1}{r+F}\Big[\int_{I-Q}^{I+\Delta} (E-I)\frac{\partial f(E,R)}{\partial R}dE + \int_{I+\Delta}^{\infty} (1-T)(E-I)\frac{\partial f(E,R)}{\partial R}dE + \int_{I+\Delta}^{\infty} T\Delta\frac{\partial f(E,R)}{\partial R}dE + Q\int_{I-Q}^{\infty} \frac{\partial f(E,R)}{\partial R}dE\Big] \tag{A6.24}$$

$$\frac{\partial D}{\partial R} = \frac{1}{(r+F)}\Big[f(b)\frac{\partial Q}{\partial R}(BC) - \int_{I-Q}^{\infty} (L(1-ic_i-(1-i_{c_i})-C-I)\frac{\partial f(E,R)}{\partial R}dE + D\int_{I-Q}^{\infty} \frac{\partial f(E,R)}{\partial R}dE\Big] \tag{A6.25}$$

Since the sign of $\partial f(E,R)/\partial R$ is not known in different regions the effect of variability on borrowing is not unambigious.

APPENDIX 7. Data

A.7.1 *Construction of Variables*:

The variables used in the estimation were measured as follows.

Leverage
Dependent variable of our model is measured as the ratio of long-term debt to the sum of long-term debt and book value of equity (C123). Long-term debt is calculated by subtracting current liabilities (C157) and shareholders' funds (C132) from total liabilities (C157).

Size
Size is measured by the amount of total assets of firms.

Growth opportunities
The firm's growth opportunities are difficult to measure. As proxy, we used the following measure

$$Growth = [(MVE + BVD) - BVA] / BVA$$

where

MVE: market value of equity,
BVD: book value of debt
BVA: book value of assets.

This variable can be interpreted as the extra value capitalized by investors into firm value over the present value of cash flows accruing from the firm's fixed assets. In this sense, it can also be seen as investments in intangible assets that cannot be readily collateralized. Another alternative which has been widely used in the literature would be R&D expenditures of firms. Unfortunately, this item is rarely available in our data set, and hence we were not able to use it.

Non-debt tax shields
In much of the existing empirical work the sum of depreciation and amortization and investment credits is used as a proxy for non-debt tax shields. Unfortunately, in our data set there were too many missing observations for these variables so that we could not employ them. Instead, we used all other tax deductible expenses to approximate the non-debt tax shields. To do this the following equation is used

$$NDTS = Sales - (profit\ before\ tax) - (total\ interest)$$

NDTS was then divided by total assets (C115) to give the NDTS ratio.

Profitability
Various measures have been used in the literature to measure the profitability as the profitability of the firm. We measure the profitability as ratio of the earnings before interest and tax to the capital employed (net total assets). This ratio is given as

$$Profitability = EBIT / Capital\ Employed$$

where

EBIT: earnings before interest and tax (C34+C57)
Capital employed: total assets (C115) - total current liabilities (C157)

Liquidity
The liquidity of the firm's assets is measured by the ratio of current assets (C114) minus stocks (C105) to current liabilities (C157).

Operating leverage
Degree of operating leverage (DOL) of the firm is constructed as

$$DOL = (\%\ \Delta\ in\ EBIT)\ /\ (\%\ \Delta\ in\ Sales)$$

A.7.2 *Sample Characteristics*

As also explained in the text, only companies with at least five continuous time series observations were selected. Our panel data set which includes 195 firms has the following unbalanced structure:

Table A7.1 Structure of Panel

Number of records on each company	Number of companies
5	63
6	37
7	34
8	26
9	20
10	9
11	6

Table A7.2 lists the number of observations (companies) available in each year of the data sample.

