FINANCIAL STRUCTURE OF UK FIRMS: THE INFLUENCE OF CREDIT RATINGS

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ABSTRACT

Credit ratings have become a widely accepted measure of firms' creditworthiness in financial markets. Despite the significant growth of rating agencies, with a continuous reliance on credit ratings by regulators, investors and firms, prior academic literature generally tends to underestimate the relevance of credit ratings in firms' financial decision-making. This thesis, therefore, provides a comprehensive analysis, which aims to examine the impact of external credit ratings on the financial structure decision-making of UK firms. The thesis has three empirical chapters. The first empirical chapter examines whether there are any systematic differences in firms' levels of leverage across the rating levels which would suggest that the cost and benefits of credit ratings are material for such firms. The study finds that credit ratings are an important determinant of the capital structures of firms and that there is a strong non-linear inverted U-shaped relationship between credit ratings and capital structures. It is noted that rated firms have higher leverage than non-rated firms, but within the rated firms, leverage varies across the rating levels. High and low rated firms are found to have low leverage in their capital structures, and mid rated firms generally have higher leverage. Low gearing ratios may suggest that such firms have higher incentive to maintain their current ratings or to achieve upgrades, given the cost and benefits offered by credit ratings, than firms with high gearing ratios.

The second empirical chapter investigates whether costs and benefits of credit ratings are material enough for potential and actual credit ratings changes to matter in the financial decision making of the firms. It does not appear from the empirical evidence that marginal changes in credit ratings possibly impose any serious costs on the rated UK firms. Whether credit ratings changes are potential or actual, they do not lead firms to follow any specific pattern with regards to their capital structure, which would suggest that firms are concerned about the marginal rating changes. Within the rating scale, however, some differences are noted among high and low rated firms. High (low) rated firms tend to issue (reduce) debt when they have a higher likelihood of upgrades. Similarly, high rated firms issue debt when they are actually upgraded or downgraded, while low rated firms are found only to reduce debt when they are upgraded indicating their efforts towards maintaining or achieving higher credit ratings.

The third empirical chapter examines the influence of credit ratings on the debt maturity structure of UK firms by testing Diamond's (1991) liquidity hypothesis. Consistent with the predictions, the results indicate that firms' debt maturity structures are significantly influenced by their levels of refinancing risk, and that this refinancing risk induces a strong non-linear relationship between credit ratings and debt maturity structures. It appears that high rated firms possibly have low levels of refinancing risk, which allows them to select debt with short maturity. Low rated and non-rated firms are also found to have shorter debt maturities, despite being exposed to high levels of refinancing risk. It appears that these firms may have constrained access to long-term debt markets and, therefore, they have to rely mostly on short-term debt. Mid rated firms, however, have more long-term debt, which appears to be due to their better access to debt markets as well as their exposure to some degree of refinancing risk.

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AUTHORS DECLARATION

“I declare that, except where explicit reference is made to the contribution of others, that this dissertation is the result of my own work and has not been submitted for any other degree at the University of Glasgow or any other institution.

Signature ______________________________

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Chapter 1
INTRODUCTION

1. Introduction

The importance of credit rating agencies has increased significantly over time with increased dependency of regulatory bodies, investors and firms on their output, *credit ratings.* Despite the increased reliance on credit ratings by market participants, credit ratings are mostly understood as an outcome of financial decisions. However, recent academic research has emphasized that the output of credit rating agencies can also influence the financial decision-making of firms. In this regard, this thesis is an attempt to explore the impact of credit ratings on the financial decisions of firms, by specifically investigating non-financial listed UK firms over the period 1988-2009.

To examine the influence of credit ratings on financial structures, the thesis is divided into three empirical chapters, each of which analyses a distinct but interrelated dimension of the relationship between the two. The first empirical chapter (Chapter 6) investigates the influence of levels of credit ratings on the capital structures of firms. It examines whether the costs and benefits of different rating levels as suggested by the *credit rating – capital structure hypothesis* (CR-CS), are sufficiently material for the firms to induce a non-linear relationship between their levels of ratings and leverage. It tests whether high and low rated firms, which arguably would be more careful about their credit ratings than mid rated firms, have lower levels of leverage compared to their counterpart mid rated firms. The CR-CS hypothesis proposes that the costs and benefits of different credit ratings are material for firms and can significantly affect managerial financial decision-making (further discussion follows in Section 1.2 and Chapter 3) . The implications of the CR-CS hypothesis are also tested in the second empirical chapter (Chapter 7) to analyse the costs and benefits of credit ratings affect financing decisions in subsequent years. It is expected that if firms are careful about their credit ratings, they will pursue leverage reducing behaviour following potential and actual rating changes. The third empirical chapter (Chapter 8) provides more detail on capital structures by specifically analysing the debt maturity structures of firms. It examines whether firms' debt maturity structures vary with their levels of rating, by specifically testing the influence of refinancing risk. Refinancing risk is expected to induce a non-linear relationship between credit ratings and debt maturity structures (further discussion follows in Section 1.2 and Chapter 4).

The aim of the present chapter is to introduce the thesis and provides the context of this research. Section 1.1 presents the background and the rationale for conducting this study. Section 1.2 discusses the main reasons for choosing UK firms as a sample, and Section 1.3 sets out the overall research questions and briefly reports the key findings of the thesis. Section 1.4 discusses the contributions of the study. Finally, Section 1.5 provides the organisation of the thesis and briefly presents the content within each of the chapters.

1.1. Background and Rationale

Capital structure remains one of the most well researched topics in finance literature, where several key aspects of the subject have already been explored. Since Modigliani and Miller's (1958) seminal study proposing capital structure irrelevancy, a rich theoretical and empirical literature have emerged challenging the underlying assumptions underpinning their proposition. It was argued that the set of assumptions including presumed homogeneity of firms, a perfect substitution of internal and external financing and unrestricted access to any type of financing, were extremely restrictive, and that the capital structure irrelevance seemed to be highly dependent on these assumptions. Subsequent studies, therefore, sought to determine the sensitivities of firms' valuation with different financing mixes when these assumptions were relaxed. To date, thus, several theories have been advanced to explain the relevance of capital structure, including tax related theories (Modigliani and Miller, 1963; Miller, 1977; DeAngelo and Masulis, 1980), static trade-off theories (Kraus and Litzenberger, 1973; Scott, 1976; Kim, 1978), pecking order theory (Myers, 1984; Myers and Majluf, 1984) and agency cost theories (Jensen and Meckling, 1976; Jensen, 1986), all of which directly conflict with the underlying assumptions of Modigliani and Miller's irrelevance proposition.

Based on the theoretical predictions, empirical studies examining the capital structure of firms have also been able to successfully unearth some stylized facts about the capital structure. The most prominent factor emerging from the studies could generally be synthesised either into the trade-off theory or into the pecking order theory (i.e., the size of a firm, its growth opportunities and profitability, etc). However, in recent years there has been a growing recognition that such theories do not fully explain the behaviour of firms regarding their financial structure decisions. For example, Graham (2000) finds that most low risk firms paradoxically prefer low levels of gearing, despite the fact that such firms can easily access debt markets, without aggravating the potential bankruptcy risk. Also, in a survey study of 392 US CFOs, Graham and Harvey (2001) show that none of the factors proposed by the traditional theories of capital structure, including profitability, taxes and costs of financial distress, are among the most important factors when financial decisions are made. Similarly, Brounen *et al.*'s (2004) and Bancel and Mittoo's (2004) survey studies on the European firms show that the relevance of the factors proposed by these traditional theories has been superseded by other determining factors which could potentially have different implications for the capital structure of the firms. Among this set of factors, the *credit ratings* of respective firms were found to be one of the most important concerns when firms make their capital structure decisions.

Credit ratings have become a widely accepted measure of creditworthiness for firms, investors and regulators, due to the increased complexities of financial markets and diversity of the borrowers and lenders (Cantor and Packer, 1994). Rating agencies play a vital role in the capital markets and are influential in altering and shaping the perceptions of market participants. They, by rating a wide range of borrowers and several types of instruments over the period, have established credit standards in the market, which have received regulatory attention in several countries as well (Pinto, 2006). The clients of these rating agencies, i.e., large and creditworthy firms, incur considerable costs in acquiring and maintaining their rating status and often even acquire ratings from more than one rating agency (Claes *et al.,* 2002). Credit ratings are clearly providing such firms with some additional benefits, which are deemed by the firms to be worth the large cost of acquiring and maintaining credit ratings. Moreover, credit ratings are also an important part of investment decisions of institutional investors. For example, Cantor *et al.* (2007) state that 86% of fund managers explicitly use ratings in their investment guidelines.

Despite continuous reliance on rating agencies by regulators, investors and firms along with the significant growth of rating agencies globally, academic studies generally tend to underestimate the relevance of credit ratings for firms' financial structure decision-making. Specifically, after the recent financial crisis of 2008, it becomes imperative to investigate the role and significance of their output for the firms' financing decisions to assess the importance of credit rating agencies in the financial markets. With the underlying assumption that credit ratings are not just an output of the financial decisions, this study specifically explores the relevance of credit ratings for the financial structure decision-making by the UK firms.

With the implicit assumption that capital structure is always a function of the demand-side factors only, prior studies have largely concentrated on firm-level characteristics such as profitability, size, and growth opportunities, towards determination of the capital structure (Faulkender and Petersen, 2006). Prior studies generally assume that the supply of funds is infinitely elastic at the correct price and time, whenever the firms require. For example, the trade-off theory suggests that the leverage of a firm is dependent on the trade-off between the benefits of debt (e.g., tax shields gained from issuing additional debt) and the cost of debt (e.g., potential bankruptcy costs). However, the supply of funds can be equally or very important in the determination of leverage and its components. Their significance was also highlighted during the recent financial crisis, where banks and financial institutions were cutting back on their lending and refinancing, causing severe financial difficulties for firms (Sakoui, 2010).

Due to the nature of credit ratings, it is also argued to represent the supply-side factors for determining the firms' financial structure (Judge and Mateus, 2009; Faulkender and Petersen, 2006; Mittoo and Zhang, 2010). Credit ratings can offer several benefits to firms, including correct pricing of securities, flexibility, and widening their investor base, which reduces reliance on typical sources of funding such as bank debt (Judge and Korzhenitskaya, 2011). Chave and Puranandam (2011) also argue that rated firms suffer less in terms of raising capital in adverse conditions such as the recent financial crisis. A recent survey study by Bacon *et al.* (2009) of 43 senior treasury professionals from non-financial UK firms, indicates that ratings have become more important during the recent crisis, while the firms without ratings sought to obtain them during this period. This suggests that the credit ratings could possibly be an important supply-side factor and necessitates further exploration of how this factor can be influential in determining the financial structure of firms.

Previous studies exploring the relationship between credit ratings and capital structure present a very restrictive view of the relationship. For example, studies on capital structure have established that credit ratings play a significant role for the firms in facilitating the access to debt markets (Faulkender and Petersen, 2006; Judge and Mateus, 2009; Mittoo and Zhang, 2010; Judge and Korzhenitskaya, 2011). These studies have found that rated firms have higher leverage than non-rated firms because holding a credit rating minimises information asymmetry and the need for evaluation and monitoring by outsiders resulting in a lower overall cost of debt for such firms (for simplicity purposes, the hypothesis in this study is termed as the *credit rating – market access hypothesis* (CR-MA)). With the exception of Mittoo and Zhang (2010), an implicit assumption of these studies is that all rated firms have higher leverage, irrespective of their level of ratings.

However, if the costs and benefits associated with different rating levels are material for firms, they are likely to have a different behaviour towards their capital structure at each level of rating. To understand whether firms vary in their capital structure at different levels of rating, the present study incorporates the implication of the *credit ratings – capital structure hypothesis* (CR-CR) as developed and tested by Kisgen (2006). The hypothesis that *'credit ratings are a material consideration in managers' capital structure decisions due to the discrete costs (benefits) associated with different rating levels'* (Kisgen, 2006, p.1037) was originally tested to examine capital structure activities of US firms following potential credit rating changes (Kisgen, 2006) and actual rating changes (Kisgen, 2009). However, and as will be explained further, it can be argued that the hypothesis can also have implications for the relationship between firms' levels of credit rating and their levels of debt. This study, therefore, tests the implications of the CR-CS hypothesis for the levels of debt, thereby, extending Kisgen's (2006, 2009) studies.

If the hypothesis holds, firms at different levels of ratings should have different concerns over the costs and benefits offered by their credit ratings. Specifically, high rated firms would have a higher incentive to maintain their credit ratings. High rated firms arguably enjoy certain financial and non-financial benefits of high credit ratings. Financial benefits may include lower cost of debt, financial flexibility, easier access to the commercial paper market and favourable terms and conditions in debt contracts while non-financial benefits can include employees' loyalty, a good management reputation in the labour market and favourable terms and conditions in suppliers' contracts. If these benefits are material for the high rated firms, they are likely to have low levels of gearing in their capital structure in order to maintain their current ratings.

The low rated firms, on the other hand, are likely to have constrained access to debt market due to the high costs of capital (Mizruchi and Stearns, 1994; Diamond, 1991) and restrictive covenants in their debt securities (Billet *et al.*, 2007). Firms with lower ratings could also face early liquidation in the event of credit rating deterioration due to a vicious cycle created by their credit ratings. Although these firms are in a better position to raise debt, due to being rated, the costs associated with low ratings are likely to be higher than the benefits of raising additional leverage. This expectation is more relevant for the UK market specifically due to the differences in the credit quality of the rated firms in addition to the creditor friendly bankruptcy code compared with other active users of credit ratings such as the US (Section 1.3 provides more discussion on these differences). Mid rated firms can be expected to have high levels of gearing due to their better access to debt markets and being cushioned from any serious consequences of any initial deterioration of their credit ratings. This study therefore adopts a different approach from the previous studies (Faulkender and Petersen, 2006; Judge and Mateus, 2009; Judge and Korzhenitskaya, 2011) to understand the differences between non-rated and rated firms, by examining the differences in the leverage between the rated firms as well. It also extends Mittoo and Zhang's (2010) study, by suggesting that credit ratings are likely to have a non-linear relationship with the capital structure of the firms.

The study also examines the impact of potential and actual credit rating changes on the capital structure activities of the UK firms. Kisgen (2006) explicitly states that capital structure research would benefit from the inclusion of credit ratings in their framework for correct inferences and depiction of firms' behaviour towards their capital structures. Kisgen notes that potential rating changes lead to debt reducing behaviour, which he attributes to the *credit rating – capital structure hypothesis* (CR-CS). He argues that if the benefits and costs offered by credit ratings are material, the firms facing a potential rating change would choose to reduce their leverage to get an upgrade or prevent a likely downgrade. In a following study, Kisgen (2009) finds that downgraded firms continue to reduce their leverage in the likelihood of regaining their target ratings or to prevent them from further downgrade. Upgraded firms are, however, not likely to make any significant change in their capital structure since being upgraded itself is beneficial for a firm in terms of its cost of capital and standing among other rated firms.

Kisgen (2006, 2009) tests these above predictions for the US market, which is characterised as a developed bond market where credit rating agencies have been in place for over a century, with several regulations tied up with the credit ratings of firms or securities (see Langohr and Langohr, 2008). The history of rating agencies together with the growing need for credit ratings arguably influences the type of firms which acquire credit ratings, the level of regulatory dependence and perceptions of investors and management. However, as will be discussed in more detail below, the UK market is characterised by a relatively less developed bond market, a shorter history of rating agencies, and almost no explicit reliance on credit ratings by the regulatory authorities. Such dissimilarities are substantial enough to warrant a separate empirical investigation as this poses an interesting question, as to whether the sensitivities of firms would be similar across the UK market. It is expected that such differences would make UK firms relatively less sensitive to rating changes than firms in the US market (further discussion follows in Section 1.2).

The study also extends the capital structure analysis by examining the relationship between credit ratings and debt maturity structures. Survey studies by Graham and Harvey (2001) and Bancel and Mittoo (2004), on US and European firms respectively, indicate that refinancing risk is the second most important concern when firms make their debt maturity structure decisions.[1] Specifically for UK firms, Brounen *et al.* (2006) find that maturity matching of assets remains the foremost factor while refinancing risk stands as the second most important driver when firms choose between long and short-term debt. Previous empirical studies on the UK market by Ozkan (2000, 2002), Fan *et al.* (2011) and Antoniou *et al.* (2006) have ignored the possibility that refinancing risk could be an important determinant of debt maturity structures. Therefore, the present study aims to explore the influence of refinancing risk by empirically testing Diamond's (1991) liquidity hypothesis for the UK firms.

Diamond's liquidity hypothesis is based on credit quality or credit ratings, which could serve as a proxy for refinancing risk. Diamond argues that refinancing risk is less likely to be a concern for high rated firms as their superior credit quality warrants easy refinancing of debt at the time of maturity. High rated firms may be confident that they are able to rollover the debt into the next period, possibly at a lower borrowing cost, and they can therefore be expected to have short maturity in their debt structure. Contrary to high rated firms, low rated firms are exposed to higher refinancing risk. However, they are argued to have less access to long-term debt markets due to their potential inability to meet their obligations in the long run, when they come due. Therefore, they are expected to rely on directly placed short-term debt. Diamond argues that mid rated firms are more likely to issue long-term debt due to relatively easier access to long-term debt markets compared with low rated firms, but they also simultaneously face higher refinancing risk than high rated firms.

[1] Graham and Harvey (2001) and Bancel and Mittoo (2004) find that maturity matching of assets is the most important concern.

The previous studies directly testing Diamond's liquidity hypothesis have mainly examined US firms (Barclay and Smith, 1995; Stohs and Mauer, 1996) and to date no UK study has tested the implications of refinancing risk for the UK firms' debt maturity structures. This study, therefore, empirically examines the relationship between credit ratings and debt maturity structures of UK firms that will shed light on the relevance of refinancing risk for firms' debt maturity structures.

1.2. Reasons for Selecting the UK as a Sample Country

Besides the fact that there is a lack of academic literature on the subject from the UK market, the institutional setup of the UK also provides a rich and unique setting. The UK firms are among the largest users of credit ratings in the world, with Hanafin (2007) finding 82% of FTSE 100 firms. They are also the third largest users of Standard and Poor's credit ratings after the US and Canada (Standard and Poor's, 2010c). It can also be noted that the FSA and the European Commission are actively pursuing measures to improve the functionality of credit rating agencies within Europe (see, for example, European Commission, 2011) which could possibly further increase the use of rating services.

Moreover, since deregulation in mid 1980s, there has been a shift in the level and diversity of the sources of borrowing of UK firms, where traditional reliance on bank loans and equity financing as their main sources of financing was gradually replaced by the use of bonded debt (Rudin, 1991). Specifically after the recent financial crisis of 2008, there has been a structural shift in the way in which UK firms finance themselves. Sakoui (2010) reports that UK financial institutions have reduced their lending to firms by £59.1bn since 2008, while over the same period corporate bond issuance by UK firms has increased by £22.2bn. The increase in the use of public bonds could arguably also increase the dependency on external rating agencies in the future. The current and potential widespread use of rating services in addition to the shifts in the sources of financing naturally makes the UK an important sample country for the study. The inferences drawn from the study would be useful for future studies, specifically following the financial crisis, conducted on the subject.

Another important reason to study the UK market is the state of development of the rating agencies and its effect on the distribution of the rated firms. Despite the increased use of rating services in the UK market, credit rating agencies do not have a very long history in the UK market. Compared to the US market, where the rating agencies originated and have a history of over a century, the operations of the rating agencies in the UK market can be traced back to the mid 1980s when rating agencies started their operations in the UK.[2] The short history of these institutions in the UK market has plausibly resulted in large differences in the quality of rated firms compared with the US. For example, European Commission data shows that speculative grade issuers make up less than 10% of the total rated firms in the European market, where the UK is the largest user of credit ratings (Standard and Poor's, 2010a), compared to more than 40% in the US market (Batten *et al.*, 2004). The sample of the present study also shows that investment grade firms, being 87% of the total rated firms, dominate the sample.

It can be argued that a self-selection bias most likely leads large and creditworthy firms to acquire credit ratings in the UK market, while in the US market it is common for the mid-sized firms which presumably have lower ratings also to possess a rating (Batten *et al.*, 2004). This skewed distribution of credit ratings can have meaningful implications for the relationship between credit ratings and capital structures, where it can be expected that low rated firms would be relatively more careful about their credit ratings compared with high rated firms. Low rated firms are arguably more at a risk of downgrade compared to high rated firms and while they are fewer in the market, can easily be identified as firms with inferior quality, which may impose certain financial and non-financial costs. Shivdasani and Zenner (2005), arguing along the same lines, state that low rated firms would be more careful about their credit ratings as debt issuance behaviour could be expected to have more serious implications for their future cost of borrowing and their credit ratings than high rated firms. Thus, it can be expected that low rated UK firms will have less leverage in their capital structure and will be less inclined to leverage issuance behavior.

While there is no clear evidence of the type of rating firms acquire due to the stage of development of the bond market and credit rating agencies, it can be expected that the US market would have a relatively higher proportion of unsolicited ratings compared to the UK market.[3] Studies find that unsolicited ratings are generally lower than solicited ratings

[2] Standard and Poor's opened its London office in 1984 to start its operations in the European Market and the first available UK rated firm-year by Standard and Poor's and Moody's in the data collected is 1989.
[3] An anecdotal enquiry via a telephone conversation with S&P customer services suggested that most of the UK firms rated by S&P have solicited ratings. Moreover, unsolicited ratings are labelled 'pi' by S&P (Poon, 2003). The sample of the present study does not indicate any presence of firms with unsolicited ratings.

(Poon, 2003) and that the ratings actually improve when firms acquire solicited ratings.[4] Firms with solicited ratings are also found to be more liquid, more profitable and to have lower leverage than their counterpart firms with unsolicited ratings (Poon and Chan, 2010). Moreover, solicited rated firms have also a chance to discuss their ratings and present their case to the rating agencies in case they do not agree with the decisions of the agencies. If the above is true, one can expect that the firms with unsolicited ratings (i.e., US firms), will be more concerned for the possible changes in their ratings and the sensitivities of reactions to rating changes would be higher for firms with unsolicited ratings compared to firms with solicited ratings (such as UK firms).

Another important distinction between the UK market and most developed markets including the US and France is the limited regulatory dependence on credit rating agencies. Despite being a high user of rating services, with the exception of the Capital Requirement Directive (CRD) 2006 (see Langhor and Langhor, 2008), the UK market does not have any explicit regulatory reliance on credit ratings. By using credit ratings as a regulatory tool, the regulators alter the behaviour and perception of market participants including issuers, investors and the rating agencies themselves (Baklanova, 2009). Firms operating within a market, which actively makes use of ratings in its regulatory structure, would be likely to be more careful about rating changes to meet the thresholds of certain regulations than the markets where the regulations are not dependent on such standards. Moreover, the dependence on the regulations can affect the cost of borrowing as minor changes in ratings can induce forced selling by institutional investors. If this is the case, the cost of borrowing of firms can change with changes in credit ratings irrespective of whether there are any changes in the underlying quality of firms. This might suggest that firms operating in countries with less regulatory dependence on credit ratings, e.g., UK firms, may be less sensitive to credit ratings changes than firms operating in markets with high regulatory dependence, e.g., the US market.

The US and UK market also differ with respect to their bankruptcy codes (Rajan and Zingales, 1995; Beattie *et al.*, 2006), which are likely to influence the behaviour of low rated firms towards their capital structure. The UK bankruptcy laws are strict in terms of enforcing creditor's rights. A creditor friendly bankruptcy code and a strict enforcement of creditors rights may theoretically encourage lending by creditors due to better creditors'

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[4] Credit ratings that are initiated and paid for by the issuer are called solicited ratings while unsolicited ratings are issued at the request of parties other than the issuing firm (Poon, 2003).

protection. However, the empirical evidence on the subject is quiet contradictory. For example, Acharya *et al.* (2011) note that creditors' rights have adverse effect on financing behaviour of firms; firms operating in countries with strong creditors' right protection have lower leverage and *vice verse*. Therefore, from the firms' point of view, a stricter creditors' code may limit the use of external debt by firms. If this is the case, it can have more serious implications for the low rated UK firms as credit ratings can reinforce a vicious cycle for such firms. This means that low ratings and any subsequent change in their ratings will affect the borrowing capacity, covenants of debt securities and financial flexibility of firms resulting in a possible further downgrade of credit ratings. Since market participants believe in the validity of credit ratings, one can expect that the low rated UK firms will be more cautious about their ratings and as a result will follow a more conservative debt policy.