Table A7.2. The Number of Companies in Each Year

Year	Number of companies
1981	7
1982	27
1983	51
1984	82
1985	115
1986	157
1987	194
1988	192
1989	190
1990	186
1991	118

The industry groups have been reduced by regrouping them in the following eight SIC 1980 one-digit industry classes. These industry classes are used as industry dummies in the estimation of our model.[1]

1. Energy and Water Supply Industries (SE Class 70);
2. Manufacture of Chemicals (SE Class 68);
3. Metal Goods, Engineering and Vehicle Industries (SE Classes 27, 33, 34, 35, 36, 41, 44, 69);
4. Other Manufacturing Industries (SE Classes 11, 14, 19, 22, 28, 30, 31, 32, 37, 38, 39, 40, 45, 49, 52, 53, 54, 59, 62, 64, 65, 66, 67, 73, 95, 96);
5. Construction (SE Class 18);
6. Distribution, Hotels and Catering (SE Classes 13, 42, 47, 51, 56, 57, 58,)
7. Transport and Communication (SE Class 71, 72, 74, 75)
8. Other Services (SE Classes 21, 48, 90, 97).

The distribution of firms with respect to industry classes is given in Table A7.3.

[1]Stock exchange classes are given in parenthesis. They correspond to the industrial classification used in EXSTAT, which are those allocated by the Stock Exchange and the Institute and Faculty of Actuaries.

Table A7.3 The Number of Companies in Each Industry Class

Industry Class	Number of companies
1	5
2	1
3	53
4	73
5	20
6	14
7	14
8	15

A.7.3 *Descriptive Statistics*

Tables A7.4 and A7.5 give descriptive statistics and annual means of variables respectively.

Table A7.4 Descriptive Statistics

Variable	Mean (standard deviation)	
	levels	first differences
Leverage	0.467 (0.277)	0.022 (0.175)
$Leverage_{t-1}$	0.444 (0.273)	0.029 (0.176)
Size	0.132 (0.775)	0.021 (0.110)
$Size_{t-1}$	0.112 (0.688)	0.019 (0.084)
Growth	0.586 (0.865)	-0.122 (0.828)
$Growth_{t-1}$	0.708 (0.974)	-0.089 (0.861)
Ndts	1.305 (0.885)	-0.018 (0.392)
$Ndts_{t-1}$	1.324 (0.904)	-0.021 (0.399)
$Profit_{t-1}$	0.254 (0.299)	-0.008 (0.255)
Liquidity	1.144 (1.151)	0.017 (1.036)

Table A7.5 Annual Means of Variables

Variable	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Leverage	0.30	0.28	0.34	0.40	0.41	0.39	0.40	0.44	0.49	0.51	0.50
Size	0.01	0.01	0.04	0.04	0.05	0.05	0.09	0.12	0.15	0.17	0.22
Growth	0.80	0.56	0.52	0.78	0.96	0.74	0.83	0.91	0.62	0.60	0.26
NDTS	1.41	1.24	1.31	1.28	1.44	1.42	1.38	1.32	1.28	1.34	1.29
Profitability	0.27	0.21	0.19	0.23	0.20	0.26	0.29	0.31	0.28	0.24	0.21
Liquidity	0.92	1.49	1.02	1.10	1.07	1.23	1.14	1.12	1.06	1.03	1.16

It should be noted that annual means of variables cannot be strictly interpreted as trends in the data since, as can be seen in Table A7.2, the structure of the data sample is unbalanced which means that the composition of companies changes over time.

REFERENCES

Aghion, P., Hart, O. and Moore, J. (1992), "The Economics of Bankruptcy Reform", *The Journal of Law, Economics and Organization*, Vol. 8, 523-546.

Aghion, P., Hart, O. and Moore, J. (1993), "A Proposal for Bankruptcy Reform in the UK", *Insolvency Law and Practice*, Vol. 9, 103-108.

Aivazian, V.A. and Callen, L.L. (1980), "Corporate Leverage and Growth. The Game-Theoretic Issues", *Journal of Financial Economics*, Vol.8, 379-99.

Alderson, M.J. and Betker, B.L. (1995), "Liquidation Costs and Capital Structure", *Journal of Financial Economics*, Vol.39, 45-69.

Altman, E.I. (1984), "A Further Empirical Investigation of the Bankruptcy Cost Question", *Journal of Finance*, Vol.39, 1067-89.

Anderson, T.W. and Hsiao, C. (1982), "Formulation and Estimation of Dynamic Models Using Panel Data", *Journal of Econometrics*, Vol. 18, 47-82.