Most of the studies on the determinants of firms' debt maturity structures, specifically those incorporating the effects of refinancing risk, are concentrated on the US market. Analyzing the UK firms' debt maturity structures also requires paying particular attention to the prominent differences in firms' debt maturity structures in both countries. Firms in the UK rely more on debt which is to mature in less than one year compared to their US counterpart firms (Marchica, 2008). Marchica (2008) reports that the median percentage of debt due within one year for small firms is 72% compared to 3% for small US firms. Similarly, for the large firms, the median short-term debt ratio is 34% while it is only 3% for large US firms. Given these differences, the study is expected to provide in-depth evidence as to whether refinancing risk would have similar implications for firms in the UK market, where firms rely mostly on short-term debt, compared to other markets.

1.3. Research Questions and Key Empirical Findings

As stated earlier, until recently, studies examining the financial structure of firms, have generally ignored *credit ratings* as one of the determinants of debt structure despite the rapid growth of rating agencies as a strong financial intermediary, both within the US, European and the UK markets. The present study is thus one of the first studies that systematically and thoroughly investigates the relationship between credit ratings and financial structures of firms. Apart from the fact that there is a serious lack of academic literature on the topic for the UK market, the discussion in the previous section highlights that the UK market presents an interesting and unique setting in which to analyse the issue in more detail. In this regard the main research question of the thesis is:

- ***Do credit ratings affect the financial structures of UK listed firms?***

To operationalise the main research question, four specific research questions will be investigated:

1. ***Is there any relationship between the level of ratings and capital structure of the UK firms?***

The study aims to explore that if rated firms have higher leverage than non-rated firms as suggested by the *credit rating – market access hypothesis* (CR-MA), do concerns about the costs and benefits of ratings as predicted by the *credit rating – capital structure hypothesis* (CR-CS) alter the behaviour of firms at different rating levels? Specifically, the CR-CS hypothesis implies a conservative debt policy for high rated and low rated UK firms. This non-linear relationship is tested for a sample of non-listed UK firms over a period of 22 years. This part of the thesis uses two main datasets to test the relationship: the first dataset contains only the 874 firm-years of rated firms, and the second dataset contains the whole sample of 38,800 firm-years of rated and non-rated firms. The study uses different coding schemes for credit ratings, different measures of the dependent variable, and various estimation techniques to test the relationship.

By estimating models specifically developed to examine the non-linear relationship between credit ratings and capital structure, the results indicate a presence of a strong non-monotonous inverted U-shaped relationship between the levels of ratings and the levels of debt. It is found that firms with high and low ratings have low amounts of debt in their capital structure while mid rated firms have high levels of debt. The low levels of leverage may indicate higher incentives of firms at both ends of the rating spectrum to maintain their current credit ratings and to prevent themselves from downgrades. Further, it is also noted that non-rated firms, which are assumed to be firms with low creditworthiness and constrained access to debt markets, have lower leverage than rated firms. The results indicate that they specifically have lower leverage than the lowest rated firms available in the sample, which may confirm the assumption made about their inferior access to debt markets.

2. ***If the cost and benefits imposed by downgrades and upgrades are material for UK firms, do they show any specific behaviour when they are faced with potential rating changes?***

This sub-research question examines the implications of the *credit rating- capital structure hypothesis* (CR-CS) by specifically testing models developed by Kisgen (2006) to ascertain whether the results of the previous US study holds for the UK. By using a sample of 874 rated firm-years, the study examines whether UK firms follow a pattern of leverage reducing behaviour when there is a proximity to a rating change. Due to the noticeable differences in the institutional settings of the UK and US markets, the present study, as a measure of robustness, specifically explores the behaviour of rated firms across the rating levels, towards their capital structures when they are faced with potential rating changes. The study also provides a decomposition analysis for components of capital structure, i.e., debt and equity issuance, and reduction activities, to examine the effects of potential rating changes on these components. Potential rating changes are measured by firms having either a '+' or a '–' sign with their credit ratings.

The results do not demonstrate any specific pattern in leverage related decisions when firms are near rating changes thus suggesting that potential rating changes do not matter for firms when they make their financial structure decisions. The results suggest that modifiers (i.e., + or -) with credit ratings do not have any particular relevance for future adjustments in capital structures. However, when the impact of potential rating changes are examined across rating levels, high and low rated firms tend to behave differently. The results indicate that high rated UK firms increase leverage when they have a PLUS sign with their credit ratings, suggesting that these firms probably take advantage of their superior credit quality within the broad rating category. Conversely, low rated firms tend to reduce leverage when they have a PLUS sign indicating that for low rated firms upgrades could provide material benefits and thus they strive to achieve upgrades when there is any likelihood of being upgraded.

3. ***Do actual credit rating changes have any explanatory power for the UK firms' financial decisions?***

The analysis of potential rating changes is extended to incorporate the effects of actual rating changes on the capital structure activities. The implications of the *credit rating – capital structure hypothesis* are tested by examining whether firms follow a pattern of leverage reduction behaviour after they have been downgraded. They are expected to have no significant change in their capital structure when they are upgraded. Similar to the analyses of potential rating changes, extensive analyses are carried out using several different model specifications and measurements of dependent variables to scrutinise the results of the main model.

The results show that actual rating changes, in general, influence the firms' financial decisions in subsequent years, where upgraded firms tend to reduce debt while downgraded firms tend to issue more debt. It appears that upgraded firms possibly continue to reduce debt once they have been upgraded, while downgraded firms continue to issue debt. However, when the impact of rating changes is tested for different levels of ratings, the results demonstrate that only the low rated firms reduce debt when upgraded, while the high rated firms still issue more debt. The debt issuance behaviour of high rated firms, when they are upgraded or downgraded suggests that high rated firms possibly consider themselves sufficiently financially sound to issue more debt even after experiencing rating changes. From the debt issuance behaviour of high rated firms, it appears that rating changes do not impose any serious financial or non-financial costs on these firms. The leverage reduction pattern observed for low rated firms when upgraded suggests that for such firms low ratings are costly and achieving higher ratings could provide benefits worth the cost of reducing leverage.

4. ***Do credit ratings have any relevance for the firm's debt maturity structure*?**

Diamond's (1991) theoretical framework, which underscores the importance of refinancing risk in the firms' debt maturity structures, is tested for the UK firms. As argued in Section 1.1 and as will be discussed further in Chapter 4, Diamond theorises that refinancing risk induces a non-linear relationship between credit ratings and debt maturity structures, where high and low rated firms are expected to have shorter maturity while mid rated firms are expected to have longer maturity. The study uses two datasets to test Diamond's predictions: the whole sample of 23,974 rated and non-rated firm-years, and a separate sample of 571 rated firm-years.

The results of the model provide strong support for Diamond's liquidity hypothesis. High rated UK firms are found to have short debt maturity, possibly due to the low refinancing risk they are exposed to. Low rated firms tend to have shorter debt maturity. It appears that low rated firms have restricted access to debt markets due to their perceived potential inability to meet their long-term obligations. Consistent with Diamond's prediction, mid rated firms have longer maturity in their capital structures, indicating their better access to the long-term debt market relative to low rated firms, but also some exposure to refinancing risk. The results indicate that non-rated firms, similar to low rated firms, have also high levels of short-term debt. The findings indicate the possibility of non-rated firms having constrained access to long-term debt markets. The results are robust to different measures of credit ratings, model specifications and estimation techniques.

1.4. Contributions of the study

This thesis offers, for the first time, a comprehensive and in-depth analysis of the relevance of credit ratings for the financial structure of UK firms, and thus makes a number of contributions to finance literature in general, and to UK based studies in particular.

This study is original in providing an in-depth examination of the leverage structures of the firms and in recognising the significance of rating levels for the leverage structures. Specifically, it has, for the first time, provided direct evidence that leverage varies across the levels of ratings due to the unique costs and benefits offered by credit ratings, even after controlling for the factors which traditional theories propose. The examination of the relationship between levels of credit ratings and leverage not only acknowledges the previous literature (Judge and Mateus, 2009; Faulkender and Petersen, 2006; Mittoo and Zhang, 2010) by suggesting that rated firms have higher leverage, but also extends these studies. While the past studies recognise that credit ratings are useful in accessing the debt market, this present study tests the implications of the *credit rating – capital structure hypothesis* (CR-CS) for different levels within the rating scale. The joint implication of the above suggests a non-linear relationship between credit ratings and capital structures, which is novel and has never been examined before in any of the previous studies.

Another finding of this study is also interesting and important. The study provides a comprehensive analysis of the credit ratings – capital structure relationship, suggesting that credit ratings are important in general for UK firms in terms of their access to the debt markets. For the rated firms specifically, credit ratings are one of the important factors in determining the level of leverage in firms' capital structures. This indicates that the variables proposed by traditional theories of capital structure have limited explanatory power with regard to capital structures' relation to credit ratings for this particular group. Also, the relationship of the factors proposed by traditional theories does not hold for this group of firms.

Moreover, this study provides direct evidence for the first time on potential and actual credit rating changes and their impact on financial decisions from a country which is unique in terms of its institutional settings. Compared to the US market, where the bond market and credit rating industry are developed and ratings are more widely accepted, a study of the UK market is an attempt to test whether the findings of the previous US studies hold elsewhere. Recognising the differences in the leverage behaviour across the rating levels, the models of Kisgen (2006 and 2009) are adjusted to incorporate such effects.

While most of the previous studies note that capital structure determinants are similar across both the US and the UK (see for example Rajan and Zingales, 1995), the impact of credit ratings is likely to be different. In this regard, the findings of the study are also unique and important. For example, unlike US firms, the rated UK firms do not seem to be very cautious about rating changes, whether these are potential or actual. Specifically, high rated firms present an interesting scenario. Unlike US firms, such firms issue more debt when they face potential or actual credit rating change. Such findings suggest that perceptions about the costs and benefits gained from credit ratings are different compared to those of their counterpart firms in the US. It seems that the acquisition of credit ratings is still mostly limited to highly creditworthy firms in the UK market and rating changes are not likely to impose any serious costs for these firms.

In addition, unlike prior studies on UK firms' debt maturity structures, which have completely ignored the relevance of refinancing risk in determinations of debt maturity structure, the study also seeks to contribute to and complement the growing debt maturity structure literature by providing a comprehensive analysis in investigating this relationship. The study, for the first time, tests Diamond's (1991) framework to explain variations among the debt maturity structures of UK firms. The empirical evidence on the determinants of debt maturity structures provides a comprehensive analysis with which to systematically examine the relevance of refinancing risk, as measured by credit ratings, for the maturity structures of the firms. The results indicate that credit ratings are among the important determinants of rated firms' debt maturity structures, and the level of refinancing risk faced by different rating classes alters the behaviour of firms towards their debt maturity structures.

Kisgen (2006) stated that '*future capital structure research would benefit from including credit ratings as part of the capital structure framework, both to ensure correct inferences* *in capital structure empirical tests, and more generally, to obtain a more comprehensive depiction of capital structure behaviour*' (p.1069). The findings of this thesis, however, imply that the sensitivities of firms towards their credit ratings depend on many external factors, and such a conclusion has restricted implications for firms in other markets. For example, regulatory dependence on credit rating agencies and the history of rating agencies along with the type of firms acquiring credit ratings may influence the behaviour of firms towards their credit ratings in a particular market. Nevertheless, trends in the UK market suggest that credit ratings are important for accessing debt markets, but also that rating changes generally do not have any implications, as suggested by the CR-CS hypothesis, for capital structure decisions made in the subsequent periods.

1.5. Structure of the thesis

The thesis has nine chapters.

Chapter 1 has introduced the thesis by presenting the general background of the study, the motivation and justification for conducting the research and the broad research questions.

Chapter 2 provides details of the general background of the rating agencies, their operations and their significance. It discusses how rating agencies have significantly developed over time and have become important global financial intermediaries. The chapter also presents an overview of the UK corporate debt market, its development and shifts in the financing pattern of UK firms in the past few years, and then discusses the role of credit rating agencies in the UK market.

Chapter 3 reviews the general literature on capital structure. It gives an account of the important theories of capital structure and presents the relevant empirical evidence. This is followed by a section devoted to discussing the limitations of the traditional theories of capital structure in fully explaining the behaviour of firms towards their capital structures and highlighting the implications of credit ratings and associated concerns for the capital structure decisions of the UK firms. The chapter also presents the workable hypotheses based on the theoretical and empirical framework.

Chapter 4 reviews the theories of debt maturity structure and the empirical evidence related to those theories. It presents a review of Diamond's 1991 theoretical framework and the hypotheses based on it, to examine the relationship between credit ratings and debt maturity structures of UK firms.

Chapter 5 discusses the methodology adopted in the present study. Specifically, it presents the data collection procedures, models and the variables for the three empirical chapters of the thesis, with discussion of the proxies and their justification.

Chapter 6 investigates the relationship between the level of credit ratings and the leverage structure of the UK firms. Specifically, it presents the descriptive statistics of the sample used in the analysis, the empirical results of the models presented in Chapter 5 and the robustness checks performed to analyse the sensitivity of the results to alternative measures and estimation techniques.

Chapter 7 empirically examines the influence of credit rating changes on the financing decisions of the firms. The chapter has two parts, addressing the impact of potential changes in the credit ratings and the actual changes in the credit ratings on the firms' leverage related decision making.

Chapter 8 investigates the impact of the credit ratings on the maturity structure of the UK firms. This chapter presents the descriptive statistics of the sample, the regression results of the models proposed in Chapter 5, and outlines the robustness checks for verifying the results of the main model.

Finally, Chapter 9 concludes the thesis by summarising the key findings, discussing the limitations of the study and offers recommendations for future research.

Chapter 2
CREDIT RATING AGENCIES AND THE UK'S FINANCING AND INSTITUTIONAL ENVIRONMENT

2. Introduction

Financial markets have changed substantially over time, with the development of innovative and complex financial instruments along with the expanding global activities of borrowers and lenders. This has increased the role of third parties such as credit rating agencies in potentially reducing any uncertainties arising thereof, and in facilitating issuers, investors and regulators in their local and global activities. To contextualise the present study, it is imperative to understand precisely what credit rating agencies are and why they are perceived to be an important component of any financial system. This chapter therefore discusses the background of the credit rating agencies and the specific role they play in the capital markets, both globally and in the UK. The focus is thus to establish how well the rating agencies have established themselves as key players in the financial markets. Furthermore, the chapter also discusses changing trends in the UK corporate debt market and the simultaneous development of credit rating agencies, in order to set out the broader framework of the study.

The chapter has three sections. Section 2.1 presents the general background of the rating agencies, presenting their history and development in the US and international markets. The section also offers some working definitions of credit ratings, their types, and then briefly discusses possible reasons for acquiring credit ratings by issuers. Section 2.2 focuses on the background of the UK corporate debt market and highlights the importance of rating agencies in the UK, their trends and development and finally Section 2.3 concludes the chapter.

2.1. General Background: Credit Rating Agencies and Credit Ratings

This section briefly presents the historical development of rating agencies and evaluates their role in the financial markets. The section is divided into three subsections: Subsection 2.1.1 presents how the rating agencies developed and expanded over time, Subsection 2.1.2 explains what credit ratings are and discusses different types of credit ratings, and Subsection 2.1.3 assesses the use and importance of credit ratings in the financial markets.

2.1.1. Historical Development of Rating Agencies

Credit rating agencies originated in the US market. While bond markets and capital markets had existed in the UK, the US and other parts of the world for over three centuries, and some markets were global for more than two centuries (Sylla, 2002), the emergence of formal credit rating agencies dates back over a century. The key feature of these credit rating agencies, i.e., the appraisal of creditworthiness is, however, not a modern concept. This is, and was, routine in all lending and borrowing activities for a long time, specifically in banks for their loan business (Sinclair, 2005). Other small institutions also provided financial information regarding firms. However, in the early 20th century, due to the expansion of financial activities in the US and globally, apart from investors, financial regulators were also demanding wider disclosure in terms of firms' financial standings. Moody's, recognising the need, formed the first formal rating agency in 1909 (Sinclair, 2005). Following Moody's, Standard Statistics Company and Fitch Publishing Company also emerged in this period.

Since their inception, credit rating agencies gradually became an important intermediary specialising in the provision of reliable appraisals of the creditworthiness of the firms and countries. Due to the desired attributes and general acceptability of credit rating agencies within the financial markets, they soon gained recognition from regulatory bodies. For example, in the 1930s, for the first time, the US Treasury Department and US Federal Reserve prohibited banks to hold securities below a certain quality threshold (Langohr and Langohr, 2008). Banks were forced solely to use the judgment of the *'recognised rating manuals'* (White, 2010, p.213) which essentially represented the formal rating agencies. Regulatory dependence continued in the US market and important criterions were established based on the credit ratings supplied by the external agencies. Such dependencies continued to enhance the overall impression of the importance of the rating agencies among the market participants.

Until the 1940s, rating agencies experienced a rapid growth in the US. The period from the 1940s to the 1960s however, was characterized by slow growth[5] but they re-emerged in the mid 1970s and experienced exploding growth up until the present day. In 1975, for example, Partnoy (2002) states that only 600 new bond issues were rated. The Standard and

[5] This may be attributable to stable economic conditions in the US market. In this phase, the US market was considered too safe for the rating agencies to matter (Langohr and Langohr, 2008).

Poor's agency had fewer than 50 professional employees. However, by the year 2000, Standard and Poor's and Moody's rated 20,000 public and private issuers in the US market with $5 trillion worth of rated debt outstanding. By 2011, statistics from Standard and Poor's show that there are approximately 4,300 people employed worldwide by Standard and Poor's, dealing with US$32 trillion of rated debt and approximately 870,000 ratings (Standard and Poor's, 2011) in more than 100 countries.[6] The compound annual growth rate of Moody's and Standard and Poor's revenues during 2002 to 2007 was also high at 17% and 14.5% respectively, indicating tremendous growth over the years.

Though the early period from 1900 to 1930 saw the development of rating agencies in the US market, the period from 1970 to 2009 showed significant expansion of the credit rating agencies around the world. According to Caouette *et al.* (2008), in 1920, the proportion of international firms among the total rated firms by Moody's was 6% which has risen to approximately 50% by 2006, with revenues earned from international operations increased to 49% of the total revenues of Moody's. Studies generally cite four main reasons for the successful expansion of rating agencies, within the US and globally. Apart from the successful track record of the credit rating agencies (Basel Committee on Banking Supervision, 2000), financial globalization (Langohr and Langohr, 2008) and the switching to an issuer-paying model by rating agencies (Packer and Cantor, 1994), the most argued reason is the widespread use of credit ratings in legislation and the endorsement of the US regulatory bodies (Partnoy, 1999, 2002). The rating agencies capitalising on the reputation earned in the US market also successfully penetrated other markets. Following the US, regulatory authorities around the world also outsourced several regulatory functions to the credit rating agencies, thus enhancing their scope, the dependence upon them, and the overall impression of credit rating agencies as a vital component of the financial system without any legal responsibility on the part of such intermediaries (Langohr and Langohr, 2008).

Although credit rating agencies have largely been successful in the past, they have always been criticised for the value addition of the information they provide (Partnoy, 2001; Cantor, 2004; Amato and Furfine, 2004; Altman and Rijken, 2004), for errors of judgment (Covitz and Harrison, 2003; Haan and Amtenbrink, 2011) and for a perceived lack of

[6] As comparable statistics are not available from any reliable source, it is believed that Moody's will have similar statistics due to their equal market share. White (2010) confirms that Moody's and S&P have a 40% market share each while Fitch has a 15% share of the market.

objectivity and independence (Mathis *et al.*, 2009; Partony, 2006; Frost, 2007). Specifically following the default of Enron in 2001 followed by the Worldcom collapse and the recent financial crisis of 2008, rating agencies have again been in the spotlight. They are blamed as major culprits of the current crisis, which has resulted in a new argument from the regulatory bodies, investors and academic community concerning the credibility of the rating agencies themselves in terms of their independence, transparency and accuracy.

Notwithstanding the fact that criticisms of credit rating agencies may seem valid, the intermediary role they have played in the financial markets over the years should not be disregarded. This is evident from recent developments regarding the role of rating agencies and measures taken by regulatory authorities to improve their functioning. Following the recent crises, the regulatory bodies in the US, the EU and the rest of the world are still attempting to improve the functionality of rating agencies rather than condemning them altogether. For example, the Basel III accord up until now allows the use of credit ratings from external rating agencies (see for example Bank of International Settlements, 2010; Standard and Poor's, 2010b, for more details). The European Commission also acknowledges the role of rating agencies in the financial markets and has recently focused on measures to improve the functioning of rating agencies in terms of their competition, transparency and vigilance. Brooks (2011) also argues that rating agencies, following the financial crisis, are still dominant in financial markets and are as important as they were three years ago.

The widespread recognition which these rating agencies have gained over time signifies the importance of these institutions in shaping the knowledge structure of the participants and community as a whole, whether they are investors, policy makers or issuing firms. It is not because credit ratings are necessarily accurate but for the reason that they are believed to come from an authoritative source of judgement (Sinclair, 2005). The opinion of credit rating agencies are respected by market participants and their actions correspond to such beliefs. Thus, it can be argued that market and debt-issuing firms have a strong incentive to consider credit ratings in their decision-making processes.

2.1.2. Understanding Credit Ratings

The term *'credit rating'* does not have any single, definite definition or standard to describe it. Regulatory bodies and rating agencies define themselves in their own ways. For example, Standard and Poor's (2010b) defines a credit rating as '*a forward-looking opinion about the creditworthiness of an obligor with respect to a specific financial obligation, a specific class of financial obligations, or a specific financial program'* and from Moody's perspective, '*credit ratings are opinions of the credit quality of individual obligations or of an issuer's general creditworthiness'* (Moody's, 2009). While the definitions may seem similar, the underlying philosophy of the rating firms may differ. For example, Moody's rate on the expected loss due to possible default while Standard and Poor's issue ratings based on the probability of default (Bongaerts *et al.*, 2012). However, the above definitions and the ones used commonly by regulatory bodies (see for example, Credit Rating Agency Reform Act, 2006; European Union, 2006; US SEC, 2003), all have one thing in common; *opinion*. Credit rating agencies provide an *opinion* or more specifically a forward-looking predictive view on the firm's ability to meet its obligations when they are due. The rating agencies explicitly express that their ratings reflect a relative risk of default and not an absolute one. Besides, these *opinions* are not with reference to any specific time horizon (Hovakimian *et al.*, 2009). Despite the fact that the word *opinion* is explicitly stated by credit rating agencies, they are actively used in investors' and firms' decision-making processes and form the basis of many regulations in different countries.

Credit ratings are a set of alphabetic codes assigned in descending order according to the rising likelihood of default. They may also include numerical codes or symbols, depending on the rating agencies, to show the relative standing within each set of broad category of alphabetic codes. For example, Standard and Poor's assigns alphabetic codes such as AAA, AA, A, BBB, BB and so on, with '+' or '-' modifiers (AAA, AA+, AA, AA-, A+, A, A-, BBB+, BBB, BBB- and so on) to show the respective creditworthiness within the broad rating category (See appendix 2A for the Standard and Poor's long-term issuer credit ratings and their interpretation). Moody's assign numerical modifiers (Aaa, Aa1, Aa2, Aa3, A1, A2, A3, Baa1, Baa2, Baa3 and so on) to the alphabetic codes (Aaa, Aa, A, Baa and so on). These ratings can be broadly assigned to the issuers or specific security issues of the issuers with (i.e., solicited ratings) or without (i.e., unsolicited ratings) a request from the issuer. Issuers' and issues' ratings, however, are argued not to be independent of each other (Langohr and Langohr, 2008) and can change with or without the credit watch or the rating outlook (Wansley *et al.*, 1992). Credit watch, also known as rating alerts and watch lists, gives a strong indication that the ratings will change in the near future. Rating agencies conclude decisions about the ratings within 90 days, if they have placed the firm or issue on credit watch (Langohr and Langohr, 2008). Ratings outlooks are issued to add more precision to the ratings. They also indicate the potential direction of rating over the next six months to two years.