Ang, J.S., Chua, J.H. and McConnell, J.J. (1982), "The Administrative Costs of Corporate Bankruptcy: A Note", *Journal of Finance*, Vol.37, 337-48.

Arellano, M. and Bond, S. (1988), "Dynamic Panel Data Estimation Using DPD - A Guide for Users", Institute for Fiscal Studies, Working Paper 88/15, London.

Arellano, M. and Bond, S. (1991), "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations", *The Review of Economics Studies*, Vol. 58, 277-297.

Asquith, P., Gertner, R. and Scharfstein, D.(1994), "Anatomy of Financial Distress:An Examination of Junk-Bond Issuers", *The Quarterly Journal of Economics*, Vol.109, 625- 658.

Auerbach, A.J. (1985), "Real Determinants of Corporate Leverage", in B. Friedman, ed., *Corporate Capital Structure in the United States*, University of Chicago Press, Chicago.

Balakrishnan, S. and Fox, I.(1993), "Asset Specificity, Firm Heterogeneity and Capital Structure", *Strategic Management Journal*, Vol.14, 3-16.

Barclay, M.J. and Smith, C.W.(1995), "The Maturity Structure of Corporate Debt", *Journal of Finance*, Vol.50, 609-632.

Baxter, N.D. (1967), "Leverage, Risk of Ruin and the Cost of Capital", *Journal of Finance*, Vol.22, 395-404.

Bayless, M.E. and Diltz, D. (1994), "Securities Offerings and Capital Structure Theory", *Journal of Business Finance and Accounting*, Vol.21, 77-91.

Berglöf, E. And Thadden, E.L. (1994), "Short-term Versus Long-term Interests: Capital Structure with Multiple Investors", *Quarterly Journal of Economics*, Vol.109, 1055-1084.

Bergman, Y.Z. and Callen, J.F. (1991), "Opportunistic Underinvestment in the Debt Renegotiation and Capital Structure", *Journal of Financial Economics*, Vol. 29, 137-171.

Berlin, M. And Loeys, J. (1988), "Bond Covenants and Delegated Monitoring", *Journal of Finance*, Vol.43, 397-412.

Blundell, R., Bond, S., Devereux, M. And Schiantarelli, F. (1992), "Investment and Tobin's *Q*: Evidence from Company Panel Data", *Journal of Econometrics*, Vol. 51, 233-257.

Bowen, R.M., Daley, L.A. and Huber C.C. (1982), "Evidence on the Existence and

Determinants of Inter-Industry Differences of Leverage", *Financial Management*, Vol.11, 10-20.

Bradley, M., Jarrell, A. and Kim, E. (1984), "On the Existence of an Optimal Capital Structure: Theory and Evidence", *Journal of Finance,* Vol.39, 857-80.

Brealey, R.A. and Myers, S.C. (1988), *Principles of Corporate Finance*, McGraw-Hill Publishers.

Bulow, J.I. and Shoven, J.B. (1978), "The Bankruptcy Decision", *The Bell Journal of Economics*, Vol.9, 437-56.

Campbell, C. and Underdown, B. (1991), *Corporate Insolvency In Practice: An Analytical Approach*, Paul Chapman Publishing, London.

Castanias, R. (1983), "Bankruptcy Risk and Optimal Capital Structure", *Journal of Finance*, Vol.38, 1617-35.

Chemmanur, T.J. and Fulghieri, P. (1994a), "Reputation, Renegotiation and the Choice between Bank Loans and Publicly Traded Debt", *The Review of Financial Studies*, Vol.7, 475-506.

Chemmanur, T.J. and Fulghieri, P. (1994b), "Investment Bank Reputation, Information Production, and Financial Intermediation", *Journal of Finance*, Vol.49, 57-79.

Chen, A.H. (1979), "A Theory of Corporate Bankruptcy and Optimal Capital Structure", in J.L. Bicksler ed., *Handbook of Financial Economics*, North Holland Publishing Company.

Chowdhury, G., Green, C. and Miles D. (1994), "U.K. Companies' Short-term Financial Decisions: Evidence from Company Accounts Data", *The Manchester School*, Vol. 62, 395-411.

Chung, K.H. (1993), "Asset Characteristics and Corporate Debt Policy: An Empirical Test", *Journal of Business Finance and Accounting*, Vol.20, 83-98.

Chung, K.S. and Smith, R.L. (1987), "Product Quality, Nonsalvageable Capital Investment and the Cost of Financial Leverage", in *Modern Finance and Indutrial Economics* ed. T.H. Copeland, Basil Blackwell, New York, 146-67.

Copeland, T.E. and Weston, J.F. (1988), *Financial Theory and Corporate Policy*, Addison-Wesley.

Cornett, M. and Travlos, N. (1989), "Information Effects Associated with Debt-for-Equity and Equity-for-Debt Exchange Offers", *Journal of Finance*, Vol.44, 452-68.

Cutler, D. and Summers, L. (1988), "The Costs of Conflict Resolution and Financial Distress: Evidence from the Texaco-Pennzoil Litigations", *Rand Journal of Economics*, Vol.19, 157-172.

DeAngelo, H. and Masulis, R.W. (1980), "Optimal Capital Structure Under Corporate and Personal Taxation", *Journal of Financial Economics*, Vol.8, 3-29.

Diamond, D.W. (1984), "Financial Intermediation and Delegated Monitoring", *Review of Economic Studies*, Vol.51, 393-414.

Diamond, D.W. (1989), "Reputation Acquisition in Debt Markets", *Journal of Political Economy*, Vol.97, 828-862.

Diamond, D.W. (1991), "Monitoring and Reputation: The Choice between Bank Loans and Directly Placed Debt", *Journal of Political Economy*, Vol.99, 689-721.

Ferri, M.G. and Jones, W.H. (1979), "Determinant of Financial Structure: A New Methodological Approach", *Journal of Finance,* Vol.34, 631-44.

Flath, D. and Knoeber, C.R. (1980), "Taxes, Failure Costs, and Optimal Industry Capital Structure: An Empirical Test", *Journal of Finance*, Vol.35, 99-117.

Frankel, A.B. and Montgomery, J.D. (1991), "Financial Structure: An International Perspective", *Brookings Papers on Economic Activity*, Vol.1, 257-310.

Franks, J.R. and Torous, W.N. (1992), "Lessons From a Comparison of US and UK Insolvency Codes", *Oxford Review of Economic Policy*, Vol.3, 70-82.

Gertner, R. and Scharfstein, D. (1991), "A Theory of Workouts and the Effects of Reorganization Law", *Journal of Finance*, Vol.46, 1189-1222.

Gilson, S., John, K. and Lang, L. (1990), "Troubled Debt Restructurings: An Empirical Study of Private Reorganization of Firms in Default", *Journal of Financial Economics*, Vol.26, 315-353.

Gordon R.H. (1985), "Comment", in B. Friedman, ed., *Corporate Capital Structure in the United States*, University of Chicago Press, Chicago.

Harris, M. and Raviv, A. (1990), "Capital Structure and the Informational Role of Debt", *Journal of Finance*, Vol.45, 321-49.

Harris, M. and Raviv, A. (1991), "The Theory of Capital Structure", *Journal of Finance*, Vol.46, 297-355.

Harsanyi, J.C. and Selten, R. (1988), *A General Theory of Equilibrium Selection in Games*, The MIT Press.

Haugen, R.A. and Senbet, L.W. (1978), "The Insignificance of Bankruptcy Costs to the Theory of Optimal Capital Structure", *Journal of Finance*, Vol.33, 383-93.

Haugen, R.A. and Senbet, L.W. (1988), "Bankruptcy and Agency Costs: Their Significance

to the Theory of Optimal Capital Structure", *Journal of Financial and Qualitative Analysis*, Vol.23, 27-38.

Homaifar, G., Zietz, J. and Benkato, O. (1994), "An Empirical Model of Capital Structure: Some New Evidence", *Journal of Business Finance and Accounting*, Vol.21, 1-14.

Hoshi, T., Kashyap, A., and Scharfstein, D. (1990), "The Role of Banks in Reducing the Costs of Financial Distress in Japan", *Journal of Financial Economics*, Vol.27, 67-88.