2.1.3. Evaluating the Need for Credit Ratings

Credit rating agencies serve several important economic functions. It is argued by Millon and Thakor (1985), Beavera *et al.* (2006) and Tang (2009) that financial intermediaries such as credit rating agencies provide a more transparent view of the securities and firms which facilitate a minimisation of information asymmetry in the market place, leading to increased capital market efficiency (Beavera *et al.*, 2006). The unique selling point of the credit rating agencies is their ability to gather all the public and private information, as argued by the rating agencies, and convey them to the market through letters and symbols easily and quickly recognisable by market participants (Hovakimian *et al.* 2009). Specifically, when issuers have solicited credit ratings, rating agencies might have access to information not strategically disclosed by the firms to the market, and the agencies therefore serve as a channel to quantify the complete information picture into meaningful codes to transfer to users.[7] It is expected that this function of credit ratings results in the correct pricing of securities, reduced transaction costs and quicker access to the debt markets for borrowers. Thus, rated firms are expected to attract a large pool of investors and to have better access to capital markets (Faulkender and Petersen, 2006; Mittoo and Zhang, 2010), and achieving financial flexibility, improved bargaining power with banks, suppliers and other non-financial parties (Langohr and Langohr, 2008). Reducing information asymmetry is thus argued to be the principal function of rating agencies. One of the basic premises of the thesis revolves around this function of the credit ratings.

Moreover, regulatory dependence on credit ratings can further motivate firms to acquire and maintain good ratings. The outsourcing to rating agencies by regulatory bodies has increased the use of credit ratings, as several regulations allow certain grades of issuer or issue to qualify for institutional investment purposes. For example, every registered security in the US market requires a rating from NRSRO[8] if it is to be sold to institutional investors.

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[7] Empirical evidence concerning the function of credit rating agencies, as reducing information asymmetry, can mostly be seen in the studies which found significant market price reaction following rating change (see for example, Katz, 1974; Liu and Thakor, 1984; Ederington *et al.*, 1987; Hand *et al.*,1992; Ederington and Goh, 1999; Dichev and Piotroski, 2001; Tang, 2009).

[8] NRSRO or Nationally Recognised Statistical Ratings Organizations are those rating agencies whose ratings qualify for the use of regulatory purposes in the US.

Initially, the information conveyed to the market through rating agencies was conceivably valuable for small investors with limited resources and unsophisticated investors for assessing the creditworthiness of the borrower (Beavera *et al.,* 2006; Cantor and Parker, 1994). However, they are now found to be widely used by banks, plans sponsors, fund managers, and trustees in the US and Europe who require a standardized form of information as investment guidelines for their portfolio management (see, Cantor and Parker, 1994; Baker and Mansi, 2002). For example, Cantor (2004), through a survey study of 200 plan sponsors and investment managers in the US and Europe, finds that around three quarter of them actively use credit ratings to setup the minimum criterion for bond purchases.

Finally, the most important reason for firms acquiring ratings could be the intention of the firms to be screened as good quality firms. The rating mechanism may be similar to the screening mechanism model presented by Stiglitz (1975). Firms pay fees to rating agencies to differentiate them from firms with inferior quality, thereby avoiding the ‘average quality pricing’ as described by Akerlof (1970) and Liu and Thakor (1984). These firms, by acquiring credit ratings, may become more visible and achieve more recognition, which results in better access to capital markets, specifically the international debt markets. For example, Perraudina and Taylor (2004) argue that, unlike domestic markets where firms can access financing through reputation, international markets may require a measure, which is more comprehensible and easily standardisable by the investor base.

2.2. The Role of Credit Rating Agencies in UK Capital Markets

As discussed earlier, due to the changing financial environment, rising complexity in financial products and services, and concern for more risk management, rating agencies have been successful in creating a niche in the global financial markets. Similar to other markets, the UK has also experienced a growth in the operations of credit rating agencies. This section provides background on the corporate debt markets of the UK and highlights the role of rating agencies for this market. This section is further divided into two subsections. Section 2.2.1 offers some details on the corporate debt market in the UK, suggesting some shifts in the trends of corporate financing patterns, while Section 2.2.2 focuses on the progression and advancements of credit rating agencies in UK capital markets.

2.2.1. An overview of the UK Corporate Debt Market

The UK, as with the US, has a market-oriented financial system (Demirguc-Kunt and Levine, 1999) where the liquidity and depth of the financial market provide the financial instruments required by the participants. After the deregulation of the financial sector in the 1980s, the banking sector in the UK experienced tremendous expansion. For example, Dimsdale and Prevezer (1994) state that bank lending rose from £55bn in 1979 to £414bn in 1989, with the bank lending to GDP ratio rising from 32% to 89% in these ten years. This expansion was, however, limited to the personal sector, and the proportion of lending by the banks to the corporate sector started declining.[9] Deregulation of the global and UK financial sectors, along with the availability of innovative financial products, facilitated UK firms in accessing the securities markets, both locally and internationally. Such access offered lower borrowing costs compared to those available from the banks.

As a result of the recession, interest rate spreads in that period were also high due to the bad debt provision of the banks. This further discouraged firms, specifically the large firms which could choose alternate sources of financing, from bank borrowing. Within a period of three years (1987-1990), bank borrowing as a proportion of the total liabilities of large firms declined by approximately 9%, while total liabilities increased from 26.6% to 46.8% for such firms (Dimsdale and Prevezer, 1994). This period thus can be regarded as the one which triggered the flow of funds through the public debt market for the UK firms.

The UK is considered a market-orientated economy similar to the US; the pattern of financing for the firms in the UK, however, differs from that of firms in the US market. Rajan and Zingales (1995) and Wald (1999) find that UK firms are typically less levered than the US firms but at the same time are more dependent on external financing. Yet the major source of external financing for UK firms is equity issuance and bank lending, unlike their US counterpart firms which rely more on the public debt market. However, in the past two decades there has been a shift in the sources of financings for UK firms, particularly the larger borrowers. They have now been actively issuing debt securities in the domestic and, particularly, in the international debt markets. A report of the Bank for International Settlements (2010) also shows an increasing trend of activity for the UK firms in the international debt securities market while the outstanding domestic debt securities have

[9] This shift in the lending of banks was not just limited to the UK but was also seen around the world. It is estimated that commercial bank lending decreased from 37% of the total capital movement in 1970s to 14% in 1980s (Sinclair, 2005).

remained constant over the past 15 years. The report indicates that the domestic debt market for non-financial firms is US $22bn. Conversely, UK corporate debt issuers in international markets have grown considerably, from $35.34bn in 1993 to $300.115bn in 2009, an increase of approximately 750% in 16 years. The UK corporate sector is noted to be the third largest international debt securities issuer after the US and France (Bank for International Settlements, 2010). The UK firms are particularly active in the Eurobond market where, despite being second following the US in terms of the number of bond issues, the mean face value of debt issued by UK firms is the largest among different countries, including the US, France and Germany (Claes *et al.*, 2002). The UK domestic bond market, however, is dominated by UK government securities commonly known as Gilt-Edged Securities or Gilts (Roberts, 2008). With the growth of public debt and international debt, the UK market also experienced a simultaneous growth in the credit rating industry. The next section, therefore, provides details on the role and growing importance of credit rating agencies in the UK market.

2.2.2. Credit rating Agencies and the UK market

As discussed in the previous section, UK firms were historically mostly financed by bank loans or through equity. However, there has been a growing trend in the use of public debt markets by UK firms. These markets may be more efficient than traditional bank borrowing, as the borrowers and lenders are able to meet without incurring the cost of bank intermediation. This efficiency may, however, be dependent on how quickly and efficiently the relevant information is disseminated between the interested parties.

In this context, the UK market has also witnessed a growing demand for credit ratings similar to other markets globally. Standard and Poor's, for example, started its operations in the UK in 1984 and up until 2010 more than 335 firms have been rated (Standard and Poor's, 2010c).[10] Among the FTSE 100 companies, Hanafin (2007) reports that 82% of these firms are publicly rated. Statistics reported by Standard and Poor's (2010a) indicates that UK non-financial firms are the third biggest users of Standard and Poor's credit ratings after firms in the US and Canada.[11] All three major rating agencies operate in the UK

[10] Comparable statistics for Moody's and Fitch are not available.
[11] One reason for this heavy use may be that the UK does not have any credit rating agency of its own while other countries such as Canada and Japan have their own rating agencies. However, as stated earlier, Standard and Poor's and Moody's have a 40% market share each and Fitch has a 15% share of the world's credit rating industry. The small and local rating agencies have about 5% of the market share. This may imply that the

market. In addition, small rating agencies focused on providing specialised rating services to the insurance industry only, such as A.M. Best, also operate in the UK.

Despite the increased growth of the credit rating agencies in the UK market, it can be argued that rated firms in the UK market are substantially different from those in other markets, specifically the US (being the largest user of credit ratings). Compared to the US market, for example, European firms' rated bonds are generally skewed towards higher ratings (Adjaoute, 2000). Moreover, as already stated in Chapter 1, the proportion of speculative grade issuers in the European market is also low at 10% of total issuers compared to 40% in the US market (Batten *et al.*, 2004). Claes *et al.* (2002) note that UK rated firms are the second largest active users of Eurobonds after the US, where 95-97% of the Eurobonds are investment grade issues. This may also indirectly support the view that UK firms would generally have better quality than firms from other markets. As will be further discussed in Chapter 7, the sample of the present study also indicates such differences. These differences can be expected because of the developed and mature rating industry in the US compared to European markets, where the credit rating agencies do not have a very long history. Due to this, small and mid-sized firms also acquire credit ratings in the US market while in the European market credit ratings are accessed predominantly by large and creditworthy firms (Batten *et al.*, 2004). Given that the UK credit rating industry does not have a very long history as compared with the US market, one could expect that rated firms in the UK market are more creditworthy firms. As will be discussed further, UK firms are also likely to self-select themselves for ratings and will therefore have higher ratings.

If the above is true, such differences could be important for the present study as it can influence the sensitivities of the rated firms towards their credit ratings. For example, it can be argued that due to the skewed distribution of UK rated firms towards the higher end, poor rated firms would be particularly more concerned about costs of low credit ratings. This is because when a large number of rated firms have higher ratings, poor quality firms can easily be identified and the market can screen out such firms from debt markets and specifically from long-term debt markets. This would imply that, unlike the US market, concerns over the costs and benefits of ratings would not be shared equally among all the

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ranking of rating users presented above will not be seriously affected once the rest of the rating agencies are taken into account.

rating levels, and that the low rated firms will be particularly more concerned about the costs imposed by their ratings.

As bond markets and rating agencies in the UK market are not as developed as they are in the US market, the UK rated firms are also expected mostly to have solicited ratings. Elkhoury (2008) also states that Moody's claim that they have not issued unsolicited ratings in Europe, while Standard and Poor's claim that they have not done any unsolicited rating outside the US. It is documented that solicited rating are more favourable than unsolicited ratings. Prior studies argue that apart from solicited rated firms being more profitable, liquid and having higher levels of debt than unsolicited rated firms (Poon and Chan, 2010), there is a self-selection bias, which drives the differences between rating levels of the two groups (Gan, 2004). This implies that highly creditworthy firms are more likely to have solicited ratings. These differences in firm-level characteristics and credit ratings might lead to different sensitivities of solicited rated firms and unsolicited rated firms towards their rating changes. For example, Shivdasani and Zenner (2005) argue that large and high credit rated firms will be less likely to be downgraded following debt issuance compared to low rated firms. Moreover, unsolicited rated firms do not generally provide any input into the ratings assigned to them and therefore these ratings lack soft information content (Bannier *et al.*, 2010). Given this, it can be expected that unsolicited rated firms will be careful about the signals they convey to the market compared to firms with solicited ratings who can discuss and present evidence of their credibility to the rating agencies before their ratings are disclosed to the public.

A distinguishing feature of the UK market that is particularly relevant for the present study is the limited regulatory dependence on credit ratings. Unlike the US market, where over a hundred federal laws and over 50 regulations (Cantor *et al.*, 2007) covering banking, real estates, mutual funds, insurance and pensions etc are based on credit ratings (Partnoy, 1999), the regulatory dependence on the credit ratings in the European market is not as widespread.[12] Particularly in the UK market, this reliance is almost non-existent, with the exception of the Capital Requirements Directive (CRD) (Langhor and Langhor, 2008) allowing banks to use external credit assessments in determining the risk weights for capital adequacy requirements (Mäntysaari, 2009). The dependence of regulations on credit ratings can be expected to have implications for the perceptions of the issuer and investors in any

[12] In Europe, France has the highest number of regulatory uses of credit ratings. See Langhor and Langhor (2008) for more details.

market. Partnoy (1999, 2006), for example, argues that the market power of rating agencies in the US market can be directly attributable to the *regulatory license* granting ability of the rating agencies. Kisgen and Strahan (2010) find that once the Dominion Bond Rating Service was assigned an NRSRO status in 2003, the firms that were rated better by Dominion compared with other NRSROs, experienced a sharp decline in their cost of capital, irrespective of any change in the underlying quality of the firms or their securities. Therefore, it seems that the level of regulatory dependence on credit ratings in a particular market may affect factors such as its cost of financing, investor base, dependence on credit ratings and the general perception about the credit ratings among the market participants.

It should be noted, however, that credit rating agencies in the European Union are under close scrutiny now. In the past, the European Union did not have targeted exit and entry requirement for the credit rating agencies (Langhor and Langhor, 2008). However, following the financial crisis, the European Commission now requires that any credit rating agencies interested in operating inside the European Union have to be registered with the European Securities and Markets Agency (ESMA) which will directly supervise the rating agencies. Moreover, they will be governed under stricter rules based on the IOSCO Code of Conduct for credit rating agencies to ensure transparency, monitoring and the addressing of potential conflicts of interests (Dewar, 2010). This does not suggest that regulatory reliance in European countries will increase but it may suggest that the perception of the market participants about rating agencies might be more favourable in the future. Increasing reliance is expected because the market would perceive rating agencies to be more formal, regulated and authenticated sources of information.

Another interesting feature that can have implications for the relationship between credit ratings and capital structures is the creditor friendly bankruptcy code which prevails in the UK market. In the UK, emphasis is placed more on the creditor rights compared to other markets such as the US, as indicated by La Porta *et al.* (1997). In some circumstances when firms are distressed, secured creditors may have the rights to sell firms' assets and realize their claim and such actions sometimes may not be challenged in the court (Kausar *et al.*, 2006; Acharya *et al.*, 2011). The creditors, therefore, have an incentive for early liquidation. This can arguably have implications for the firms and their sensitivities over their credit ratings given that credit ratings create a vicious cycle and may lead to liquidation much before firms are actually distressed. Due to the mediating role of the bankruptcy code, a firm far from distress is expected to have less concern for downgrades leading to liquidation, compared to a firm near distress. Specifically, it would suggest that low rated firms are likely to be more concerned about the costs of low credit ratings as low ratings will result in higher capital costs, constraining their access to debt markets and may possibly even lead to inefficient early liquidation.

A survey study on UK corporate treasurers by Bacon *et al.* (2009) suggests that the use of credit ratings is likely to increase in the foreseeable future, as unrated firms in the UK market also seek to obtain credit ratings to minimise uncertainties in their flow of financing. Moreover, recent steps taken by the FSA and the European Union to improve the functionality of domestic debt markets and credit rating agencies respectively, is also likely to influence the role played by rating agencies in the UK market.

2.3. Conclusion

This chapter highlighted the role of credit rating agencies in financial markets and presented an overview of the UK market and the role of credit rating agencies in the UK. The aim of the chapter was to establish that credit rating agencies are powerful intermediaries in financial markets and because of this, they are likely to have a strong influence on the perceptions of investors, regulators and even the managements of firms. Therefore, it can be argued that firms take into consideration the impact of their decisions on their credit ratings. The chapter also discussed that the UK market, similar to other markets, has witnessed a high growth in the use of credit ratings. However, despite the increased use of credit ratings, the UK market has some unique features, including non-reliance of regulations on credit ratings, a tendency towards issuing international debt, a higher likelihood of high rated and solicited rated firms than in the US market, and a creditor-friendly bankruptcy code, all of which make the UK an interesting sample country to study. The influence of these features is also likely to play a mediating role in the relationship between credit ratings and the financial structure decisions made by the UK firms.

Chapter 3
Literature Review: Credit Ratings and Capital Structure

3. Introduction

The main objective of this thesis is to examine the role of credit ratings in determining the financial structure of UK firms. The aim of the current chapter is to present a systematic review of the previous studies on the subject, to provide the background and develop a link to the present study. The first half of the chapter discusses the major theories of capital structure along with a review of the previous empirical studies relating to those theories. The later part of the chapter attempts to underline the importance of the credit ratings for capital structure decision-making and also presents the specific testable hypotheses based on the literature review. The chapter is divided into four main sections. Section 3.1 discusses the major theories related to the determinants of capital structure, and Section 3.2 contains a review of the empirical literature on the determinants of capital structure based on the traditional theories. Section 3.3 presents a detailed discussion on the relevance of credit ratings towards firms' leverage structures and the hypotheses based on the literature presented. This section is further divided into three subsections; each looking at different aspects of the credit rating-capital structure relationship. Section 3.4 concludes the chapter.

3.1. Capital Structure: Review of the Traditional Theories

Even after five decades of extensive academic research, the question of what constitutes the determinants of capital structure still remains one of the most contentious issues in the finance literature. The origin of the debate can be traced back to Modigliani and Miller's 1958 *irrelevance proposition*, which serves as the focal point of the major theories and the studies conducted afterwards. During the 1960s and 1970s, the studies presented criticism of Modigliani and Miller's proposition by proposing imperfections that might make the capital structure of a firm relevant. They proposed factors such as tax benefits (Modigliani and Miller, 1963), personal taxes (Miller, 1977) and the role of bankruptcy (Kraus and Litzenberger, 1973; Scott, 1976; Kim, 1978) for the relevance of capital structure. By the end of the 1970s, the studies focused more on the signalling and information asymmetry (Myers and Majluf, 1984; Myers, 1984; Krasker, 1986) aspect of capital structure. A rich strand of literature has also recently emerged which emphasises the understanding of more detailed aspects of capital structure such as the type of debt, e.g., private vs. public (Denis and Mihov, 2003), its components, e.g., convertible debt and debentures (Mayers, 1998), and the maturity structure, e.g., long-term vs. short-term (Stoh and Mauer, 1996; Barclay and Smith, 1995a, 1996; Guedes and Opler, 1996; Ozkan, 2000, 2002). Despite the large number of theoretical and empirical studies, it still remains an empirical question as to how firms choose their capital structure. The present section aims to provide a comprehensive review of literature relating to the existing theories of capital structure. The next section will discuss the empirical evidence on the determinants of capital structure based on these theories.

3.1.1. The Irrelevance of Capital Structure

The seminal study by Modigliani and Miller (1958) can be regarded as a starting point of the theoretical and empirical debate on capital structure. They proposed the *irrelevance proposition* suggesting that the debt has no inherent advantage for the firm and thus how assets are financed is irrelevant for a firm's total value and its cost of capital. This proposition rests on the arbitrage argument, which suggests that the investors of a firm can create homemade leverage, which can replicate the firm's capital structure without incurring any additional costs. Therefore, any change in the firm's capital structure is irrelevant to the shareholders.

The *irrelevance proposition* raises several questions pertaining to the validity of the theory in the real world. For example, if the capital structure does not matter, then why are financial managers concerned about it? It should be noted that the proposition was originally proved under a certain restrictive set of assumptions including perfect and frictionless markets with perfect substitution of financing types, where there was no transaction cost, constraining regulation, default risk, taxation or information asymmetry and the firms were homogenous in nature within an equivalent risk class. The theory might be valid with these underlying assumptions, but may not hold if the assumptions critical to the theory are relaxed. Therefore, the study received criticism generally pointing out that the capital structure does matter for the firm's value. Regardless of the criticism (detailed discussion of which follows in the next sections), this apparently simplistic theory provides a conceptual basis for other major theories on capital structure.

The following discussion points out several different factors, which theoretically influence capital structure in the real world. These theories generally add imperfections to the irrelevance model proposed by Modigliani and Miller (1958), by addressing some dimensions of the capital structure. Nevertheless, it is argued that no single theory can fully explain the dynamics of firms' capital structure. As Myers (2001) rightly points out, '*there is no universal theory of the debt-equity choice, and no reason to expect one'* (p.81).

3.1.2. Theories of Taxes and Capital Structure

In an imperfect world, where the influences of corporate and personal taxes, agency costs, information asymmetry and bankruptcy costs exist, the irrelevance of the capital structure for a firm's value is an inappropriate generalization. In 1963, therefore, Modigliani and Miller proposed *a correction*, as they called it, of an error in their earlier paper of 1958. They recognised the value of the tax deductibility of the interest payments for the capital structure. Modigliani and Miller (1963) argue that given the value of the tax shield, an optimal decision for firms would be to use as much debt as the firm can get, as this would lead to increased value of the firm. This would imply a near exclusion of equity financing. The value of the levered firm would therefore be equal to that of the unlevered firm plus the value of the debt tax shield. This would mean that firms, which have higher tax benefits, *ceteris paribus,* should have higher leverage. However, the study overestimates the benefits of using debt, as this would imply that an optimum capital structure would consist almost entirely of debt financing, with no limits to the maximum amount of debt a firm can safely employ. Moreover, the theory rests on similar assumptions as the *irrelevance proposition* including no personal taxes, potential bankruptcy costs, information asymmetry and agency costs in this choice of debt.

It is argued that the tax advantages proposed by Modigliani and Miller (1963) could be completely offset if the personal taxes are also considered. The modelling of the implications of personal taxes for the capital structure determination by Miller (1977) was the first major development in the tax related argument following Modigliani and Miller (1963). Miller argues that as the debt increases, the firms also have to pay higher interest rates to entice higher tax bracket bondholders to hold corporate debt. This will increase the net after-tax cost of debt to the firms to the point that there is no net advantage of further debt. Consistent with Modigliani and Miller, he argues that the irrelevance proposition would still hold. While both Modigliani and Miller (1963) and Miller (1977) offer extreme predictions about the leverage of firms, there are theories which are relatively less inclined towards any particular behaviour around the choice of capital structure. For example, DeAngelo and Masulis (1980) highlight the benefits of non-debt tax shield such as depreciation and investment tax credit, which firms can substitute for the debt tax shields. The presence of a substantial amount of non-tax debt shields would imply lower levels of debt, as the incentive to borrow more for the tax reasons would diminish, when such an alternative is available for the firms. Under such circumstances, the firms will have a *unique interior optimum capital structure* (p.27) which affects value of the firms.

3.1.3. The Role of Bankruptcy and the Trade-off Theory

Studies proposing the advantages of tax shields suggest that firms can employ infinite levels of debt. However, subsequent studies argue that such conclusions are unrealistic and can have little intuitive appeal because for firms, there might be risks associated with acquiring and servicing debt. As a result, studies by Kraus and Litzenberger (1973), Scott (1976) and Kim (1978) formally introduce bankruptcy cost into their models to explain a firm's choice of capital structure. These studies suggest that firms can achieve a finite and an optimal capital structure by offsetting the present value of the tax shields and the expected cost of bankruptcy. Kim (1978) specifically argues that if the firms are subject to direct and indirect bankruptcy costs, then they reach their maximum debt capacity, defined as the maximum borrowing allowed by the capital markets, well before 100% debt financing is employed. Scott (1976) proposes that firms can issue more debt as long as it is backed up by collateral since these collaterals can serve as security for lenders as well as the fact that in the case of default, debt can be recovered through liquidating or selling off the assets. The existence of bankruptcy costs would therefore restrict the firms to a finite optimal capital structure (Baxter, 1967), which would reconcile Modigliani and Miller's 1963 tax argument with the observed behaviour of the firms.

This theory, more generally known as the *static trade-off theory* (Myers, 1984), thus suggests that, other things being constant, firms that have higher bankruptcy costs should have lower leverage and correspondingly firms with lower bankruptcy costs will have higher leverage (DeAnglo and Masulis, 1980; Fischer *el al.*, 1989). Such costs can be broadly classified into indirect (such as, loss of sales, profits and employees and an inability to raise capital) and direct costs (such as, lawyer and accountant fee, managerial administration time spent during a bankruptcy process and other professional fee) (Warner, 1977; Altman, 1984). Barclay and Smith (1999) argue that these costs can have different implications for large and small firms. Larger firms have significant economies of scales and therefore are likely to have higher leverage than their counterpart smaller sized firms.