Hoshi, T., Kashyap, A., and Scharfstein, D. (1991), "Corporate Structure, Liquidity and Investment: Evidence from Japanese Industrial Groups", *Quarterly Journal of Economics*, Vol.106, 33-60.

Hsiao, C. (1985), "Benefits and Limitations of Panel Data", *Econometric Reviews*, Vol. 4, 121-174.

Jensen, M.C. (1986), "Agency Costs of Free Cash Flow, Corporate Finance and Takeovers", *American Economic Review*, Vol.76, 323-39.

Jensen, M.C and Meckling, W. (1976), "Theory of the Firm: Managerial Behaviour, Agency Costs, and Capital Structure", *Journal of Financial Economics,* Vol.3, 305-60.

John, K. and Nachman, D.C. (1985), "Risky Debt, Investment Incentives, and Reputation in a Sequential Equilibrium", *Journal of Finance*, Vol.40, 863-880.

Keasey, K. and Watson, R. (1994), "The Bank Financing of Small Firms in UK: Issues and Evidence", *Small Business Economics*, Vol.6, 349-362.

Kim, E. (1978), "A Mean-Variance Theory of Optimal Capital Structure and Corporate Debt Capacity", *Journal of Finance*, Vol.33, 45-63.

Kim, W.S. and Sorensen, E.H. (1986), "Evidence on the Impact of the Agency Costs of Debt on Corporate Debt Policy", *Journal of Financial and Qualitative Analysis*, Vol.21, 131-44.

Kraus, A. and Litzenberger, R. (1973), "A State-Preference Model of Optimal Financial Leverage", *Journal of Finance*, Vol.28, 911-22.

Kreps, D. and Wilson, R. (1982), "Reputation and Imperfect Information", *Journal of Economic Theory*, Vol.27, 257-79.

Leland, H. and Pyle, D. (1977), "Informational Asymmetries, Financial Structure and Financial Intermediation", *Journal of Finance*, 32, 371-387.

Long, M. and Malitz, I. (1985), "The Investment Financing Nexus: Some Empirical Evidence", *Midland Corporate Finance Journal*, Vol.3, 53-59.

Lys, T. and Sivaramakrishman, K. (1988), "Earnings Expectations and Capital Restructuring: The Case of Equity-for-Debt Swaps", *Journal of Accounting Research*, Vol.26, 273-99.

Maddala, G.S. (1989), Introduction to Econometrics, Macmillan Publishers, New York.

Maksimovic, V. and Titman, S. (1991), "Financial Policy and Reputation for Product Quality", *Review of Financial Studies*, Vol.4, 175-200.

Marsh, P. (1982), "The Choice Between Equity and Debt", *Journal of Finance*, Vol.37, 121-44.

Milgrom, P. And Roberts, J. (1982), "Predation, Reputation and Entry Deterence", *Journal of Economic Theory*, Vol.27, 280-312.

Miller, M.H. (1977), "Debt and Taxes", *Journal of Finance*, Vol.32, 261-75.

Modigliani, F. and Miller, M.H. (1958), "The Cost of Capital, Corporation Finance and the Theory of Investment", *American Economic Review*, Vol.48, 261-97.

Modigliani, F. and Miller, M.H. (1963), "Corporate Income Taxes and the Cost of Capital A Correction", *American Economic Review*, Vol.53, 433-43.

Myers, S.C. (1977), "Determinants of Corporate Borrowing", *Journal of Financial Economics,* Vol.5, 147-75.

Myers, S.C. (1984), "The Capital Structure Puzzle", *Journal of Finance*, Vol.39, 575-92.

Myers, S.C. and Majluf, N.S. (1984), "Corporate Financing and Investment Decisions When Firms Have Information that Investors Do Not Have", *Journal of Financial Economics*, Vol.13, 187-221.

Ofek, E. (1993), "Capital Structure and Firm Response to Poor Performance: Empirical Evidende", *Journal of Financial Economics*, Vol.34, 3-30.

Pesaran, M. and Smith, R. (1994), "Estimating Long-run Relationships from Dynamic Heterogenous Panels", Mimeo, University of Cambridge.

Prowse, S.D. (1991), "Institutional Investment Patterns and Corporate Financial Behaviour in the U.S. and Japan", *Journal of Financial Economics*, Vol. 27, 43-66.

Rajan, R. (1992), "Insiders and Outsiders: The Choice between Relationship and Arms Length Debt", *Journal of Finance*, Vol.47, 1367-1399.

Rajan R.G. and Zingales, L. (1995), "What Do We Know About Capital Structure? Some Evidence from International Data", *Journal of Finance*, Vol.50, 1421-1460.

Ross, S. (1977), "The Determination of Financial Structure: The Incentive Signalling Approach", *Bell Journal of Economics*, Vol.8, 23-40.

Scott, J.H. (1976), "A Theory of Optimal Capital Structure", *Bell Journal of Economics*, Vol.7, 33-54.

Sharpe, S. (1990), "Asymmetric Information, Bank Lending and Implicit Contracts: A Stylized Model of Customer Relationships", *Journal of Finance,* Vol.45, 1069-1087.

Shleifer, A. and Vishny, R.W. (1992), "Liquidation Values and Debt Capacity: A Market Equilibrium Approach", *Journal of Finance*, Vol.47, 1343-1366.

Stiglitz, J.E. (1969), "A Re-Examination of the Modigliani-Miller Theorem", *American Economic Review*, Vol.59, 784-93.

Stiglitz, J.E. (1972), "Some Aspects of the Pure Theory of Corporate Finance: Bankruptcies and Takeovers", *Bell Journal of Economics and Management Science*, Vol.3, 458-82.

Stiglitz, J.E. (1974), "On the Irrelevance of Corporate Financial Policy", *American Economic Review*, Vol.64, 851-66.

Stulz, R. (1988), "Managerial Control of Voting Rights: Financing Policies and the Market for Corporate Control", *Journal of Financial Economics*, Vol.20, 25-54.

Stulz, R. (1990), "Managerial Discretion and Optimal Financing Policies", *Journal of Financial Economics*, Vol.26, 3-27.

Sydsæter, K. and Hammond, P.J. (1995), *Mathematics for Economic Analysis*, Prentice Hall, New Jersey.

Thakor, A.V. and Wilson, P.F. (1995), "Capital Requirements, Loan Renegotiation and the Borrower's Choice of Financing Source, *Journal of Banking and Finance*, Vol.19, 693-711.

Titman, S. (1984), "The Effect of Capital Structure on a Firm's Liquidation Decision", *Journal of Financial Economics*, Vol.13, 137-51.

Titman, S. and Wessels, R. (1988), "The Determinants of Capital Structure Choice", *Journal of Finance*, Vol.43, 1-19.

Warner, J.B. (1977), "Bankruptcy Costs: Some Evidence", *Journal of Finance*, Vol.32, 337-48.

Webb, D.C. (1987a), "The Importance of Incomplete Information in Explaining the Existence of Costly Bankruptcy", *Economica*, Vol.54, 279-88.

Webb, D.C. (1987b), "Conflict of Interest, Bond Rating and the Value Maximization Rule", *Economica*, Vol.54, 455-63.

Webb, D.C. (1991), "An Economic Evaluation of Insolvency Procedures in the United Kingdom: Does the 1986 Insolvency Act Satisfy the Creditor's Bargain", *Oxford Economic Papers*, Vol.43, 139-157.

Weiss, L.A. (1990), "Bankruptcy Resolution-Direct Costs and Violation of Priority Claims", *Journal of Financial Economics*, Vol.27, 285-314.

White, M.J. (1980), "Public Policy Toward Bankruptcy: Me-First and Other Priority Rules", *Bell Journal of Economics*, Vol.11, 550-64.

White, M.J. (1983), "Bankruptcy Costs and the New Bankruptcy Code", *Journal of Finance*, Vol.38, 477-88.

White, M.J. (1989), "The Corporate Bankruptcy Decision", *Journal of Economic Perspectives*, Vol.3, 129-51.

Williamson, O. (1988), "Corporate Finance and Corporate Governance", *Journal of Finance*, Vol.43, 567-591.