A further implication of the static trade-off model is that firms have a target or an optimal debt ratio and they gradually move towards that ratio (Myers, 1984). This optimal debt ratio is achieved by the continuous rebalancing of the benefits of debt (tax shield advantages) against the expected cost of debt (indirect and direct costs of bankruptcy). Thus, substituting debt for equity or equity for debt would allow the firm to maximise the value of the firm. These adjustments might be costly for firms. Studies (e.g., Flannery and Rangan, 2006) argue that if there were zero adjustment costs, firms would never deviate from their optimal debt ratio. However, given that adjustments are costly, this may hinder firms from immediately reverting to their optimal leverage level.

There has been some disagreement on the relevance of tax shields and costs of bankruptcy in capital structure determination. Studies propose that the tax subsidy should not be offset against bankruptcy costs to reach an optimal capital structure, as the latter can be avoided by informal reorganisation (Haugen and Senbet, 1978). In addition, the cost of bankruptcy is difficult to calculate (Baxter, 1967) especially the indirect costs (Warner, 1977) and the magnitude of the bankruptcy costs cannot be accurately determined unless the firm is actually declared insolvent (Haugen and Senbet, 1978). Studies also propose to offset the transaction cost of the debt against the tax advantage since bankruptcy can be avoided by selling new shares and purchasing the outstanding debt given that such informal reorganization is beneficial for both parties (Haugen and Senbet, 1978).

3.1.4. Information Asymmetry, Signalling and Pecking Order Hypothesis

Studies arguing the relevance of corporate or personal taxes and the relevance of bankruptcy costs for the capital structure, implicitly assume that managers and investors share similar knowledge of a firm’s prospects for returns and investment opportunities. However, in the real world the insiders (i.e., the firm or management), and the outsiders (i.e., the investors), do not have symmetrical knowledge about the firms. Given such information asymmetries, investors will continuously update their beliefs from the observable information communicated through the actions of managers, while managers also take into consideration investors’ reaction when they make firms’ capital structure decisions.

There are a number of ways in which information asymmetry affects capital structure decisions. First, Myers and Majluf (1984) argue that managers are likely not to issue equity for financing a project, knowing that it may be mispriced by the market. Investors believe that firms issue debt when managers think that the firm is undervalued, while issuing equity occurs when it is overvalued (Myers, 1984). The larger the size of new investment project, the larger will be the mispricing (Krasker, 1986). Due to such underpricing, the existing shareholders will incur a net loss, as the new shareholders will capture more than the net present value of the new project. Myers and Majluf (1984) argue that such under-pricing can be avoided by using the safest and least costly source of financing first. For example, the firms may prefer to utilise internally generated funds, followed by less risky debt and finally by equity. They argue that even the risky debt will be preferable to equity, as it will be less severely undervalued than equity. Narayanan (1988) further argues that firms can restrict dividends so that they can finance themselves through internally generated funds. Overall, this suggests a hierarchy in financing which Myer (1984) called a *pecking order*. Unlike the static trade-off theory, however, the pecking order theory does not suggest an optimal leverage ratio

Second, in the presence of information asymmetry, managers can use capital structure as a mean with which to communicate information to outsiders about their superior quality of the firms. Ross's (1977) model assumes that managers have better information about the true quality of their firms and by issuing high levels of debt, they signal their firms' superior quality to the outsiders. If managers have unfavourable information regarding the prospects of the firm, they are likely not to take on more debt, which would otherwise expose them to bankruptcy risks. This can result in a separating equilibrium because the low quality firms cannot imitate the high quality firms by issuing more debt as the low quality firms have higher marginal expected bankruptcy costs. Narayanan (1988) also supports the argument that debt has an advantage over equity as it serves as a barrier for the inferior firms to enter the market.

A third way in which the information asymmetry can affect capital structure is by examining the proportion of the firms, which is held by the insiders. Since insiders have better information, Leland and Pyle (1977) argue that this will induce managers or entrepreneurs to choose a fraction of the equity to convey information about the quality of the project or the firm. Good quality firms will choose such costly signals to convey information to the outsiders in order to prevent the poor quality firms from mimicking them. Moreover, their model suggests that firms, which have a higher proportion of equity held by insiders, will issue more risk free debt to finance the projects. This implies an indirect relationship that higher quality firms have higher levels of equity owned by insiders and will also have higher debt.

3.1.5. Agency Cost and Capital Structure

Another factor, which may affect the way firms finance themselves, is the agency costs arising from conflicts between various stakeholders such as the managers, bondholders and shareholders of the firms. The idea of an *optimal capital structure* proposed by some of the previous studies may also become ambiguous due to such costs, as the *optimal capital structure* can vary from one group to another. Jensen and Meckling (1976) were the first to present a formal framework, which incorporates the significance of agency costs for capital structure. They argue that an optimal capital structure can be achieved by offsetting the agency costs of debt against the benefits of debt.

Two main types of conflicts can arise: conflicts between the management and the shareholders and conflicts between the bondholders and the shareholders (Jensen and Meckling, 1976). The former agency problem can arise because management has a smaller stake in the residual claims compared to equity holders. This may lead to behaviour, which is less than optimal for maximising the firm's value. For example, the managers may invest the firm's resources for their own benefit such as extensive rewards and perquisites, plush offices and building empires, and may not invest their best efforts into the firm unless the firm's interests are consistent with their own self-interests. Moreover, they may invest in projects with low net present value (called *overinvestment problems*) (Jensen, 1986). Such inefficiencies can be reduced by increasing managers' share in the equity, by increasing the debt in the capital structure or by repurchasing equity through debt. As Jensen (1986) argues, debt disciplines the managers, as the contractual nature of debt forces them to pay regular interest and principal payments. This will reduce the problem of free cash flows. Moreover, debt financing provides a mechanism of continuous monitoring by externals, which is likely to reduce the agency conflicts between both the parties.

The latter agency problem arises because in the presence of debt, the equity holders have an incentive to invest sub-optimally. Equity holders will follow courses of action, which benefit themselves at the expense of debt holders, thus transferring the wealth from bondholders to shareholders. Jensen and Meckling argue that shareholders of geared firms capture investment yield above the debt holders' fixed claim, but they will not suffer any loss above their basic investment in the firms, due to their limited liability in the firm. Therefore, shareholders will be more inclined towards investing in risky projects with higher returns. Myer (1977) adds that the likelihood of shareholder-bondholders conflict will further increase when the value of assets is largely based on growth opportunities. In the presence of risky debt, firms are likely to forgo investment opportunities, as the returns from those investments would go to the debt holders, leaving nothing for the shareholders. Myers (1977) describes this as the *underinvestment problem*. In such cases, firms are less likely to issue new debt (see more detailed discussion in Subsection 3.2.4).

3.1.6. Market Timing Theory

A more recently developed theory, which suggests that firms time their equity issuances with their stock market performance, has challenged the traditional trade-off theory and the pecking order theory. However, similar to the pecking order theory and unlike the trade-off theory, the market timing theory does not assume that firms have a target debt ratio. The theory, developed and tested by Baker and Wurgler (2002), suggests that firms issue equity when they are overvalued while they reduce equity when they are undervalued. Therefore, the observed capital structure of firms is the cumulative outcome of their past efforts to time the market where they opportunistically issue overvalued equity. Though Baker and Wurgler (2002) find strong negative relationship between weighted measure of past stock performance and capital structure, following studies find mixed support for the theory. Leary and Robert (2005) and Alti (2006), for example, argue that market timing is an important short run determinant of changes in capital structure but this effect has limited explanatory power in the long-run. They note that the actual behaviour of firms is more supportive of the dynamic trade-off theory. In line with Leary and Robert (2005) and Alti (2006), Hovikimian (2006) argues that market timing effects are not persistent and that the negative relationship that does exist between the weighted average of past stock performance and the capital structure is because the measure also reflects the growth opportunities of firms. Conversely, a survey study by Graham and Harvey (2001) finds that 76% of respondents consider overvaluation and undervaluation important determinants of equity issuance. Welch (2004) and Huang and Ritter (2009) also finds strong support in favour of the theory.[13]

[13] It should be noted that the market timing theory is not tested in the present study due to the nature of research questions under investigation. The implications of credit ratings are tested by incorporating them into

The review of the capital structure theories shows the extent to which the theoretical framework has developed in explaining the various viewpoints on the determination of firms' capital structures. It highlights several factors which can influence the debt and equity choice of the firms. As can be noted, there are two competing theories in the capital structure theoretical literature: the *trade-off theory* and the *pecking order theory*. The basic static trade-off theory refers to the offsetting of tax benefits against the costs of bankruptcy to reach an optimal debt ratio. It can be argued that the extended version of the trade-off theory can incorporate other benefits and costs of debt and equity, such as information asymmetry and the agency costs of debt. Proponents of the trade-off theory suggest that firms weigh such costs against the benefits to reach a target debt ratio. On the other hand, the pecking order theory suggests a hierarchy in financing choices but does not suggest any optimal level of financing. The empirical literature is generally dominated by these theories.

3.2. Empirical Evidence on the Firm-Level Determinants of Capital Structure

This section reviews the empirical literature on the determinants of the capital structure of the firms based on the main theories of capital structure as discussed above. It discusses the most prominent factors, which affect capital structure decisions.

3.2.1. Size

The size of the firm, which mainly represents the trade-off theory, is argued to be important for capital structure decisions due to a number of reasons. Large firms on average raise larger amounts of capital compared with smaller firms, due to economies of scale, e.g., the lower percentage fixed flotation cost (Kurshev and Strebulaev, 2007). They also have a lower ratio of bankruptcy costs to firm value compared with small firms (Warner, 1977; Ang *et al.*, 1982). Compared with large firms, small firms are more likely to be liquidated in case of financial distress and thus they are likely to have less leverage (Ozkan, 1996). In addition, large firms tend to be more diversified (Titman and Wessels, 1988), have superior debt capacity and to be more likely to get loans at favourable terms (Ferri and Jones, 1979; Kim and Sorensen, 1986). Such firms are likely to have lower agency costs associated with assets substitution and underinvestment problems (Chung, 1993; Ozkan, 2001) and are therefore likely to have higher leverage. The size of a firm is sometimes also regarded as a proxy for information asymmetry, which suggests a negative relationship between size and

the models which tests implications of the costs and benefits of different financing options and thereby examining the relative significance of costs and benefits of credit ratings for capital structure decisions.

leverage. For example, Rajan and Zingales (1995) argue that large firms have lower information asymmetry (e.g., due to more public information being available, more analysts following) which can in turn help them with regards to equity issuances.

The above reasoning generally suggests that size may have a positive relationship with the gearing ratios of the firms. The empirical evidence related to size and gearing, however, is rather mixed. By and large, a positive relationship is found for the size of firms and leverage by Bennett and Donnelly (1993), Rajan and Zingales (1995), Wald (1999) and Bevan and Danbolt (2002) for UK firms, Fama and French (2002) for US firms, and Deesomsak *et al.* (2004) for Asian Pacific firms. However, Jong *et al.* (2008), similar to Booth *et al.* (2001) studying several international firms, find mixed results of a relationship between size and gearing for firms in different countries. Barclay and Smith (1995), examining 6700 US firms from 1963 to 1993, also find mixed results; a significant negative result using OLS alongside a significant positive result using fixed effects regression. However, they note that the economic significance of the variable is relatively small compared with other factors affecting capital structure regardless of the estimation technique used. A study of 390 non-financial UK firms for the period 1984-1996 by Ozkan (2001) finds limited support for the positive relationship between size and gearing, while Toy *et al.* (1974) and Kim and Sorensen (1986) do not find size to be significant in explaining the debt structure of US firms.

Theoretically, size of the firm is believed to have a positive relationship with gearing, which to a large extent is supported by previous studies (with a few exceptions as mentioned above). In this study, size is used as one of the control variables to isolate the effect of size from the credit ratings of the firms in explaining their capital structure, as most of the previous studies have used size as a proxy for bankruptcy or access to the capital market. Based on theoretical reasoning and following most of the previous empirical findings, size is expected to have a positive relationship with the leverage of the firms.

3.2.2. Profitability

The motivation for using profitability as one of the explanatory variables in past studies has been stimulated by the seminal paper of Myers and Majluf (1984). The pecking order theory, as discussed above, suggests a negative relationship between profitability and gearing. Myers and Majluf’s (1984) pecking order theory relies on the signalling and information asymmetry problems associated with the issue of specific types of external financing, and the transaction costs of issuing equity. Consequently, firms follow a hierarchy in their financing policies, where internal sources are given preference over external sources. The model proposes that firms will choose internally generated sources such as retained earnings followed by less informational disadvantaged sources, e.g., debt and hybrid securities. When firms have exhausted all other financing sources, they will issue equity as a last resort. It follows that firms with higher levels of internally generated funds, typically measured by profitability in earlier studies, will have lower debt ratios. Most of the prior studies confirm the pecking order hypothesis and that profitability has a strong negative association with gearing ratios given that such firms do not need outside capital (Titman and Wessels, 1988; Rajan and Zingales, 1995; Frank and Goyal, 2000; Ozkan, 2001; Bevan and Danbolt, 2002, 2004; Barclay *et al.*, 2003; Fan *et al.*, 2011).

In contrast, the trade-off theory carries different implications about the relationship of a firm's profitability and its gearing. Debt ratios are expected to have a positive association with profitability, according to Modigliani and Miller (1963). Profitable firms have higher income to shelter, higher marginal tax rates, and have less probability of bankruptcy. It follows that profitable firms' capital structures will comprise of more debt to gain the added advantages of tax shields, apart from the other benefits of higher debt. However, the empirical studies have strongly substantiated Myers and Majluf's pecking order theory suggesting a negative association between profitability and the gearing of firms. Following prior literature, profitability is expected to have a negative relationship with the leverage of firms.

3.2.3. Tangibility of Assets

Another factor in the literature of capital structure is the amount of tangible assets in the firms' assets structure. Tangibility has been integrated in the models in previous studies to signify the influence of collateralisable assets in leverage related decisions. Scott (1977) argues that issuance of debt backed up by assets will increase firms' value and thus the optimal strategy for the firms is to issue, as far as possible, secured debt. The underlying rationale is that for the borrowing firm in the case of bankruptcy, the amount of cash paid to the secured creditors will be less since the market value of collateralised assets will serve the purpose of compensating lenders. Scott also argues that if firms do not have collateral, they either have to bear high borrowing costs or have to issue equity instead of debt.

Alternatively, Smith and Warner (1979) argue that the secured debt may also reduce the total cost of lending to the creditors by precluding the assets substitution problem. The collateralised assets cannot be disposed to any other use without the consent of the lender. Moreover, the borrower may not issue additional debt secured on the same asset, as this will jeopardise the claim of the existing secured lenders. The tangibility of firms' assets may also help in reducing information asymmetries as the payoffs of tangible assets are more easily observed (Almeida and Campello, 2007). This may offer further benefit, in the correct pricing of securities.

In contrast, Titman and Wessels (1988) argue that debt may also have a negative relationship with collateral assets. The capital outlay of firms with less collateralisable assets may be more difficult to monitor and thus they are more inclined to use debt as a monitoring mechanism. A large proportion of debt, as argued earlier, reduces the tendency of consuming excessive perquisites by management, and principals may thus encourage firms to have higher leverage. An indirect explanation for a negative relationship could be that firms with a higher amount of tangible assets are more likely to have a stable and constant source of earnings. Such internally generated funds are more likely to be reinvested according to the pecking order theory; therefore, the reliance on external sources is minimised.

Several empirical studies have documented the importance of collateralisable assets in leverage decisions (Titman and Wessels, 1988; Rajan and Zingales, 1995; Wald, 1999; Bevan and Danbolt, 2002; Jong *et al.*, 2008). These studies generally find the tangibility of firms to have a positive relationship with their capital structures. However, a few studies, specifically from the developing market, also report negative (e.g., Booth *et al.*, 2001) and insignificant (see for example, Deesomsak *et al.*, 2004) relationships of fixed assets ratios with gearing. Following theoretical and empirical studies and specifically studies focused on the UK firms, tangibility is expected to have a positive relationship with the leverage of the firms.

3.2.4. Growth Opportunities

As discussed in Section 3.1.5, a firm's investment opportunity set may also have implications for its capital structure. Myers (1977) deconstructs a firm's total value into two categories; the value of assets in place, and the present value of the investment opportunities firms have. In essence, Myers terms the present value of the future investment opportunities as '*real options'* or more specifically '*call options',* where their value is determined by the likelihood of exercising and materialising the payoffs of these options. Myers argue that such options may eventually lead to conflicts of interest between shareholders and debt holders. For example, in the case of risky debt outstanding, firms may not undertake any positive NPV projects as, due to the riskiness of the firm the returns from the investment would go to the debt holders. The existing debt may alter the management's behaviour in the best interest of the equity holder, which leads to *underinvestment* or *debt overhanging* problem. Firms in such cases will not issue new debt, as the returns generated from the projects will be used to compensate the risk borne by debt holders and they will extract most of the net present value of the project. Myers assumes that since managers will work in the best interest of equity holders, they will not issue equity to finance new projects or the shareholders would be forced to bear the associated risks of the project, which would otherwise be borne by the junior debt holders. To reduce the debt and equity holders' agency problems, firms with risky debt outstanding are likely not to issue debt when they have growth opportunities.

Another possible explanation of the negative relationship of growth opportunities with leverage is that the revenues from these growth opportunities have not yet materialised and firms are reluctant to take on large amounts of debt at this stage or engage in a contractual obligation against it (Bevan and Danbolt, 2002). Moreover, these assets do not generate taxable income, which otherwise might have motivated firms to issue more debt, according to the trade-off theory. In addition, investment opportunities are seen as capital assets adding value to the firms but they cannot be collateralised for obtaining debt (Scott, 1977; Titman and Wessels, 1988; Ozkan, 2001; Booth *et al.*, 2001; Bevan and Danbolt, 2002). Thus, it is likely that firms whose value primarily reflects their set of investment opportunities will have lower amounts of leverage.

Some previous studies have documented a negative relationship between growth opportunities and firms' leverage, specifically for the UK market (e.g., Rajan and Zingales, 1995; Ozkan, 2001; Deesomsak *et al.*, 2004; Frank and Goyal, 2009; Jong *et al.*, 2008). Bevan and Danbolt (2002), for example, examining 822 UK firm, find that the investment opportunities are negatively related with most of the measures of leverage, with results being more pronounced for the market measures of debt. The book debt ratio, however, shows an insignificant positive relationship with the level of growth opportunities. Fama and French (2002) also confirm that leverage is negatively related to growth opportunities when measured by market to book ratio and R&D by total assets, respectively, whereas the book ratios show a positive relationship with investment opportunities. Booth *et al.* (2001), studying international firms, find mixed results, where market measures of total debt and long-term debt still mostly show a significant negative relationship. Conversely, Rajan and Zingales (1995), investigating capital structures of G-7 countries, find both market and book debt ratios to have a significant negative relationship with the market to book ratio. Following most of the previous UK studies, it is predicted that there is a negative relationship between growth opportunities and the leverage of the UK firms.

3.2.5. Liquidity

Though not widely used in the capital structure literature, the levels of liquidity of firms' assets may also have implications in their capital structure decisions. Assets' liquidity means the ease with which the assets can be traded at a price close to their value. Theoretical literature suggests a mixed relationship of liquidity with the financing decision of the firms. For example, Shleifer and Vishny (1992) argue that the liquidity of firms' assets enhances their debt capacity, as liquid assets serve as better collateral and thus increase the liquidation value of the firm. Moreover, firms with higher liquidity ratios may have better ability to pay their obligations as they come due, suggesting a positive relationship between the liquidity and leverage choice of the firms. This view contradicts the collateral argument put forward in favour of the fixed assets role for debt capacity, where it is suggested that fixed assets can be utilised as collateral for acquiring external finance.

Morellec (2001) to some extent supports the positive relation and argues that asset liquidity may increase leverage capacity only when covenants in debt securities restrict the transformation of those assets. On the contrary, in the case of unsecured debt, higher asset liquidity increases the credit spreads of the debt and thus reduces optimal leverage. Assets' liquidity may also have a negative impact on leverage. Managers may take advantage of excessive liquidity in shareholders' favour and can manipulate the liquid assets against debt-holders' interests. They may replace safe and stable assets with risky assets. For this reason, the creditors may require a higher yield, decreasing the optimal leverage (Myers and Rajan, 1998). From the pecking-order perspective as well, liquidity may be negatively correlated with leverage, as liquid assets can serve as an internal source of financing, thus reducing dependence on external finance.

Empirical studies are limited on this subject. One of the studies on UK firms' capital structures by Ozkan (2001) finds a highly significant negative relation of liquidity with the capital structure, suggesting a potential conflict between the shareholders and debt holders of the firms as discussed above. Deesomsak *et al.* (2004), investigating the capital structure of firms in Thailand, Malaysia, Singapore and Australia, find the liquidity of the firms to have a strong negative relationship in most of the countries. In an international comparison of the capital structure of 42 countries by Jong *et al* (2008), liquidity is found to have a significant negative correlation with leverage for most of the countries, although it should be noted that for UK firms, liquidity has an insignificant positive relation. Since previous theoretical and empirical studies yield mixed results regarding the liquidity and leverage relationship, it is hypothesised that liquidity may have either a positive or a negative relationship with the leverage of the firms.

3.2.6. Industry level factors

The industry class can potentially be another important determinant of the capital structure. Firm characteristics may vary in terms of assets structure, type of assets and requirement for external financing between different firms across industries and so too may the leverage which is dependent on such characteristics. Different industries are subject to different regulations (e.g., utilities) and economic and global changes can influence the industries differently. Balakrishnan and Fox (1993) argue that firms using similar technology and producing similar goods are likely to face similar levels of uncertainty with respect to demand shocks and funding availability. Schwartz and Aronson (1967) state that *'...the various classes of firms have developed typical financial structures that are optimal for their operational risks and asset structure',* and '*…presumably, if optimal financial structures did not exist for the different industry classifications, then theoretically there should be no recognizable patterns…'* (p.10). It follows that firms may have similar debt ratios within the industry because of their tendency to cluster due to similar business policies (Scott, 1972).

Empirical evidence substantiates the industry effect on leverage. For example, Scott and Martin (1975) find significant differences in the capital structure choices across a wide array of industries. Bradley *et al.* (1984) find that industry dummies explain 54% of variation whereas when regulated firms are excluded from the sample, industry dummies explain 25% of the variation in the leverage ratios. On the other hand, studies investigating UK firms' capital structures such as Marsh (1982), Bevan and Danbolt (2002) and Ozkan (2001) generally do not control for effects of industry-level heterogeneity on the capital structures. This omitted variable could possibly introduce misspecification into the model. Therefore, in order to reduce any misspecification bias and to proxy out any of the effects of industry in the determination of capital structure, industry dummies are included in the model.

The above discussion points out the most prominent variables for capital structure determination by specifically focusing on UK and US studies, a summary of which is also presented in Table 3.1. As will be discussed further in the following section, until recently studies tended not to consider *credit ratings* as an important determinant of capital structure decisions, which may restrict a thorough understanding of capital structure determinants and correct inferences from the empirical tests in the previous studies. The next section, therefore, will discuss the implications of credit ratings for the capital structure decisions with a specific focus on the UK firms.

3.3. Credit Ratings and Capital Structure

Credit rating, as discussed in Chapter 2, is a well-established term in the financial markets. The appropriateness of these ratings and the incremental information they communicate has been a focal point of the academic debate for a long period. As discussed in Chapter 2, investors, specifically institutional investors and regulatory bodies, have been actively dependent on these ratings as a source of independent judgement on the firms' creditworthiness. Investors, for example, not only rely on credit ratings for fund allocations but also for pricing, monitoring and future risk evaluation (Norden and Weber, 2004). Several studies have documented credit ratings' influence on security prices.

Table 3.1
Theoretical Argument and Empirical Evidence of Capital Structure Theories

Theory	Argument	Empirical Evidence
Modigliani and Miller irrelevance proposition	*Leverage of firm is irrelevant for firm's value*	Not support: Weston, 1963 Support: Sametz, 1964
Corporate taxes, Personal taxes and Non-debt tax shields	*Firms with higher tax rates have higher leverage*	Support: Grahan *et al.* 1998
	Firms with higher non-debt tax shields have low levels of leverage	Support: Bowen *et al.*, 1982 Not Support: Bradley *et al.*, 1984; Balakrishnan and Fox, 1993
Cost and probability of bankruptcy	*There is an optimal debt ratio by offsetting tax benefits and bankruptcy*	Support: Flath and Knoeber, 1980; Flath and Knoeber, 1980
	Leverage is negatively related to cost of bankruptcy	Support: Fama and French, 2002; Castanias, 1983
	Firms have a target debt ratio and they tend to revert to it	Support: Ozkan, 2001
	Large firms have economies of scale and lower chances of bankruptcy, therefore they have higher leverage	Support: Bennett and Donnelly, 1993; Rajan and Zingales, 1995; Wald 1999; Bevan and Danbolt 2002; Fama and French 2002; Deesomsak *et al.*, 2004
Information Asymmetry, Signalling and pecking order theory	*Profitability has a negative relationship with leverage*	Support: Titman and Wessels, 1988; Rajan and Zingales, 1995; Frank and Goyal, 2000; Ozkan, 2001, Bevan and Danbolt, 2002, 2004; Barclay *et al.*, 2003; Fan and Titman, 2008
	Firms issue equity after abnormal price appreciation	Support: Marsh, 1982; Korajcyzk *et al.*, 1990
	Debt gives positive signals to market	Support: Kim and Stulz, 1988
	Managerial ownership is positively related to leverage	Support: Kim and Sorensen, 1986; Amihud *et al.*, 1990; Agrawal and Mandlker, 1987
Agency cost of debt and equity	*Debt with covenants reduce assets substitution problems*	Support: Smith and Warner, 1979
	Debt increases with the increase in the free cash flows	Support: Bowen *et al.*, 1982; Bradley *et al.*, 1984
	Firms which have higher growth opportunities have lower leverage	Support: Rajan and Zingales, 1995; Ozkan, 2001; Deesomsak *et al.*, 2004; Frank and Goyal, 2009; Jong *et al.*, 2008; Bevan and Danbolt, 2002; Fama and French, 2002; Booth *et al.*, 2001; Alderson and Betker, 1995

Notes: This table presents major theories of capital structure and the argument supporting each theory. Column 3 reports some of the empirical evidence either consistent (support) or inconsistent (not support) with the theoretical argument.

For example, security prices react to actual ratings changes (Katz, 1974; Liu and Thakor, 1984; Ederington *et al.*, 1987; Hand *et al.*, 1992; Ederington and Goh, 1999; Dichev and Piotroski, 2001; Barron *et al.*, 1997), and also to the assignment of modifiers to the original ratings (Tang, 2009), the initial assignment of commercial paper rating and commercial paper rating changes (Nayyar and Rozeff, 1994) and to the assignment of a credit watch (Hand *et al.*, 1992; Matolcsy and Lianto, 1995). Credit ratings are also argued to have an association with the credit spread, with a higher credit rating implying a lower spread (Cantor and Packer, 1995; Altman, 1989).

The credit rating agencies have become important intermediaries with a powerful quasi-regulatory role in the financial markets (Partnoy, 2001). However, it is worth noting that previous literature tends to focus only on evaluating the incremental information communicated by the credit ratings. Prior studies have largely ignored the significance of credit ratings in capital structure decision-making. In the past few years, however, there has been a growing recognition that credit ratings are important in determining the financial structure of firms; for example, as Denis and Mihov (2003) note, many rated borrowers are high issuers of public borrowing. They find that 73% of public borrowers have a rating assigned by Standard and Poor's while for bank borrowers and non-bank debt placements, 24% and 26%, respectively, have a rating assigned by Standard and Poor's. Similarly, by using credit ratings as a proxy for accessing public debt markets, Faulkender and Petersen (2006) for a US sample, Judge and Mateus (2009) and Judge and Korzhenitskaya (2011) for a UK sample, and Mittoo and Zhang (2010) for a Canadian sample, find that firms possessing a credit rating have significantly higher leverage compared to those who do not possess a rating. These studies provide empirical evidence which substantiates the relevance of credit ratings in accessing debt markets by suggesting that credit ratings reduce information asymmetry. This leads to a lower cost of capital and a reduction in the duration and distance between the borrowers and investors, thus resulting in higher levels of leverage for rated firms.

In 2001, a survey study by Graham and Harvey was the first to highlight that credit ratings is an important consideration when firms make their capital structure decisions. Their survey of 392 US firms' CFOs shows that they consider *credit ratings* as the second most important concern when they make their capital structure decisions (57% of the respondents consider credit ratings, while 59% of the respondents consider financial flexibility as their foremost concern). They note that management places a far higher concern on their credit rating, compared to the other factors proposed by the traditional trade-off and pecking order theories. Following Graham and Harvey (2001), Brounen *et al.* (2004) and Bancel and Mittoo (2004) also report that European firms' managers, similar to US firms' CFOs, rate credit ratings as one of the most important concerns when they make financial structure decisions.

The first formal theoretical and empirical study to model the implications of the concerns for credit ratings for the capital structure of the firms was by Kisgen (2006). He developed the *credit rating — capital structure hypothesis* (CR–CS) that *'credit ratings are a material consideration in managers' capital structure decisions due to the discrete costs (benefits) associated with different rating levels'* (p.1037). The hypothesis imply that if the costs and benefits of certain credit ratings are material for firms, they are likely to have lower leverage or would tend to reduce the amount of leverage. The empirical findings by Kisgen (2006) for US firms support his fundamental hypothesis. He finds that following proximity to rating changes, firms behave in a way that suggests that credit ratings are an important consideration. They reduce the amount of leverage in their capital structure when they are near upgrades or downgrades. A subsequent study by Kisgen (2009), exploring the influence of actual credit rating changes on firms' leverage related decisions, also supports the CR-CS hypothesis suggesting that credit ratings are material considerations for the firms and that firms follow leverage reduction behaviour when they have actually been downgraded. The CR-CS hypothesis following empirical evidence by Kisgen (2006, 2009) points out that the credit ratings may not just be a proxy for default or a measure for the cost of capital, but instead they also provide certain discrete benefits and costs, which can be material for the concerned firms.

The above studies provide an overview of the previous literature which points out the relevance of credit ratings for the capital structure of firms, a summary of which is also provided in Table 3.2. The following two subsections discusses in further detail the implications of credit ratings for the levels of debt (Subsection 3.3.1) and the potential influence of rating changes on the capital structure decisions of the firms (Subsection 3.3.2).

Table 3.2
Previous Studies on the Relationship between Credit Rating and Capital Structure

Study	Aim of Study	Sample	Findings
Graham and Harvey (2001)	To examine the practices of cost of capital, capital budgeting, and capital structure through a survey study	392 CFOs from Fortune 500 US firms	Credit ratings are the second most important concern when firms make their financial structure decisions
Brounen *et al.* (2004)	To understand the capital budgeting, cost of capital, capital structure. and corporate governance practices through a survey study	313 CFOs from listed and unlisted firms in the UK, Netherlands, France, and Germany	Credit ratings are important for European firms but specifically for the UK firms, credit ratings rank as the fifth most important concern
Bancel and Mittoo (2004)	To examine cross-country determinants of capital structure choices through a survey study	87 respondents of publically listed firms in 16 European countries including the UK	Credit ratings are the second most important concern for capital structure decisions of the European firms' managers
Faulkender and Petersen (2006)	To assess whether firms with credit ratings (as a tool for reducing information asymmetry) have better access to public debt markets resulting in higher leverage	63,272 firm-years observations of US firms for the years 1986-2000	Rated firms have significantly more (5 to 8 percentage points) leverage than non-rated firms
Kisgen (2006)	To examine whether concern for credit ratings affect the capital structure decisions	10,842 firm-years observations of US firms for the years 1986 to 2001	Firms with potential rating change measured by a '+' or '-' sign with their credit ratings have debt reducing behaviour
Kisgen (2009)	To examine whether concerns for credit ratings are material for capital structure decisions	11,372 firm-years observations of US firms for the years 1987- 2003	Downgraded firms follow leverage reduction behaviour. Upgrades do not have any significant effect on the leverage behaviour of firms
Tang (2009)	To examine the effect of Moody's credit rating refinements in 1982 on firms' credit market access, financing decisions, and investment policies	266 US firms between 1980-1983	Firms which are upgraded as a result of rating refinements experience ex post decrease in the cost of borrowing and they issue more debt than downgraded firms
Hovakimian *et al.* (2009)	To examine whether firms have target credit ratings	84,051 firm-year observations of US firms between 1985 and 2006	Firms above credit rating targets show leverage issuance behaviour while firms below target show leverage reduction behaviour
Judge and Mateus (2009)	To examine whether rated firms have better access to debt markets	Top 500 UK according to market capitalization from 1999 to 2006	Rated UK firms have significantly higher leverage (5 to 12 percentage points) than non-rated UK firms
Mittoo and Zhang (2010)	To examine whether bond market access, measured through credit ratings, is linked to higher leverage	4,741firm- year observations of Canadian firms from 1990-2003	Rated firms have higher leverage than non-rated firms. Investment grade firms have less leverage than speculative firms
Judge and Korzhenitskaya (2011)	To examine the role of credit ratings in accessing debt markets during financial crisis of 2001 and 2008	7,258 firm-year observations of top 500 UK firms according to market capitalization from 1989-2008	The role of credit ratings in accessing public debt markets is more pronounced in periods of tight credit market conditions

Notes: This table presents a summary of the previous literature to date on the relationship between credit ratings and capital structures.

3.3.1. Credit rating as a Determinant of Capital Structure

As discussed in Section 3.1.3, under the traditional trade-off theory, firms are likely to determine their capital structure by weighing the benefits of debt (e.g., tax shields) against the costs of debt (e.g., potential costs of bankruptcy). Further theoretical and empirical evidence indicates that mispricing due to information asymmetry and agency costs of debt and equity also affects the leverage choice of firms. Therefore, the generic version of the trade-off theory suggests that firms should weigh such cost and benefits to determine the firms' capital structure. However, these studies implicitly assume that the supply of funds is infinite with a correct price and how much debt to employ is a decision solely at the discretion of firms (Faulkender and Petersen, 2006). In frictionless markets, there can be infinite funding opportunities available and thus firms are able to secure funding for all positive NPV projects. However, in the presence of information asymmetry, firms are opaque to outsiders and the investors cannot directly assess their quality. If this is the case, credit rationing by the market does not allow firms to obtain sufficient funds to finance all such projects (Stiglitz and Weiss, 1981; Faulkender and Petersen, 2006). If outsiders cannot directly assess the firms' projects, they will demand high coupon rates due to moral hazards (Boots *et al.*, 2006). Thus, an optimal strategy for the firms would be to engage in high-risk projects to generate higher returns. This creates multiple equilibrium, in which firms with higher costs of debt have the incentive to engage in high-risk projects with higher returns.

However, financial intermediaries, such as credit rating agencies, can resolve such problems by minimising concerns about information asymmetry (Boots *et al.,* 2006; Tang, 2009). As discussed in Chapter 2, these institutions are theoretically able to generate superior information due to economies of scale, specialisation and close connections with the firms. Moreover, the continuous monitoring role of rating agencies may further lessen such information asymmetry and serve as a coordination mechanism in the financial markets (Boot *et al.*, 2006). Faulkender and Petersen (2006) argue that if two identical firms have similar projects, one firm has no established track record, requiring evaluation and monitoring by the lenders, then this firm will have higher costs of debt capital and constrained access to sources of funding compared with the other firm with an established track record. This implies that firms with credit ratings have better access to the capital markets with lower costs compared with their counterpart firms without credit ratings. The hypothesis, initially developed by Faulkender and Petersen (2006), for the purpose of simplification, is here called the *credit rating – market access hypothesis* (CR-MA).

Faulkender and Petersen (2006) also empirically test the CR-MA hypothesis by examining differences in the capital structure of rated and non-rated US firms. After controlling for the determinants suggested by the traditional theories of capital structure (e.g., size, profitability and volatility) and further controlling for potential endogeneity, their findings show that rated firms have significantly higher leverage compared to non-rated firms. In addition, consistent with Boots *et al.* (2006), rated firms have lower interest coverage ratios, showing that firms with low information asymmetry face lower costs of capital. A similar study by Mittoo and Zhang (2010), investigating Canadian firms between 1993 to 2003, also note that Canadian rated firms have higher leverage in comparison to non-rated firms.

A recent study by Judge and Mateus (2009) provides similar evidence for the CR-MA hypothesis from the UK market. However, unlike the US and Canadian samples, the effects of credit ratings on leverage structure are more pronounced for UK firms. Judge and Mateus note that UK rated firms have around 5-12 percentage points higher leverage than non-rated UK firms, while Faulkender and Petersen (2006) and Mittoo and Zhang (2010) report 5-8 and 6 percentage points for US and Canadian rated firms respectively. This testifies the significance of credit ratings for the UK firms, as already discussed in Chapter 2 Subsection 2.2.2, and shows its relevance to the capital structure of these firms. Another recent study, by Judge and Korzhenitskaya (2011), further supports the CR-MA hypothesis but also suggests that the effect of possession of credit ratings becomes more evident during the period of financial crisis which is characterised by constrained access to funding sources, specifically bank financing.

It should be noted that these studies generally ignore any differences in the rating levels and any implications that this can have in determining the capital structure of the firms. This would mean that all firms which have credit ratings, *ceteris paribus*, would have higher leverage, irrespective of the particular credit rating they possess. Such a conclusion would imply that firms at every rating level have equal access to public debt markets.

However, it can be argued that levels of leverage can differ across the rating levels. Specifically, low rated firms are likely to have constrained access to the debt market since a low credit rating would imply higher costs of debt and more covenants in their debt contract. For example, Mizruchi and Stearns (1994), using credit rating as an indirect proxy for cost of capital, argue that firms with low ratings will have higher cost of capital and therefore for such firms it might be expensive to engage in high levels of leverage. Similarly, Diamond (1991) argues that borrowers with lower credit ratings may have higher capital costs compared with higher rated firms. Billet *et al.*'s (2007) empirical findings are that low rated bonds have a higher number of restrictive covenants. This can include all types of covenants including restrictions on issuing further debt, which will dilute the claims of the existing bondholders. In addition, from the financial distress point of view, low rated firms may have a higher probability of default, which will restrict them from issuing more debt. Lemmon and Zender (2010) argue that the high risk firms have debt capacity constraints which prevent them from issuing more debt despite the fact that such firms may have a preference of debt over equity financing.

Apart from the above factors, a more important reason for low rated firms to have low levels of gearing could be their concerns for costs imposed by their credit ratings. Following Kisgen (2006), who highlighted that credit ratings are important considerations for the managerial capital structure decisions due to their discrete costs and benefits, it can be argued that low rated firms would be more inclined towards low gearing levels as concerns for credit ratings can be expected to be higher for such firms in comparison to other rated firms. The implication of the *credit rating – capital structure hypothesis* (CR-CS) would suggest that for low rated firms, the benefits of improving credit ratings or the cost of low ratings outweighs the benefits of issuing additional leverage as suggested by the CR-MA hypothesis. This is because, compared to other rating categories, downgrades for low rated firms can have more serious implications. For example, as already discussed in Chapter 2, credit ratings, which are a widespread phenomenon and which are considered a key input in the financial decision-making of market participants, can create a vicious cycle for such firms. Low rated firms will face higher cost of capital, which as a result will affect their probability of default and further increase the likelihood of a downgrade. Shivdasani and Zenner (2005) also argue that downgrades for low rated firms can seriously affect their ability to access debt markets. Moreover, a low rating and any subsequent downgrades may also have reputational concerns for these firms which affect their business operations and disclosure requirements. To achieve better ratings and to avoid any downgrade, low rated firms can be expected to have low levels of gearing.

The positive relationship between the low ratings and levels of gearing is expected to hold specifically within the UK context since UK rated firms are likely to be of superior credit quality compared to rated firms in other markets. Not specifically from the UK market but it is noted that speculative grade issuers comprised less than 10% of issuers in the European market compared to more than 40% in the US market (Batten *et al.*, 2004). As will be discussed in Chapter 6 and 7, the sample of the present study also shows such differences where 87% of total sample firms are investment grade, while 13% are speculative grade firms. Moreover, since the operations of credit rating agencies are relatively newer in the UK market, one can expect that initially highly creditworthy firms would have been more inclined towards acquiring credit ratings (see Chapter 2, for more details). If the above is true, this skewed distribution will make low rated firms particularly concerned about their credit ratings, as such firms can easily be identified as less creditworthy firms in the market, thus restricting their access to debt markets and imposing certain financial and non-financial costs. Moreover, it can be expected that low rated firms operating in a market with a creditor friendly bankruptcy law would also be more concerned about the high costs of low credit ratings as rating downgrades can presumably lead debt holders to sub-optimally liquidate low rated firms even in cases where there could be any possibility of reorganization.

The arguments above are, however, inconsistent with Mittoo and Zhang (2010), who argue that speculative grade firms have high levels of gearing, as acquiring credit ratings facilitates low rated firms in accessing alternative sources of financing. Moreover, they argue that speculative grade issuers can issue public debt with fewer covenants, longer maturity and less secured assets compared to what is required to obtain bank debt. Therefore, such firms can issue speculative grade debt and pay back the bank debt to protect themselves from covenants and increase their financial flexibility. However, such assumptions might not be valid since speculative grade firms, particularly the lowest rated firms within the speculative grade, can be expected to have constrained access to debt markets due to higher costs of debt, restrictive covenants and high concerns over the costs imposed by their credit ratings.

It should be noted that the implications of the trade-off theory and the CR-CS hypothesis for the capital structure of low rated firms are similar. However, given that credit ratings are a relative measure of risk and that the credit ratings are acquired by high creditworthy firms who have confidence about the outcomes (see Chapter 2 for details), low rated firms can be argued to be financially sound firms according to the trade-off theory. Nevertheless, models testing the relationship between credit ratings and capital structure in the study include variables that control for the financial condition and therefore the effects of credit ratings can be identified separately from financial distress effects.

From the discussion above, the joint implications of the *credit rating – capital structure hypothesis* (CR-CS) and the *credit rating – market access hypothesis* (CR-MA) suggest that although rated firms have better access to debt markets, for low rated firms in particular, the cost of having high levels of leverage or having low ratings are expected to be high. If the cost of low ratings and benefits of achieving high ratings are material for the firms, low rated firms can be expected to have low levels of gearing. Therefore:

H_{1a} = ***Other things being equal, low rated firms are likely to have low levels of leverage in their capital structure.***

High rated firms can also be expected to choose low levels of leverage for a number of different reasons. High ratings may arguably offer firms a competitive edge, with many financial and non-financial benefits. Financial benefits can include lower cost of financing, easy access to the commercial paper market, favourable terms and conditions in debt contracts, availability of alternate sources of financing and increased financial flexibility (Diamond, 1991; Shivdasani and Zenner, 2005; Mittoo and Zhang, 2010; Kisgen, 2006). Non-financial benefits may include a reputation of being the safest and highest rated firms in the market, managements' successful image in the labour market, employees' loyalty and favourable suppliers' terms and conditions (Shivdasani and Zenner, 2005; Kisgen, 2006).

Due to the benefits of high credit ratings, the CR-CS hypothesis would imply that such firms may have low gearing ratios. The conservative behaviour of high rated firms towards their leverage is, however, different to that predicted by traditional theories of capital structure (Kisgen, 2006). For example, the traditional trade-off theory proposes that firms weigh the costs of debt against the benefits of debt to reach an optimal debt ratio. It predicts that firms which have a lower probability of bankruptcy will choose higher leverage and *vice versa*. However, if the costs and benefits of credit ratings are material and taken into consideration when weighing other costs and benefits of debt, the optimal capital structure ratio thus achieved would be lower than the traditional trade-off theory prediction. This implies that for high rated firms the benefits of high ratings can be expected to outweigh the benefits of having higher leverage irrespective of the fact that they can safely employ high levels of debt. It can therefore be expected that high rated firms will have low levels of gearing.

Some previous empirical evidence also finds that high rated firms have low levels of leverage. For instance, Graham (2000) finds that large firms, which are more liquid and profitable with a very low probability of distress, surprisingly have lower leverage. Mittoo and Zhang (2010) also document that financial flexibility and concerns for credit ratings lead high rated Canadian firms to choose low gearing ratios. Following the above argument it is expected that high rated firms are likely to prefer low levels of debt. Therefore:

> **H_{1b} = *Other things being equal, high rated firms are likely to have low levels of leverage in their capital structures.***

Contrary to higher rated and lower rated firms, intermediate rated firms can be expected to have higher leverage. Although the *credit rating – capital structure hypothesis* suggests considerations for credit ratings should be observable at each rating level, mid rated firms should in relative terms be less concerned about their credit ratings in comparison with high and low rated firms. It could be argued that mid rated firms take more advantage of being able to tap debt markets through the possession of credit ratings. Mid rated firms would likely require a large change to get into category where they would benefit from being top rated firms. On the other hand, they can be expected to have limited risk of being downgraded to a level where market imposes certain financial and non-financial costs. Thus, it can be expected that high leverage due to credit ratings, as suggested by the *credit rating – market access hypothesis*, is mostly driven by this category of rated firms. Therefore:

> **H_{1c} = *Other things being equal, mid rated firms are likely to have high levels of leverage in their capital structures.***

Overall, the above discussion suggests that access to debt markets may not automatically mean higher leverage and that the credit ratings held by firms is likely to have a non-linear, inverted U-shaped relationship with the leverage structure of the firms. In particular, high and low rated firms are expected to have lower levels of leverage than mid rated firms.

3.3.2. Impact of Credit Rating Change on Capital Structure Decisions

The previous section highlighted that credit ratings can potentially influence the capital structure of firms due to the benefits and costs associated with different rating levels. Therefore, some firms, which have access to debt markets, can be expected deliberately to select lower levels of leverage if the costs and benefits of credit ratings are material for those firms. While firms are expected to have a certain amount of leverage in their capital structure, the actual level of leverage might change with a change in their credit ratings. The effects, which credit ratings have on capital structure, can be examined from two distinct but interconnected perspectives. The financial behaviour of the firms can be expected to be influenced by potential credit rating changes, as well as when firms experience actual rating changes. Therefore, this section reviews the previous theoretical and empirical literature on the effects of credit rating changes on the capital structure of firms. This section is divided into two subsections: Subsection 2.3.2.1 reviews previous studies related to potential credit ratings changes and presents the hypotheses for the present study and Subsection 2.3.2.2 discusses the literature focusing on the impact of actual credit ratings on financing decisions by firms, and presents hypotheses based on the literature review.

3.3.2.1. Influence of Potential Credit Rating Changes

The *credit rating- capital structure hypothesis* (CR-CS) was originally developed to test the potential and actual rating changes on the capital structure of US firms. Since the discrete costs and benefits of credit ratings are likely to be material for the firms, they are argued to be sensitive even to minor changes in their credit ratings. Therefore, Kisgen (2006) argues that firms follow a financing behaviour which will ensure that they can achieve higher credit ratings or protect existing ratings from downgrades.

Credit rating changes may impose financial and non-financial costs on the firms. Given that the market perceives credit ratings as conveying some meaningful information about firms or their securities, the cost of debt will be sensitive to rating changes. If a firm is downgraded to the next broad rating category, this can theoretically create a pooling equlibria for that firm. The market may perceive a similar default probability for all the firms in a particular rating class, irrespective of whether the quality of the individual downgraded firm is above or below other firms in the same category. It is therefore likely that firms with similar ratings may have a more or less similar credit spread (Kisgen, 2006). For example, Shivdasani and Zenner (2005) empirically find that credit ratings explain 58% of variations in the credit spreads of bonds with different maturities and features. Therefore, rating upgrades (downgrades) may be associated with decreases (and increases) in the cost of debt.

Moreover, due to a strong correlation between the long-term credit rating and short-term credit rating of firms (Standard and Poor's, 2008), credit rating downgrades may restrict firms in accessing short-term debt markets too. The rating-based triggers in debt contracts can also force firms to make repayments earlier or may lead to termination of their credit facility (Gonzalez *et al.*, 2004). For example, in a survey study of 1000 US and European investment grade debt issuers, Standard and Poor's reports that few firms were highly vulnerable to rating triggers or some sort of rating linked contingent liability, such that a moderate rating change can lead to serious liquidity problems for those firms (Kisgen, 2006). Rating triggers in the case of Enron also gave rights to lenders to demand cash collateral, which further increased the financial difficulties of the firm (Langohr and Langohr, 2008). In addition, boards of directors of firms may also use credit ratings as a quantifiable measure for evaluating the performance of management (Langohr and Langohr, 2008). Ratings changes and triggers also become an important part of the media and press news.

Kisgen (2006) also argues that regulatory dependence on credit ratings is likely to increase the sensitivities of firms towards any rating changes. Credit rating embedded into laws and regulations can make the behaviour of market participants more predictable (Cantor *et al.*, 2007). For example, in the US market, institutional investors may not be able to hold securities below a certain threshold, e.g., below investment grade (see Partnoy, 1999), and if ratings fall below investment grade, this eventuality leads to forced selling. Since many investors are constrained by regulations dependent on credit ratings, the price reaction could be significant on rating changes, causing yields on the bonds to increase. Thus, firms’ underlying risk levels may not have increased but they may face higher cost of borrowing because of their credit ratings.

If the above mentioned costs and benefits of different rating levels are material for firms, the *credit rating – capital structure hypothesis* (CR-CS) predicts that firms will follow leverage behaviour which will protect them from downgrades and also ensure (or at least increase the likelihood of) upgrades, even if such behaviour contradicts what traditional theories of capital structure propose. For example, the traditional trade-off theory predicts that the firms will offset the benefits of debt against the costs of debt to reach an optimal capital structure, which maximises the firms' value. Such an optimal capital structure, once achieved, would require that firms continuously balance these costs and benefits and they will revert towards the optimal debt ratio to the degree to which it has departed from this optimal debt ratio. However, if the costs or benefits from credit rating changes are material for firms, the CR-CS hypothesis predicts that the proximity to rating change will induce firms to reduce the amount of leverage, irrespective that the trade-off theory suggests higher leverage ratios (Kisgen, 2006). This suggests that firms will balance the costs and benefits of credit ratings with the other costs and benefits of debt proposed by the trade-off theory in order to reach an optimal capital structure.

Similarly, the CR-CS hypothesis also has implications for the pecking order theory, which suggests a hierarchy in financing where firms typically choose the safest source of funding first, i.e., the internal financing. When such sources are fully exhausted they will then turn to external financing where they have a preference for debt over equity since equity communicates negative signals to the market. The CR-CS hypothesis, however, implies that if the discrete cost and benefits of credit rating changes to firms are material, then firms near to rating changes may not follow this hierarchy and may instead issue equity first (Kisgen, 2006). Hovakimian *et al.* (2009), for example, argue that high rated firms, which are arguably fewer in the market, may be more reluctant to issue debt and can choose more costly measures such as issuing equity, if by issuing debt they have to compromise on their high ratings.

Empirically, US studies support the CR-CS hypothesis, showing that firms tend to show leverage reducing behaviour if they are close to rating changes. Kisgen (2006) finds that US firms near upgrades (as measured by a PLUS sign with the credit ratings) issue 0.6% less net debt than equity, while the firms which are near downgrades (as measured by a MINUS sign with the credit ratings) issue 0.5% less net debt than equity. The findings across all broad rating categories suggest similar results, although the effects of proximity to rating changes are more pronounced for firms with higher likelihood of being upgraded from speculative grade to investment grade or with higher likelihood of being downgraded from investment grade to speculative grade.

If the costs and benefits of rating changes were material for firms, the implication of the CR-CS hypothesis would lead to somewhat similar leverage behaviour by firms irrespective of the market. However, there remains the empirical question of whether firms in other markets, such as the UK (characterised by a less developed credit rating industry and bond market with little or no regulatory dependence on credit ratings), would behave in a similar way to countries with a long history of credit rating agencies and well developed bond markets, such as the US market. As argued in Chapter 2, UK rated firms are possibly larger firms with higher creditworthiness compared to their US counterparts. The distribution of UK rated firms suggest that 87% of the firms are investment grade while only 13% are speculative grade firms. Hence, it can be argued that the sensitivities to ratings changes might be different too. As Shivdasani and Zenner (2005) argue, debt issuance by high rated firms with limited debt on their balance sheets may not have as significant and economic impact on their ratings and cost of debt as it would for low rated firms. Moreover, if the firms have mostly solicited their ratings, which is arguably often the case with UK firms, then they are likely to have close relationships with the credit rating agencies where they can discuss issues related to their financial leverage, financial risks and exposures and other business strategies in advance (Shivdasani and Zenner, 2005). This may lessen the sensitivities to rating changes. As discussed by Kisgen (2006 and 2009), one of the major factors, why firms are sensitive to rating changes is the regulatory dependence on credit ratings. Such dependencies on credit ratings can have affect on the use and perception of credit ratings by investors and can significantly affect the cost of borrowing of firms. Rating changes can lead to forced selling by institutional investors, which may be argued to affect the cost of borrowing irrespective of any significant change in the underlying quality of rated firm (Kisgen, 2006). Thus, it can be expected that firms operating in countries with little or no regulatory dependence on credit ratings such as the UK market, will be less sensitive to rating changes, whether potential or actual.

Nevertheless, following the prior literature which suggests that firms will follow leverage reducing behaviour when they are near credit rating changes, it is hypothesised that:

H_{2a} = *Other things being equal, firms with a higher likelihood of rating changes are more likely to reduce the amount of leverage.*

H_{2b} = *Other things being equal, firms with a higher likelihood of downgrade are more likely to reduce the amount of leverage.*

H_{2c}= *Other things being equal, firms with a higher likelihood of upgrade are more likely to reduce the amount of leverage.*

3.3.2.2. Influence of Actual Credit Rating Changes

As discussed already, previous studies note security price reactions along with changes in firms' credit ratings. However, most of the previous literature supports the view that rating downgrades are followed by negative price reactions whereas rating upgrades do not lead to any significant price changes (Griffin and Sanvicente, 1982; Holthausen and Leftwich, 1986; Wansley and Clauretie, 1985; Cornell *et al.*, 1989; Hand *et al.*, 1992; Steiner and Heinke, 2001). In line with US studies, Barron *et al.* (1997) find similar results for the UK market. These studies argue that downgrades by credit rating agencies have far more information content than upgrades because firms are far more reluctant to directly communicate bad news to outsiders than good news. Rating upgrades generally are not followed by positive price reactions as firms might be quicker to disclose good news to the market before rating agencies incorporate them into their ratings.

In the context of capital structure, the *credit rating – capital structure hypothesis* (CR-CS) also proposes that downgrades are important for the firms and will lead to reduction of debt by firms. Rating downgrades, as discussed in the previous section, affect costs of debt, access to the short-term debt market, third party relationships and can increase agency problems between shareholders and management. Therefore, firms have an incentive to revert to their previous ratings or prevent themselves from further downgrades. Kisgen (2009) and Hovakimian *et al.* (2009) argue that firms have target credit ratings, and if costs associated with downgrades are higher than adjustment costs of reverting to the debt ratio corresponding to the previous rating, downgraded firms have a higher likelihood of reducing leverage compared with firms which are not downgraded. If the costs associated with downgrades are material, firms may choose lower debt ratios than the optimal debt ratios suggested by the trade-off theory. The CR-CS hypothesis further proposed that firms may have a preference of equity over debt, if they anticipate that such behaviour will ensure them an upgrade.

On the other hand, upgraded firms may not experience significant changes in their capital structure (Kisgen, 2009). Upgraded firms would arguably enjoy the benefits that rating upgrades offer them, i.e., better access to long-term and short-term debt markets, improved financial flexibility, and a better management reputation in the labour market, leading also to minimisation of agency problems with debt holders and shareholders. It can be argued, following the CR-CS hypothesis, that if these benefits are material for upgraded firms, they are not likely to bring any significant changes in their capital structure. If the effects of the CR-CS hypothesis are incorporated in the dynamic trade-off theory, which suggests the firms revert to their target debt ratios once there is a deviation from target, it is likely that firms will not do so if the benefits of higher credit ratings (through upgrades) are greater than reverting to their targets. For example, if the debt ratio before the upgrade was higher and the firm received an upgrade after reducing the total amount of debt or by any positive shocks to the cash flow, it is less likely that it will revert to their original debt ratio after upgrades if upgrades provide material benefits. Similarly, the hypothesis implies that debt issuance after an upgrade also is an unlikely event, as upgraded firms would not like to jeopardise their high credit ratings. (Kisgen, 2009).

Kisgen (2009) also finds empirical results consistent with the CR-CS hypothesis, where firms following a downgrade have leverage reducing behaviour. He notes that US firms issue 1.5% to 4% (depending on the model used) less debt than equity when they face a downgrade. He also finds that the speed of adjustment will double when firms are downgraded compared to when they are upgraded or have no change in their ratings. This is also consistent with Hovakimian *et al.* (2009), who note that firms tend to issue equity instead of debt, if their target ratings are below their actual credit ratings. However, they note that if actual credit ratings are above their target ratings, they make issuance and purchase decisions that increase their amount of leverage.

For the upgraded firms, Kisgen’s results are generally inconsistent with the CR-CS hypothesis for most of the specifications. With the exception of models with industry effects, upgraded firms issue more debt than equity. This behaviour is rather more supportive of the distress argument where the further a firm is from bankruptcy, the higher the probability of that firm issuing more debt than equity. The coefficient of the upgrade dummy, however, is notably lower than for the downgrade dummy. Other studies also note that the upgraded firms take advantage of their superior position in the market and issue more debt. Tang (2009), for the US market, finds that after rating refinements by Moody's in 1982, the firms, which receive higher ratings within the broad rating category, issue 3% more debt than the firms which were downgraded. The issuance behaviour of upgraded firms can also be explained from a signalling perspective. For example, a survey report by the Association of Financial Professionals (2004) shows that 57% of the firms viewed that their upgrades were delayed by more than six months after the firms' financials improved, while 73% of respondents believe that they were downgraded within six months of their financial deterioration. It is possible that if credit rating agencies delay upgrades, upgraded firms are likely to signal their good quality by issuing more debt.

As stated in Section 3.3.2.1, the sensitivities of firms towards rating changes may be influenced by the institutional setup. As the UK market is less developed in terms of credit ratings and bond market with little or no dependence on credit ratings, it may affect the way firms perceive the relevance of credit ratings and any changes therein for their capital structure. However, following the previous theoretical and empirical literature, if firms have concerns for their credit ratings as proposed by the CR-CS hypothesis, they would be more likely to reduce their amount of leverage after a downgrade in a hope of achieving their previous ratings or at least maintaining their current ratings. Conversely, following the implications of the CR-CS hypothesis, upgraded firms are more likely not to have any change in their capital structure, since the upgraded firms enjoy the discrete benefits of achieving higher ratings. Therefore:

H_{3a} = *Other things being equal, downgraded firms will decrease the amount of leverage in their capital structure.*

H_{3b} = *Other things being equal, upgraded firms are likely to have significant change in their capital structure.*

3.4. Conclusion

This chapter presented a review of the previous literature related to the capital structure of firms. It discussed the main theories of capital structure along with the empirical findings of the proxies representing different theories. It highlighted that the previous theoretical and empirical studies tend to underestimate the relevance of *credit ratings* in capital structure decisions until some recent survey studies pointed out the importance of credit ratings for managerial capital structure determination. The chapter also highlights the lack of empirical studies that have employed UK data, given that one can expect differences in the significance of credit ratings for UK firms' capital structure, due to its unique institutional settings.

This chapter also presented the hypotheses of the present study based on the review of previous literature. The rationale behind the hypotheses follows from the *credit rating-capital structure hypothesis* (CR-CS), developed by Kisgen (2006), which states that credit ratings impose specific costs and benefits on firms, and thus firms are cautious about their capital structure decisions. Specifically, it presented three main set of hypotheses to examine the relevance of credit ratings for the capital structure of the firms. The first set of hypotheses relates to the level of credit ratings and the capital structure of the UK firms. It is hypothesised that credit ratings have a non-linear, inverted U-shaped relationship with the capital structure of the firms. By proposing the implications of the CR-CS hypothesis, this is likely to extend prior studies that have assumed similar levels of leverage for all rated firms. The second set of hypotheses related to the implications of the CR-CS hypothesis, which suggests that firms are expected to be concerned about any potential credit ratings changes. If the costs and benefits associated with these changes are material, firms with proximity to downgrades or upgrades are likely to follow leverage reducing behaviour. The third set of hypotheses focuses on the relevance of actual credit rating changes and their impact on the subsequent capital structure decisions. Firms are expected to reduce their amount of debt if rating downgrades impose any material costs on firms, but they are not likely to make any change in their capital structure if they are upgraded. These hypotheses are tested in Chapters 6 and 7.

Chapter 4
Literature Review: Credit Rating and Debt Maturity Structure

4. Introduction

This chapter reviews the theoretical and empirical literature on the determinants of corporate debt maturity structures. Although studies have established the prominent factors that determine the capital structures of firms, theoretical and empirical research on debt maturity structure decision making is still far from being complete. Recent studies (e.g., Rauf and Sufi, 2010) emphasise the heterogeneity in capital structure, which conventional studies on capital structure mostly ignore in assuming that all debt is the same. In practice, debt has several different dimensions such as maturity, convertibility, call provisions, covenants and security, and each one of them is potentially important (Barclay and Smith, 1996). For example, the recent failure of some financial institutions (e.g., Lehman Brothers and Bear Stearns) and non-financial firms (e.g., WorldCom, Enron and Penn Central) during the financial turmoil are some prominent cases where the inability to roll over short-term debt exacerbated the financial deterioration of these firms. This study, therefore, provides an in-depth on one of the important dimensions of capital structure: the maturity of debt in capital structure. An optimal balance between long-term debt and short-term debt can, therefore, ensure reductions in the costs of financing (Ozkan, 2000), tax liabilities (Brick and Ravid, 1985), information asymmetry (Goswami *et al.*, 1995; Diamond, 1991; Flannery, 1986; Kale and Noe, 1990) and agency costs (Barnea *et al.*, 1980; Myers, 1997).

The present chapter is divided into four sections. Section 4.1 reviews the theoretical literature on the choice of debt maturity structure. Section 4.2 presents empirical literature on the determinants of corporate debt maturity structure. Section 4.3 presents Diamond's (1991) theoretical framework to explain the relationship between firms' credit ratings and their debt maturity structures. It also reviews the previous empirical studies which have tested the theory in different settings and presents hypotheses for the present study based on the prior literature. Section 4.4 concludes the chapter.

4.1. Debt Maturity Structure: Theoretical Review

Similar to Modigliani and Miller's (1958) *irrelevance proposition* for capital structure, Stiglitz (1974) argues that in perfect capital markets, the debt maturity structure of a firm is irrelevant for its value. Following this, numerous theoretical and empirical studies have challenged this maturity structure irrelevance proposition due to the market imperfections that play a role in determining the maturity structure of a firm. These theoretical extensions, originating as a result of the irrelevance proposition proposed for debt maturity structure, can be broadly grouped into four categories: (1) Agency/contracting Cost Hypothesis (2) Assets Maturity Hypothesis, (3) Implication of Taxation for the Debt Maturity Structure and (4) Information Asymmetry and Signalling Theories of debt maturity structure. Each of these will be discussed in the following sections.

4.1.1. Agency/Contracting Cost Perspective

Many theoretical studies view debt maturity structure as a means to reducing potential conflicts between shareholders and bondholders. As discussed in Section 3.1.5, risky debt financing may increase potential conflicts of interests between bond and shareholders. These conflicts may arise when firms have included risky debt in their capital structure and plan to undertake some positive NPV projects, the benefits of which have to be shared between the bondholders and shareholders. However, when the firm already has risky debt outstanding, the bondholders may capture more benefits from the project, such that existing shareholders do not earn the required return from that investment project. This may in turn give rise to potential agency conflicts over materialising those opportunities, leading to debt overhang or underinvestment problems.

Among other ways to resolve these conflicts, such as the inclusion of restrictive covenants in debt contracts and reducing the amount of leverage in the capital structure, Myers (1977) and Bodie and Taggart (1978) argue that reducing the maturity of the debt in the capital structure is also likely to lessen any underinvestment problems. The reduction in the maturity of debt ensures that the short-term debt matures before the growth opportunities are exercised as the firm gets an opportunity to re-contract and re-price its debt such that all the gains from the new investment opportunity do not accrue to bondholders.

It is also argued that short-term debt holds a higher effective priority, as it is paid first. Ho and Singer (1982) argue that short-term debt is similar to secured debt, even if the priority in bankruptcy is equal for both short and long-term debt. Short-term debt also helps lenders to monitor borrowing firms, which may also effectively reduce the disincentive to invest. For example, Barclay and Smith (1995) argue that most bank loans are short-term as the reduced term of the debt gives banks superior bargaining positions, and maximises the effectiveness of the monitoring activities. Easterbrook (1984) further argues that the agency cost of monitoring is also lower when firms issue short-term debt on regular basis, as the market evaluates the prospects and reviews the firm on a regular basis. Hart and Moore (1990) and Stulz (1990), arguing along the same lines, suggest that long-term debt discourages any managerial discretion in making poor investments. They would mean that firms should use more long-term debt when they have fewer growth options. The contraction cost hypothesis therefore suggests that firms with a higher growth opportunities set tend to prefer to have shorter debt maturity in their capital structure.

Given that smaller firms normally have higher growth opportunities than large firms (Denis, 1994), smaller firms are likely to have more short-term debt in their capital structure. Smith and Warner (1979) argue that small firms are also more likely to face potential conflicts of interest between bondholders and shareholders. This is because lenders know that small firms' owner/managers will gain greater advantage from any wealth transfer in favour of their shareholders due to them having a higher stake in the firm. Therefore, they are more likely to substitute one asset for another, thus altering the overall risk of the firm (Scherr and Hulburt, 2001; Pettit and Singer, 1985). Barnea *et al.* (1980) argue that such conflicts can be curtailed by lowering the maturity in the capital structure. Moreover, long-term debt, specifically the long-term public debt, has fixed flotation costs which small firms are less capable of paying (Barclay and Smith, 1995). These costs include legal fees, investment banker fees, filing and other transaction costs and they can play a significant role in explaining the choice between public and private debt (Krishnaswami *et al.*, 1999). Although such costs offer economies of scale, small firms are unable to take advantage of these opportunities due to their limited resources. Consequently, they are forced to take private debt, which has an overall low cost, particularly a low fixed component of the cost, with shorter maturity. Hence, the contracting cost argument implies a shorter maturity of debt for small firms compared to larger firms.

4.1.2. Assets Maturity Hypothesis

One of the risks associated with debt financing is an inability to service the fixed cash outflows with the cash inflows generated by the operations of the business (Morris, 1976; Myers, 1977). This risk can be minimised by matching the stream of the incoming and outgoing cash flows with each other. This may serve as a hedging policy for the firms whereby the maturities of assets are matched with the maturity of debt. In this case, firms may have enough funds generated from the assets so that they can service debt or retire debt at the maturity of the debt. When debt matures before the end of the asset's life, this event may elevate the risk of a firm, as there is a possibility that not enough funds are generated to pay back the debt by the time of the retirement. Similarly, if debt is due to mature after the end of the assets' life, the funding source and volume is uncertain at the maturity of debt and it is likely that the firm has already used up the cash flows generated from the assets. Both situations push firms into unfavourable conditions and may elevate their risk of liquidation. It is also argued that underinvestment problems can be minimised when the schedule of repayments corresponds with the declining value of assets (Myers, 1977). It follows that firms will finance long-term assets with debt of longer maturity and short-lived assets with short-term debt.

4.1.3. The Role of Taxation for the Debt Maturity Structure

Another possible explanation for the choice of debt maturity structure can be found in the tax related theories by Kane *et al.* (1985) and Brick and Ravid (1985, 1991). Kane *et al.* (1985) argue that optimal maturity structure can be reached by trading off the benefits of tax against bankruptcy costs and the cost of raising the debt. They show that a firm's optimal debt maturity structure is likely to have a negative relationship with its tax advantages and a positive relationship with the flotation costs of the debt. The reason for this is that the flotation costs decrease the advantages associated with the debt. When there is a decrease in the tax advantages of debt, firms are likely to choose higher maturity in the debt structure to ensure that the flotation costs are amortised over a longer period of time, such that the tax advantages of debt are never less than the amortised flotation costs.

Conversely, Brick and Ravid (1985) postulate a positive relationship between taxation and debt maturity structure. If the term structure of the interest rate has an increasing slope, then the optimal strategy for the firms would be to increase their proportion of long-term debt. This is because if the yield curve is upward sloping, it will increase the present value of the tax shields in the initial years, thus reducing the tax burden of a firm. This will have a direct effect on a firm's value. In addition to the accelerated tax advantages proposed by Brick and Ravid (1985), Brick and Ravid (1991) argue that the long-term debt is also optimal, when the term structure of interest rates is either flat or even downward sloping. It is argued that in the case of uncertain interest rates, firms with long-term debt are less concerned about adverse shifts in interest rates, unlike firms who have more short-term debt. This increased debt capacity particularly increases the value of tax benefits of debt. Therefore, the higher the effective tax rate, the higher will be the proportion of long-term debt. On the other hand, Lewis (1990) argues that taxation does not have any effect on the debt maturity structure once capital structure and debt maturity structure are simultaneously determined. Therefore, firms can achieve an optimal capital structure by various combinations of short-term and long-term debt. These tax related theories collectively suggest a mixed relationship between taxation and the debt maturity structure.

4.1.4. Information Asymmetry and Signalling Theories

The choice of debt maturity structure may also depend on private information which management holds about the quality of their firm. Flannery (1986) and Kale and Noe (1990) are among the initial studies which model the role of signalling for the maturity structure of a firm's debt. In the presence of information asymmetry, Flannery (1986) argues that insiders choose a particular maturity structure of their debt to signal to outsiders the true quality of the firms. Flannery argues that high quality firms will elect to have shorter debt maturity in their capital structure compared to low quality firms, given that there is a positive transaction cost. If the markets cannot distinguish between good quality and poor quality firms, good quality firms are more likely to issue short-term debt when insiders know that their firm is undervalued.

Flannery's model assumes that issuing short-term debt frequently over a given period incurs more fixed transaction costs than issuing long-term debt and this cost has to be sufficiently high so that good firms will choose a maturity structure to identify themselves as better firms. If there had been no costs associated with the issuance of short-term debt, all firms, whether of good or poor quality, would have the incentive to issue short-term debt. This would create a pooling equilibrium such that the market could learn nothing about the firm's quality and their beliefs would remain the same after the issuance of the debt. However, if the flotation costs are sufficiently high for the short-term debt, low quality borrowers cannot mimic high quality borrowers and they have no choice but to issue long-term debt. This results in a separating equilibrium such that high quality borrowers issue short-term debt and low quality borrowers issue long-term debt.

Flannery's model assumes that all firms, whether of high or low quality, will have a preference for short-term debt but the transaction costs associated with short-term debt will not permit low quality borrowers to issue more short-term debt. However, Kale and Noe (1986) argue that such separating equilibrium can exist without the transaction costs. Due to information asymmetry, uninformed investors might misprice the securities. Although both types of long and short-term securities are subject to mispricing, long-term debt is more specifically sensitive to such mispricing. Good quality firms would therefore like to reduce the losses due to mispricing of long-term debt and issue more undervalued short-term debt. On the other hand, the low quality borrowers will issue more overvalued long-term debt. The theoretical models from both studies thus predict a negative relationship between a firm's quality and its maturity structure.

To summarise, this section has provided a review of the different theoretical frameworks that emerged as a direct or indirect critique of debt maturity irrelevance. It has highlighted several different factors that affect the maturity structure of the firms, such as agency costs faced by firms, their maturity of assets, information asymmetry and firms' willingness to signal quality, and minimisation of their tax burdens. The next section provides a review of the empirical evidence on the debt maturity structure of the firms based on the theories above. It highlights the prominent factors, which are argued to be of prime importance for the determination of the debt maturity structure of firms.

4.2. Determinants of Debt Maturity Structure

Studies have empirically found several important determinants based on the theoretical models discussed in the previous section which impact on decision making on debt maturity structure. These are discussed below:

4.2.1. Size

The size of a firm is one of the most well documented determinants in the empirical literature of debt maturity structure. The empirical literature mostly supports the contracting cost-hypothesis, which suggests that large firms have higher maturity in their debt maturity structures than their smaller firm counterparts. For example, Barclay and Smith (1995, 1996), Stoh and Mauer (1996), Fan *et al.* (2011) and Cai *et al.* (2008) report a positive association between the size of a firm and its debt maturity structure. Ozkan (2000) and Ozkan (2002), using a dataset of 429 and 321 non-financial UK firms, respectively, report a direct relationship which supports the theory that larger firms have lower agency problems (Smith and Warner, 1979), easier access to long-term debt markets (Titman and Wessels, 1988) and higher levels of collateralisable assets than smaller firms (Whited, 1992). Deesomsak *et al.* (2009), investigating the debt maturity structure of Asian economies pre and post the 1997 crisis, find that size maintains its consistency in positively affecting the debt maturity in both periods. Other studies, such as Pettit and Singer (1985) and Scherr and Hulburt (2001), argue that small firms provide less information about their prospects and operations and find it expensive to produce audited statements/reports to outsiders. Consequently, these difficulties affect their access to financial markets and such firms are therefore more likely to rely on private debt such as bank loans with shorter maturity. Thus, the theoretical and empirical literature suggests a positive relationship overall between the size of firms and their debt maturity structures.

4.2.2. Growth Opportunities

As discussed in Section 4.1.1, theoretical models developed by Myers (1977), Hart and Moore (1990) and Stulz (1990) predict a negative relationship between growth opportunities and the debt maturity structure of the firms. However, empirical evidence on the relationship of growth opportunities and debt maturity is somewhat mixed. For instance, Barclay and Smith (1995, 1996) and Guedes and Opler (1996), using US data, find a significantly negative relationship of investment opportunities with leverage. However, Scherr and Hulburt (2001), investigating the debt maturity structures of small US firms, find mixed results for different measures of debt maturity structure. Many studies, contrary to the above, have failed to document any relationship between the growth opportunities and debt maturity structure of firms (Esho *et al.*, 2002; Cai *et al.*, 2008). Fan *et al.* (2011), studying a large international dataset of 39 developed and developing economies, find that growth opportunities affect the debt maturity structures of the full sample of developed and developing economies directly but for the sub-samples of developed and developing economies separately, the growth opportunities do not show any impact. Individual regression results of the countries show mixed evidence where the coefficient is insignificant for UK firms.

Consistent with Fan *et al.* (2011), Antoniou *et al.*'s (2006) results also show that growth opportunities do not have any significant impact on debt maturity structures for the sample from the UK, France and Germany implying that UK firms are not concerned about sub-optimal investment. However, Ozkan (2000, 2002), employing a dataset of relatively larger firms than that used by Antoniou *et al.*(2006), reports a significant negative relation of investment opportunities with debt maturity structure for the UK firms which might support the theory that firms use their maturity structures to curtail any underinvestment problems, as proposed by Myers (1977). As the evidence is mixed overall for the relationship of the two variables and specifically for the UK sample, the expected relationship is hypothesised based on the theoretical argument that predicts a negative relationship between the investment opportunities set and debt maturity structure.

4.2.3. Assets Maturity Matching

The asset maturity argument put forward by Myers (1977) has received considerable empirical support. It appears to be one of the most important factors in a large number of the studies examining the determinants of debt maturity structure of firms. In a survey study of 392 US firms' CFOs, Graham and Harvey (2001) report that CFOs consider maturity matching of their debt with assets as the most important consideration when they come to make decisions regarding short and long-term debt and Bancel and Mittoo (2004), through a survey study of European firms, also find similar results. Kim *et al.* (1995), Stohs and Mauer (1996), Scherr and Hulburt (2001) for the US firms and Cai *et al.* (2008) for the Chinese listed firms, amongst others, empirically find support for the maturity matching theory. In addition, for the incremental data of straight debt as well as total debt issues, assets maturity shows a direct relationship with debt maturity (Guedes and Opler, 1996). It should also be noted though that a few studies, on the other hand, also report mixed or insignificant evidence (see for example, Deesomsak *et al.*, 2009; Fan *et al.*, 2011).

For UK samples, Ozkan (2000, 2002) finds that assets maturity has a significant positive relationship with the debt maturity of firms. However, contrary to this, Antoniou *et al.* (2006) find no relationship between assets maturity and debt in the case of UK firms. Antoniou *et al.* (2006) argue that the firms might not match the maturity of their assets with the maturity of their debt because the firms are at a stage in their life cycle where concerns for maturity matching and associated risk are minimal. As noted above, the majority of the empirical studies find a direct relationship, which suggests that firms composed of long-lived assets may have longer maturity in their capital structure to minimise risk. However, the empirical evidence for the UK firms is mixed. Following the theoretical argument by Myers (1977), it is hypothesised that assets maturity and debt maturity may have a direct relationship.

4.2.4. Taxes

Several empirical studies have tested the impact of taxes on the debt maturity structure as proposed by Brick and Ravid (1985) and Kane *et al.* (1985). Their findings are generally inconsistent with the models. For example, Barclay and Smith (1995), Guedes and Opler (1996) and Stohs and Mauer (1996), examining US firms, do not support the positive relationship predicted by Brick and Ravid (1985). They find that the term structure of interest rates is negatively associated with the debt maturity structures of US firms. In most cases, however, the economic significance of the variable is trivial. The negative relationship may be attributable to the assets substitution hypothesis. It can be argued that that when interest rates are high, firms may find it difficult to borrow long-term debt as the higher required rate of return may create an incentive to substitute low-risk projects with high-risk projects (Guedes and Opler, 1996).

Empirical evidence also suggests either insignificant or inconsistent results for the theory proposed by Kane *et al.* (1985). Stohs and Mauer (1996) find a negative but economically insignificant relationship between effective tax rates and maturity structures for the US firms. Cai *et al.* (2008) find effective tax rates to be insignificant and negatively associated with the debt maturity structures of the Chinese firms. For Germany, characterised by relatively higher tax rates than other sample countries, Antoniou *et al.* (2006) find that effective tax rates are significant and positively associated with maturity structures. Antoniou *et al.* (2006) note that effective tax rates are positive but insignificantly associated with debt maturity structures for UK and French firms. Similarly, Ozkan (2000 and 2002), for UK firms, finds either positive and/or insignificant relationships between effective tax rates and debt maturity structures, depending on the estimation technique. Given that in the UK, a dividend imputation system (Fan *et al.*, 2011) is in place and tax rules exist that allow separate preparation of accounts for taxation purposes and for public financial reporting with allowance of other provisions, such as carry forward losses (Antoniou *et al.*, 2006), it can be expected that the role of taxation may not be as prominent as in those countries that adopt a more ‘classical’ tax system. However, following the theoretical predictions and empirical studies, the effective tax rate is included as one of the explanatory variables for the determination of the debt maturity structure of a firm.

4.2.5. The Quality of the Firm

As discussed in Section 4.1.2, the models proposed by Flannery (1986) and Kale and Noe (1990) predict the existence of a negative relationship between the quality of firms and their debt maturity structures. This prediction for the quality of firms has been studied empirically in a number of studies. However, the findings of these studies are largely contradictory to the theory. For example, Barclay and Smith (1995) and Stohs and Mauer (1996), investigating US firms' debt maturity structures, note that the quality of firm, as measured by abnormal earnings (i.e., the difference between earnings in the subsequent year and in the current year, scaled by the earnings of the current year or the share price), has a negative relationship with the maturity structure of the debt, but the economic significance of the variable is very low. A subsequent study by Barclay and Smith (1996) shows that the effect of abnormal earnings is positive and significant for long-term debt, yet the economic significance remains immaterial. Other studies also find contradictory evidence for the theory. For instance, Cai *et al.* (2008) find that quality is either not significant or has a positive impact on the debt maturity structure, irrespective of the estimation techniques used. Similarly, Antoniou *et al.* (2006) also find mixed or contradictory results for the sample set of UK, French and German firms.

There could be a number of reasons for these contradictory results. For example, for firms in countries dominated by a bank-based system, it might be more prestigious to borrow long-term bank loans, and short-term bank loans may actually indicate poor quality of the firms (Cai *et al.*, 2008). In addition, levels of information asymmetry may vary in different countries. For instance, counties with civil law are expected to have less severe information asymmetry problems than common law countries (Antoniou *et al.*, 2006). Therefore, the practical implications cannot be directly observed in these countries. It might also be possible that the measurement used for the quality of firms, the abnormal earnings of firms, does not truly represents that which it is intended to measure (this point is discussed in detail in Chapter 5).

Although the empirical evidence is inconclusive about the significance and direction of the variable, the theoretical proposition predicts a negative relationship between the quality of firms and the level of maturity of their debt structures. Therefore, following the theoretical literature and in alignment with the previous studies that include firms' quality as a determinant of debt maturity structure, it is expected that debt maturity structure is negatively affected by firms' quality. Good quality firms are expected to have more of a preference for shorter maturity in their capital structure than the counterpart poorer quality firms.

To sum up, this section has presented a review of prior studies that have highlighted factors which, theoretically and empirically, have been found to affect the choice of debt maturity structure of firms. More specifically, the models and empirical analyses point that debt maturity structure can be used as a contracting device to minimise agency costs between different stakeholders, as a measure to reduce the tax burden, to ensure the smooth servicing of debt and to signal firms' quality or private information about firms' prospects to outsiders. A summary of these findings are presented in Table 4.1. Apart from these factors, the cost of inefficient liquidation may also affect the choice of debt maturity structure, as will be discussed further in the next section.

4.3. Credit Ratings and Debt Maturity Structure: Diamond's (1991) Framework

As argued in the last section, firms have to balance the costs and benefits of different maturities of debt to reach an optimal debt maturity structure (Stohs and Mauers, 1996; Jun and Jen, 2003). The previous section discussed the prominent factors that firms take into consideration when making their debt maturity structure decisions. Another stream of literature on corporate debt maturity structure points out the significance of liquidity risk in the determination of debt maturity structure. If the firms are unable to rollover debt to the next period, they may have to resort to more expensive sources of financing or they may even be subject to liquidation in some cases. In such cases, the liquidity risk has to be weighed against other costs and benefits of choosing certain levels of maturity in the capital structure.

Survey studies also show that liquidity risk is an important determinant of debt maturity structure. For example, Graham and Harvey (2001), investigating 392 US firms' CFOs, find that liquidity risk is the second most important factor in the determination of the maturity structure of the debt. Bancel and Mittoo (2004), surveying firms' managers from 16 European countries including the UK, report that 77% of respondents rate asset maturity matching as the most important concern, while 70% of the respondents rate liquidity risk as the second most important concern in debt maturity decisions. However, the

Table 4.1
A Summary of Prior Theoretical and Empirical Literature on the Determinants of Debt Maturity Structure

Theory	Argument	Support	Not Support
Contracting Cost/ Agency Cost Perspective	*Firms with large investment opportunity sets will prefer more short-term debt*	Barclay and Smith, 1995; Barclay and Smith, 1996; Ozkan, 2000; Ozkan, 2002; Guedes and Opler, 1996;	Esho *et al.*, 2002; Cai *et al.*, 2008; Antoniou *et al.*, 2006;
	Large firms have longer debt maturity than small firms	Barclay and Smith, 1995; Barclay and Smith, 1996; Ozkan, 2000; Ozkan, 2002; Stohs and Mauer, 1996; Fan *et al.*, 2011; Cai *et al.*, 2008; Datta *et al.*, 2005	Antoniou *et al.*, 2006
Maturity Matching Theory	*Firms match the maturity of their assets with the maturity of their debt*	Ozkan, 2000; Ozkan, 2002; Graham and Harvey, 2001; Bancel and Mittoo, 2004; Stohs and Mauer, 1996; Scherr and Hulburt, 2001; Cai *et al.*, 2008; Guedes and Opler, 1996	Antoniou *et al.*, 2006; Datta *et al.*,2005
Signalling Theory of Debt Maturity Structure	*Firm signal their quality through the choice of debt maturity structure. High quality firms have shorter maturity while low quality firms have longer maturity in their debt structure*	Barclay and Smith, 1995; Barclay and Smith, 1996	Ozkan, 2000; Ozkan, 2002; Antoniou *et al.*, 2006; Datta *et al.*,2005
Tax Related Theories	*Firms employ more long-term debt when the term structure of debt is upward sloping*	Datta *et al.*, 2005	Barclay and Smith, 1995; Barclay and Smith, 1996; Guedes and Opler, 1996, Stohs and Mauer, 1996
	Debt maturity structure has a negative relationship with the tax advantages of debt	Stohs and Mauer, 1996	Ozkan, 2000; Ozkan, 2002; Antoniou *et al.*, 2006; Cai *et al.*, 2008

Note: This table displays a summary of the main theories of debt maturity structure and reports some of the empirical evidence, which supports or not supports the theoretical argument.

empirical literature addressing concerns over liquidity risk in the debt maturity structure is still limited, while the way in which it affects the debt maturity structure is also unclear.

The liquidity risk of the firms may increase with the level of information asymmetry present between borrowers and lenders. In the literature on debt maturity structures, two frameworks that theorize the relationship between information asymmetry and the debt maturity structure are most prominent. The first series of studies, which have been reviewed in Section 4.1.4, is by Flannery (1986) and Kale and Noe (1990) where firms choose a certain maturity structure to signal to outsiders about the true quality of the firms. The second framework, which extends the conventional models of Flannery (1986) and Kale and Noe (1990), is provided by Diamond (1991). Diamond's framework, as will also be discussed further, theorises a non-monotonous link between credit ratings and the debt maturity by incorporating the effects of liquidity risk.

Although both models rely on information asymmetry, there are some notable differences between Flannery's (1986) and Diamond's (1991) models. Such differences make Diamond's theoretical framework more relevant to explain the credit ratings – maturity structure relationship among firms. Flannery and Diamond's models are both two period models where the firms can finance their projects either through long-term debt extended over two periods or by short-term debt, which has to be rolled over at the end of first period to the next period. In Flannery's model, the quality of the firms is not observable directly and the NPV of the projects are not known to outsiders. In the presence of information asymmetry, Flannery (1986) argues, that the firms, through their choice of maturity structure, may signal to the market about their quality. In his model, all the firms are expected to have a preference for short-term debt, but due to transaction costs associated with short-term debt, high-risk firms may be screened out of the short-term debt market. The low-risk firms with favourable private information are likely to choose short-term debt, as they believe that the market is charging them higher risk premium given that the market does not have full set of information about their quality. Moreover, they believe that the market would probably alter its beliefs once the firms' quality becomes apparent, and will then charge lower risk premium. This, as stated in Section 4.1.4, would imply a negative relationship between the quality of the firms and their debt maturity structures.

Contrary to Flannery's model, which implies that all firms will prefer short-term debt unless the transaction costs do not permit them, Diamond's model implies that not all firms have a preference for short-term debt. In Diamond's theoretical framework, the market can observe the initial differences in the firms' quality, but cannot assess the differences in the present value of their projects. The firms, however, have private information about whether their projects have positive or negative NPVs. The only observable factor to outsiders is the initial quality of the firms, which, unlike in Flannery's model, varies for different firms (Berger *et al.,* 2005). This may be similar to the actual credit ratings, which shows the initial quality of the firms while the information is periodically updated for the investors to reduce the information asymmetry that exists between insiders and investors. Unlike Flannery's model, therefore, the choice of maturity structure reveals no private information to outsiders. While Flannery's model is based on the transaction costs, Diamond argues that concerns over liquidity risk or rollover risk will result in firms choosing different maturity structures. Liquidity risk is defined by Diamond (1991) as '*... the risk that a solvent but illiquid borrower is unable to obtain refinancing'* (p.710). The firms will therefore trade off the costs of liquidity risk against the benefits of choosing short-term debt.

Diamond argues that low risk or high rated firms may have private information about the superior quality of the projects and thus likely choose short-term debt, specifically directly placed debt such as commercial paper, with an expectation that they can rollover the short-term debt into the next period with low interest rates. Due to favourable private information, such firms are likely to subject themselves to a new set of information that will arise at the time of refinancing. For such firms, the benefits of revealing good news in future may outweigh the costs associated with the risk of refinancing and liquidation. For high rated firms, the concerns of refinancing may be lower in the event of bad news revealed to the market at the time of refinancing than that of other firms with low ratings. Unlike the average rated borrower, downgrades for high rated firms may not necessarily mean that they will be forced into liquidation. As these firms know about the true value of their projects, new favourable information at the time of refinancing the existing debt may lead to lower expected costs of borrowing. This suggests that if the liquidity risk is absent, firms will borrow short-term debt.

If there is liquidity risk present, firms are likely to issue more long-term debt. In Diamond's two period model, long-term debt may not lead to liquidation at the end of the first period because the lenders do not have the right to liquidate the firm. The firms, which have intermediate ratings with favourable private information, may choose more long-term debt. In comparison with other firms, mid rated firms might choose longer debt maturity at higher interest rates to minimise the liquidity risk of being unable to refinance the short-term debt in the next period. Being intermediate or mid rated firms, they can be expected to have better access to long-term debt markets compared to the low rated borrowers. In Diamond's model, the availability of long-term debt for any firm would also automatically mean that they could access short-term debt. This would mean that only the high and mid rated firms have access to the long-term debt market but, significantly, only the mid rated borrowers would prefer to use more long-term debt.

For some firms the option of long-term debt is not available because of the high probability of a negative NPV project. Low rated firms with unfavourable private information may like to mimic highly rated firms so that they may not be identified as having negative information associated with them. However, such firms are likely to have unstable cash flows and higher required rates of return by investors. Higher required rates of return may encourage asset substitution problems and, therefore, such firms are likely to have lower levels of leverage in their capital structure (Diamond, 1991; Barnea *et al.*, 1980). As their initial quality is observable to outsiders, long-term debt financing might not be available for such firms. Consequently, these firms will rely more on short-term debt.

4.3.1. Empirical Evidence on Diamond's Theoretical Framework

Diamond's (1991) theory as a whole suggests a non-monotonic relationship between the liquidity risk, as measured by credit ratings, and the debt maturity structure. High risk (or low rated) and low risk (or high rated) firms are expected to choose to issue more short-term debt and intermediately rated firms are likely to issue more long-term debt. The non-monotonicity has been tested by several empirical studies, which have mostly concentrated on the US market. These studies generally use either the available balance sheet data or the incremental debt issuance data to test the relationship. Nevertheless, the relationship is found to be generally mixed. For example, Barclay and Smith (1995), using balance sheet data for the US firms over a period of 19 years (1974-1992), support Diamond's theory. However, the findings suggest that the non-monotonic relationship is solely driven by the inclusion of non-rated firms in the sample. If non-rated firms are considered to be of poor quality with higher information asymmetry and low rated firms are considered intermediate rated firms, then the findings support the theory. Stohs and Mauer (1996), using the weight average debt maturity ratio, find strong support for Diamond's theory even after controlling for the inclusion of non-rated firms in the sample.

Most of the studies testing Diamond's theory use balance sheet data. Those using incremental debt issuance data either do not test the theory directly or do not find results consistent with the theory. For example, Guedes and Opler (1996) examine the maturity structure of 7,368 public debt issuances made by US firms from 1982 to 1993. They note that investment grade firms are more likely to issue short-term debt than non-investment grade firms.[14] Mitchell (1993) finds that high rated firms have longer maturity compared to low rated firms. Berger *et al.* (2005), using data on 6,000 newly issued bank loans, find that low risk firms tend to issue more short-term debt and the maturity increases as their information asymmetry is reduced. However, for high-risk firms, their results are inconsistent with this theory. They note that such firms have maturity structures similar to intermediate risk firms. It should be noted that Berger *et al.*'s (2005) results cannot be compared directly with prior studies by Barclay and Smith (1995), Guedes and Opler (1996) and Stohs and Mauer (1996) as they have used bank loan data, which arguably has different features compared with public debt. Banks have close relationships with borrowers so that they can effectively monitor, renegotiate, and enforce their loan terms and conditions. Such characteristics of bank loans may limit the power of the models to test Diamond's theory correctly.

A few studies have also used accounting measures of credit quality for testing Diamond's theory. Scherr and Hulburt (2001), for example, test the theory for small US firms by using Altman's (1968) z-score. Although their results are consistent with the theory, accounting measures might not be appropriate for testing the theory, as the maturity of the debt structure is dependent on the disclosure of information to outsiders at the end of the first period, when the firms have to rollover the debt to the next period. Accounting measures are based upon information which is already publicly available. A few studies, where although they do not test any signaling theory directly, support Diamond's liquidity risk argument for high rated firms. Jun and Jen (2003), for example, report that the short-term debt is mostly accessed by financially strong firms who enjoy greater financial flexibility.

[14] Specifically for capturing liquidity risk, Guedes and Opler (1996) use the size of firms, for which they note that large firms have lower maturity in their debt issuance.

Unlike US studies, which tend to include liquidity risk in modelling the determinants of debt maturity structure, evidence from non-US markets and specifically for the UK market is non-existent. For example, Schiantarelli and Sembenelli (1997), Ozkan (2000, 2002), Antoniou *et al.* (2006) and Fan *et al.* (2011), ignore the relevance of liquidity risk in their models. Moreover, it should also be noted that most of the empirical studies from the US market also find mixed relationships between liquidity risk, as measured by credit ratings, and debt maturity structures. Therefore, it is expected that a non-US study will provide empirical evidence to the extent that liquidity risk is relevant for debt maturity structure decisions. Following Diamond's (1991) theoretical argument, it is hypothesised that:

H_{4a}: ***If other things remain constant, there is a non-linear, inverted U-shaped relationship between credit ratings and the debt maturity structures of the firms***.

4.4. Conclusion

This chapter reviewed the theoretical and empirical literature on the determinants of corporate debt maturity structure. The literature suggests several possible determinants of debt maturity choice, including firms' size, growth opportunities, the maturity of their assets structure, the firms' quality, and taxation. The chapter focuses on Diamond's theoretical framework to test the relationship between firms' credit ratings and debt maturity structures. It highlights that prior US studies have found mixed empirical support in relation to Diamond's theory. Given that there is no prior UK study, which tests the liquidity hypothesis, a study using data on UK firms is likely to provide an interesting insight regarding the applicability of the theory within a different market. Following the theoretical argument put forward by Diamond (1991), which is based on the varying levels of liquidity risks across rating levels, a non-linear relationship is hypothesised between the credit ratings and the debt maturity structures. High rated firms are likely to have low liquidity risk and therefore they are expected to prefer short-term debt, mid rated firms have relatively higher liquidity risks but better access to long-term debt markets, and finally low rated firms may have higher liquidity risk but also suffer from constrained access to the long-term debt market. Thus, high rated and low rated firms are expected to have higher levels of short-term debt, compared to mid-rated firms, which may use more long-term debt. These theoretical predictions are put to the test in Chapter 8.

Chapter 5
Sample and Methodology

5. Introduction

This chapter discusses the sample selection criteria and presents the empirical models under consideration. The objective of the chapter is to provide a clear rationale behind the research design of the study. The chapter has four sections: Section 5.1 focuses on the sample selection criteria and the design of the study, while Section 5.2 presents the empirical models and estimation techniques along with the measurement of the proposed variables. Section 5.3 presents the outlier detection and treatment procedures and Section 5.4 concludes the chapter.

5.1. Sample Design

This section describes the sample selection procedures regarding the sample period, sources of data used and sample formatting procedures. The section is further divided into three subsections. Section 5.1.1 presents the criteria for selecting the sample period, while Sections 5.1.2 and 5.1.3 justify and discuss the sample selection procedures for the rated and non-rated firms' samples, respectively.

5.1.1. Sample Period

The data for Standard and Poor's credit ratings were acquired in September 2009 and the extraction of accounting data from Datastream was finished in January 2010. The data period for the present study therefore runs from January 1988 to January 2009. The selection of the initial year for both credit ratings and accounting data are driven by the availability of the first rated firm-year with Standard and Poor's. The final data before outlier treatment consist of 42,872 firm-years of 4,169 firms over 22 years. With respect to previous studies, the present study covers a comprehensive database in terms of the length of the period covered, and the sample size included. For example, prior studies on capital structure and debt maturity structure such as Bennett and Donnelley (1993) used data from 1988 to 1988 (433 firms), Rajan and Zingales (1995) from 1987 to 1991 (608 firms), Ozkan (2000) from 1983 to 1996 (429 firms), Ozkan (2001) from 1984 to 1996 (390 firms), and Bevan and Danbolt (2004) from 1991 to 1997 (1054 firms). Large sample sets, on the other hand, may raise some issues, as the variables under consideration may not retain their consistency over the sample period. The study, therefore, also provides an in-depth analysis of the determinants of capital structure and debt maturity structure on an annual basis, to examine whether the explanatory variables maintain their consistency over the years. Moreover, regressions are also conducted with year dummies to reduce any potential time effects in the model.

The study uses two data sets with respect to the hypotheses set in the study. For the purpose of investigating the impact of credit ratings on the level of debt and its maturity structure ($H_{1a,}$ $H_{1b,}$ $H_{1c,}$ and H_{4a}), a sample of rated and non-rated UK firms is used. This consists of 4,065 non-rated firms (41,998 firm-years) and 104 rated firms (874 firm-years). For examining the effects of potential as well as actual rating changes (H_{2a}, H_{2b}, H_{2c}, H_{3a} and H_{3b}), a sample of rated UK firms is used, which consists of 104 rated firms (874 firm-years). The following subsections discuss the sampling selection procedures of these rated and non-rated firms and present the related statistics of the sample selected.

5.1.2. Data for Rated Firms

Standard and Poor's historical issuer credit ratings data were not readily accessible to the public and were not available from any financial database or website at the time of collection. For the present study, the data were purchased from the Standard and Poor's. The credit rating data were only acquired for non-financial firms as per Standard and Poor's classification criteria. Following Shyam-Sunder and Myers (1999), Rajan and Zingales (1995) and Kisgen (2006, 2009) for the US, and Ozkan (2000, 2001 and 2002) and Bevan and Danbolt (2004) for the UK, amongst others, financial firms, such as banks, insurance agencies and other financial institutions, are excluded from the sample. These firms may have a different capital structure, which may not be directly comparable with the capital structures of non-financial firms. For example, specifically in the banking sector, the requirements of minimum capital may directly affect the capital structure decisions of these firms. Additionally, insurance firms have investor insurance schemes such as deposit insurance, which are not comparable to the debt issued by non-financial firms (Rajan and Zingales, 1995). Following Barclay and Smith (1995), Guedes and Opler (1996) and Kisgen (2006, 2009), the dataset includes utility firms, as these firms actively acquire ratings, and the nature of the research questions allows for this inclusion. However, to be consistent with prior studies which have generally excluded regulated firms from their sample (e.g., Stohs and Mauer, 1996; Ozkan, 2000, 2001 and 2002; Shyam-Sunder and Myers, 1999), the analysis is also carried out excluding utility firms. In addition, the effects of such inclusion are further controlled for by a dummy variable for utility firms.

5.1.2.1. Reason for Selecting Standard and Poor's Ratings

The dataset acquired from Standard and Poor's contained 355 UK rated firms. Standard and Poor's is a reputable credit rating agency recognised by Nationally Recognised Statistical Rating Organizations (NRSRO) in the US (see Chapter 2, for more details). Although these rating agencies do not have any recognition criteria in the UK market, Standard and Poor's, according to the Basel Committee on Banking Supervision (2000), is among the well-recognised rating agencies in the UK market based on *market recognition* (p.51). This report also suggests that as in the year 2000, Standard and Poor's rating agency is also amongst the two rating agencies with the largest coverage of UK non-financial firms. (Table 5.1). However and as will be further discussed in Subsection 5.1.3, Standard and Poor's are found to have the largest coverage of quoted public UK firms when datasets of different rating agencies are matched with Datastream. For example, the total number of firms rated by Standard and Poor's are 119 compared to 48 by FITCH and 38 by Moody's. Given that the present study employs only public firms with data available from Datastream, choosing the Standard and Poor's database for rated firms is appropriate for sample selection.

Table 5.1
Corporate Ratings by Agency and Country (G10)

G10*	Duff & Phelps	FITCH	Moody's	Standard and Poor's
US	434	245	2,645	2,224
UK	26	72	155	147
Japan	2	2	254	40
Netherlands	2	1	56	39
France	4	6	26	37
Sweden	2	1	21	19
Germany	1	1	18	18
Switzerland	0	0	11	13
Belgium	0	0	6	4
Italy	27	0	1	4

Source: Basel committee on banking supervision (2000).
** The report does not provide comparable figures for Canada*

Another reason for using credit ratings from Standard and Poor's is the availability of historical data. Historical long-term credit ratings data from other agencies are either not accessible or not suitable. For instance, A.M. Best mostly rates the financial sector, particularly the insurance sector (Duff and Einig, 2009) while for FITCH, only current data on credit ratings as of 2009 was available. Duff and Einig (2009) also find that in the UK, the demand for smaller or specialised rating agencies is less and generally firms acquire ratings from either Standard and Poor's or Moody's or both. In some cases, however, firms also acquire FITCH ratings. The use of the Standard and Poor's ratings is in line with prior literature (Barclay and Smith, 1995; Kisgen, 2006 and 2009; Hovakimian *et al.*, 2009) which will facilitate a direct comparison with these studies.

Some previous studies, such as Stohs and Mauer (1996), also used Moody's ratings for firm-years where Standard and Poor's ratings were not available. Therefore, Moody's long-term issuer credit ratings data are also matched with Datastream to identify the firms rated by Moody's but not by Standard and Poor's. The total number of firms obtained from Moody's website was 128[15] during 1988-2009 but data for only 38 firms were available from Datastream. The matching of Standard and Poor's and Moody's datasets reveals that only 3 firms or 24 firm-years are not rated by Standard and Poor's. Given that prior studies have shown that both firms have issued nearly identical ratings (e.g., Beattie and Searle, 1992[16]; Cantor and Packer, 1994), if only Standard and Poor's ratings are used presently, it can be expected that the results will be qualitatively similar to alternative rating agency data. Moreover, as the data available from Moody's are inadequate, it is not economically feasible to conduct a separate analysis for this group of firms. The analysis in this study is therefore restricted to Standard and Poor's credit ratings.

5.1.2.2. Rationale for Selecting Domestic Long-Term Issuer Credit Rating

The dataset acquired from Standard and Poor's contains the long and short-term issuer ratings for the UK firms. Consistent with the objectives of the study, the present study employs the long-term issuer's ratings only. The use of the long-term issuer ratings is essential for the analysis, as it will help understand how the overall ability to pay debt obligations affects a firm's overall financial decision making rather than investigating the effects on any specific debt commitment. The issuer credit ratings do not take into account any debt instrument specific risk such as its standing in bankruptcy, statutory preferences or enforceability of the obligation, and instead only provides an opinion of the obligator's capacity to meet the obligations when they come due (Standard and Poor's, 2008). The

[15] It can be noted that the number of rated firms by Moody's available on their website appear to be different from the number of rated firms reported by the Basel committee on banking supervision (2000). The difference may be because of the classification adopted by the authors of the committee's report.

[16] Beattie and Searle (1992) find a correlation of 0.97 between the ratings of Standard and Poor's and Moody's.

overall ability to fulfil long-term obligations measured by long-term issuer credit ratings is also argued to play an important role in determining the ratings of specific debt issues (Langhor and Langhor, 2008). Another reason to choose long-term issuer credit ratings is the strong relationship between long-term credit ratings and short-term credit ratings (see Standard and Poor's corporate rating criteria, 2008), which allows the use of long-term credit ratings even for debt maturity structure analysis. Besides, the database acquired from Standard and Poor's firms mostly contains long-term issuer ratings and only a limited number of firms have short-term ratings. Finally, the selection of long-term ratings is well in line with that employed in prior literature (e.g., Kisgen, 2006, 2009; Hovakimian *et al.*, 2009; Barclay and Smith, 1995; Stohs and Mauer, 1996; Rauh and Sufi, 2010).

5.1.3. Data Matching between Standard and Poor’s and Datastream

Firms from Standard and Poor’s are manually matched with Datastream using identification codes provided by Standard and Poor’s which included CUSIP, GICS, base CINS, SIC, NAICS, and TICKER and other information such as firms’ name, previous names of firms, industry classification (as per Standard and Poor’s classification) and parents of the firms. The initial matching is done by matching the tickers symbols in the Standard and Poor’s dataset with Datastream Ticker Symbol (Datastream code WC05601). If the ticker symbol was not available in Datastream, base CUSIP, GICS and SIC were compared to identify the firm. Since ticker symbols are only assigned to firms listed on the London Stock Exchange, private firms were excluded from the sample. Notice that, delisted firms are included in the sample as long as their data are available within the sample period in order not to face a survivorship bias problem.

With initial matching of 355 Standard and Poor’s rated firms with Datastream, the available firms were reduced to 119 firms as 234 excluded firms were non-quoted firms. The non-quoted firms are not part of the sample as such firms may have different financial structures compared to the listed or quoted firms. Listed firms have better access to national and international markets and thus are subject to different local and international laws and policies (Hall *et al.*, 2004) and as a result, unlisted firms may have a different set of variables influencing their capital structures (Giannetti, 2003; Hall *et al.*, 2004), which is outside the scope of the present study.

The remaining 119 rated firms are classified into 10 major industries (i.e., Oil & Gas, Basic Materials, Industrials, Consumer Goods, Health Care, Consumer Services, Telecommunications, Utilities, Financials and Technology) using the Datastream code 'ICBIN'. This reduces available sample firms to 111, as 4 firms are classified as financials while the industry classification is missing for the other 4 firms. 7 firms are further excluded from the sample as no accounting data were available for any year in the sample period. The total number of rated firms used as a sample is therefore reduced to 104 over a period of 22 years with 874 firm-years available (See Table 5.2). The final sample consists of 57 active and 47 dead firms.

Table 5.2
Initial Matching of the Rated Firms

	No. of firms
Firms rated by Standard and Poor's	353
(-) Private or non-quoted firms	234
Classified as financial firms by Datastream code ICBIN	4
Firms with no Industry classification available	4
Firms with no accounting data available in Datastream	**7**
Final sample of rated firms	**104**
Active firms	57
Dead firms	47

Note: This table reports the steps followed for the initial matching of Standard and Poor's firms with Datastream

Table 5.3 shows the firm-year observations of 104 firms over the 21 years. The sample period starts from 1989 to 2009 but the first rated firm-year is available in 1989. Panel A of Table 5.3 shows the number of available rated firm-years across the sample and Panel B shows the frequency of data available for different firms. It can be noted that the highest number of firm-years are available in 2003-2004. Both the panels shows that the data is not equally distributed across the years and the number of firm-years vary considerably aver years. This further provide support to conduct analysis across the sample period.

Table 5.4 shows the industrial classification of the 104 sample firms. The sample is dominated by consumer services, having 29% weighting in the total sample, followed by industrial firms. From the statistics, it can be noted that data are not evenly distributed which may pose problems in interpreting the results as the results may be driven by the large proportion of firms within one industry. This provides some motivation to include industry dummies to capture any effects that this may have on the results. Moreover, as can be noted, and was discussed earlier, the sample includes the utility firms. The proportion of utility firms is only 14% of the sample, which although low as a proportion of total rated firms, suggests active use of credit ratings by regulated firms.

Table 5.3
Distribution of Firm across the Sample Period (Rated Firms Only)

Panel A: Firm-years available and their weights in the sample

Years	Firm-years	Percent	Year	Firm-years	Percent
1989	1	0.1%	2000	61	7.0%
1990	7	0.8%	2001	61	7.0%
1991	10	1.1%	2002	69	7.9%
1992	15	1.7%	2003	71	8.1%
1993	21	2.4%	2004	74	8.5%
1994	26	3.0%	2005	69	7.9%
1995	29	3.3%	2006	63	7.2%
1996	30	3.4%	2007	59	6.8%
1997	36	4.1%	2008	54	6.2%
1998	40	4.6%	2009	30	3.4%
1999	48	5.5%	Total	874	100%

Panel B: Number of Firms with their available data

Years of Data	No. of Firms	Years of Data	No. of Firms
1	2	11	5
2	11	12	3
3	6	13	4
4	8	14	2
5	5	15	2
6	5	16	1
7	9	17	2
8	10	18	4
9	7	19	4
10	14	Total	104

5.1.4. Data for Non-Rated Firms

To examine the effects of credit ratings on capital structures and debt maturity structures, the construction of a credit quality coding scheme is done by using two coding methods. The first coding scheme is based purely on the actual credit ratings of firms, while the second coding scheme includes the non-rated firms as one of the categories of credit quality. In the second coding scheme, non-rated firms are classified as the firms with relatively inferior credit quality and having less access to debt markets. Rated firms are assigned a numerical code from 1 to 5 based on the broad rating category (see Subsection 5.2.1.2 for more details) and non rated firms are assigned a numerical code of ‘6’. The numerical coding is assigned according to the actual rating of the firms starting from ‘1’ to AA+, AA and AA- rated firms (the highest broad category available in the sample), numerical code of 2 to the second broad category of A+, A and A-, to ‘5’ to B+, B and B- rated firms (the lowest broad category available in the sample). This is followed by the last numerical code ‘6’ to non-rated or NR firms. The non-rated firms are considered to be of lower quality or firms with low creditworthiness due to various reasons. For example, there might be a self-selection bias in the rating process (Adam *et al.,* 2003). Prior to being rated, the management of the rated firms may be aware and are confident that their firms would have a favourable outcome and thus they are more likely to get ratings from external rating agencies. In such cases, it can be assumed that firms whose management considers their credit quality to be superior are more likely to get rated. Stated differently, rated firms have better creditworthiness than non-rated firms.

Table 5.4
Industrial Classification of Rated Firms

	Total No. of Rated Firms	Total Weight of Firms within the Sample (%)
Basic Materials	7	6.73
Consumer Goods	14	13.46
Consumer Services	30	28.85
Health Care	3	2.88
Industrials	18	17.31
Oil & Gas	4	3.85
Technology	2	1.92
Telecommunications	11	10.58
Utilities	15	14.42
Total	104	100

Apart from assigning the lowest code to the non-rated firms due to their creditworthiness, these firms may also face constrained debt capacity. For example, Lemmon and Zender (2010) argue that firms with credit ratings, whether investment or speculative grade, are not constrained by the debt capacity, while firms without a credit rating may face difficulties in raising the amount of leverage they require. This implies that firms that have speculative grade ratings are expected to be better-off in terms of debt capacity than their counterpart non-rated firms. For example, a number of studies, using ‘rating status’ as a proxy for debt capacity (e.g., Faulkender and Petersen, 2006; Judge and Mateus, 2009; Mittoo and Zhang, 2010), find that rated firms have higher leverage in comparison to non-rated firms. Moreover, the rated firms have also an option to disclose or not their ratings to the public (Standard and Poor's corporate rating criteria, 2008) and it is more likely that high rated firms disclose their ratings to the public more often. Given that the present sample contains only firms that have disclosed their ratings, these firms are expected to be of superior quality than remaining firms not included in the sample of rated firms. A similar procedure has also been followed by Stohs and Mauer (1996) who argue that non-rated firms have high liquidity risk but constrained access to long-term debt markets.

Although non-rated firms in the UK market may be considered as having constrained access to public debt markets (*the rating effect* as suggested by the CR-MA hypothesis), it can be argued that they may not be strictly classified as firms with poor credit quality such as in the case of the US market. Since possession of credit ratings is more prevalent in the US market, firms that do not possess credit ratings in the US market can be classified as firms having poor credit quality. However, in the UK market, the assumption about credit quality may not always hold, as several firms that do not acquire credit ratings cannot be strictly classified as low creditworthy firms. Nevertheless, in relative terms, rated firms can still be expected to have better access to public debt market than non-rated firms where public debt arguably have longer maturity than other sources of financing (e.g., bank loans). The results of the present study, as will be discussed further in Section 6.2.2 of Chapter 6 and Section 8.2.1 of Chapter 8, provide strong evidence for the validity of the assumption after controlling for several firm-level characteristics. It should also be noted that endogenous relationship in this case is also inevitable. Firms who do not want to access public debt market are not likely to have credit ratings. The results for non-rated firms should, therefore, be interpreted with caution.

To obtain a sample of non-rated firms, Datastream codes DEADUK 1-7 are used to extract the data for dead firms while Datastream code 'FBRIT' is used to extract data for all active firms. The data similar to rated firms extend over the period between 1989 and 2009. The initial sample contained 8,967 firms out of which 7,049/1,918 are dead/active firms (See Table 5.5 for sample selection steps). These firms are classified into 10 industries (Datastream code: ICBIN) to identify the financial firms. The classification reduces the number of firms to 6,013. A total of 1,320 firms with no industry classification available and 1,462 firms with missing accounting information during the sample period are also excluded from the sample.

As most of the explanatory and control variables are scaled by total assets, any firm that reports ‘zero’ total assets or where the data are not available for total assets had to be excluded from the sample. Out of the remaining 4,551 firms, 53 firms are deleted on this basis. Firms with no information available on total debt are also excluded although firms reporting ‘zero’ total debt remains part of the sample as they convey meaningful information. From the remaining sample, 285 firms were identified which had similar data but reappear with different codes. Such firms may distort the analysis by their double or triple inclusion and may underestimate the effects of explanatory or control variables, specifically for rated firms.

Table 5.5
Sample Selection Procedure

	Dead	Active	Sub-Total	Total
Initial Sample	7,049	1,918	8,967	8,967
(-)Firms with no industry classification available	1,319	1	1,320	
Financial Firms	1,147	487	1,634	
Firms with no accounting data available			1,462	
Firms with no total assets information			53	
Firms with no total debt information available			21	
Firms included more than one time			285	
Firms Rated by FITCH			8	
Firms Rated by Moody’s			3	
Rated firms with previous names appearing as separate firm			12	(4,798)
Final sample containing firms rated by Standard and Poor’s	**2,868**	**1,301**	**4,169**	**4,169**
(-) Firms rated by Standard and Poor’s	47	57	104	104
Non-rated Firms	**2822**	**1,244**	**4,065**	**4,065**
Firm-Year Observations				**42,872**

To ensure that the sample only comprises of non-rated firms, firms rated by the other two major rating agencies Moody’s and FITCH, are also eliminated from the sample. The credit rating data of the two rating agencies is extracted from their official databases.[17] As discussed earlier, these three credit rating agencies (Standard and Poor’s, Moody’s and FITCH) have the largest share of rating business in the UK and it is believed that the chances of error due to inclusion of rated firm by other small agencies is minimal.

FITCH only reports the current issuer rating data on their website and no historical information is available. There are potential chances of error that firms, which were

[17] Available at http://www.moodys.com and http://www.fitchratings.com

historically rated by FITCH, are not identifiable in the current database and are therefore not removed from the non-rated sample. However, after matching FITCH currently rated firms with Standard and Poor's and Moody's datasets, it is noted that most of the FITCH rated firms have also Moody's and/or Standard and Poor's ratings. This is likely to reduce any chances of erroneous inclusion of rated firms in the non-rated sample as those firms become part of the Moody's or Standard and Poor's sample set.

A total of 131 firms are rated by FITCH as on September 2009 out of which 48 firms have accounting data available from Datastream. FITCH ratings information contains details about the CUSIP, Ticker's, SIC code, GICS, NAICS of firms. Each firm is individually matched with Datastream firms ID's. Eight firms were identified as having ratings from FITCH but not Standard and Poor's and Moody's and are excluded from the sample. Data for firms rated by Moody's are also collected from their official website. A similar procedure is followed to eliminate rated firms from the sample. Three firms were identified which do not have ratings from Standard and Poor's or FITCH and are also removed.

Out of the remaining 4,181 firms, twelve firms were identified from FITCH, Moody's or Standard and Poor's databases with a different previous name. It is difficult to identify when they received a rating status or whether the rating status was before or after the change of their name. Therefore, these firms are excluded from the sample to ensure that the sample for 'NR' or code '6' only contains firms not rated by Standard and Poor's, Moody's or FITCH. The final sample consists of 4,169 firms which includes the 104 firms rated by Standard and Poor's. The total number of non-rated firms in the sample is 4,065. The final sample of 4,196 firms, without the exclusion of the 104 Standard and Poor's firms, is dominated by the industrial sector followed by consumer services sector (see Table 5.6). The utility sector only carries 2.3% weight (lowest) in the total sample, the inclusion of which is not expected to change the results significantly. To minimise any potential impact of the industry-level heterogeneity, industry dummies are also incorporated in the model (discussed in detail in Subsection 5.2.1.3).

The final dataset is an unbalanced panel dataset containing 42,872 firm-years observations. It should be noted that the sampling procedures followed in this study are more reliable than a majority of prior studies, as there are no minimum criteria for the firms to be selected in the sample. For example, Ozkan (2001) only included firms with at least 5 years of data available, De Miguel and Pindado (2001) for at least 6 consecutive years, and

Titman and Wessels (1988) and Auerbach (1985) amongst others, also excluded firms which did not have continuous data within the sample period. Prior studies, therefore, bias their sample towards large capitalisation firms. For this reason, the sample used in this study is large compared to that employed by previous studies on capital structure and debt maturity for UK firms (Ozkan, 2000, 2001 and 2002; Bevan and Danbolt, 2002 and 2004; Rajan and Zingales, 1995). This study, therefore, aims to provide results for a wider market capitalization of firms.

Table 5.6
Industry Classification of Sample Firms

	Dead	Activ	Total	% Weight
Basic Materials	284	155	439	10.53
Consumer Goods	376	100	476	11.42
Consumer Services	670	239	909	21.80
Health Care	194	97	291	6.98
Industrials	728	374	1102	26.43
Oil & Gas	116	126	242	5.80
Technology	341	159	500	11.99
Telecommunications	27	87	114	2.73
Utilities	71	25	96	2.30
Total	**2807**	**1362**	**4169**	**100**

5.2. Measures and Justification for Variables and Model specification

This section concentrates on justifying the approach used in the study, focusing on defining variables and specifying the model used. The section is further divided into three subsections: Subsection 5.2.1 defines explanatory and control variables for the credit rating and capital structure examination, Subsection 5.2.2 provides the details of the explanatory and control variables to examine the impact of potential and actual credit rating changes on capital structures, and Subsection 5.2.3 gives an explanation of the variables and models related to the credit rating and debt maturity structure of the firms. The control variables selected for the models are those which have, theoretically and empirically, been demonstrated in the prior literature to be significant in explaining the capital structure and debt maturity structure of firms in general and UK firms in particular (details of which can be found in Chapters 3 and 4).

5.2.1. Influence of Credit Rating on Capital Structure

The hypotheses H_{1a}, H_{1b} and H_{1c} presented in Chapter 3 jointly postulate a non-linear relationship between firms' credit rating and their capital structures; high and low rated firms are expected to have lower leverage compared to mid rated firms. To empirically test such relationships, *credit ratings* are integrated into models previously developed and tested by Rajan and Zingales (1995), Ozkan (2001) and Bevan and Danbolt (2002) for examination of UK firms' capital structures. The following subsection defines, discusses and justifies various elements of the models.

5.2.1.1. Dependent variable

The study uses the book debt ratio (scaled by total assets) as the main measure of capital structure.[18] Rajan and Zingales (1995) argue that the selection of the measure of leverage depends on the objective of the analysis. As credit ratings are incorporated into the previous models of capital structure, book debt ratios become more important when the relevance of credit rating is assessed relative to factors suggested by theories of capital structure including the trade-off and pecking order theories. For example, Banerjee *et al.* (2004) argue that at the time of debt issuance, changes in the market value of debt do not affect the cash saving from the interest tax shield of the firms. Also, in the case of bankruptcy, the book values of the firms' debt are taken as a measure of the firms' outstanding liabilities. Therefore, the implications of credit ratings can be evaluated more directly using book debt ratios rather than market debt ratios. Kisgen (2006) also points out that the rating agencies use book values of financial ratios to evaluate firms' creditworthiness.

Book values of debt are argued to be more realistic measures of capital structure as they are composed of the assets' value in place and are not the capitalised future value of assets (Myers, 1977). Taggart (1977) argues that firms' market value of debt can be the result of their actions, but the firms' book value is what firms control and use in their financial decision-making processes (also, Baskin, 1989; Marsh, 1982). When the choice of measure is concerned i.e., book debt ratio (the book value of debt scaled by book value of assets) versus market debt ratio (the book value of debt scaled by market value of assets), survey

[18] Accounting standards have changed over the 22 years sample period and this may affect the way in which debt and total assets are is measured. However, testing the relationship on an annual basis as well as regression analysis with time effects carried out in the study shows that the results are stable over time.

studies point towards the use of book debt ratio by firms' managers. A survey study of financial executives of French, Japanese, Dutch, Norwegian, and American firms by Stonehill *et al.* (1975), confirms the use of book debt ratios in managerial decision-making. In a more recent survey study, Graham and Harvey (2001) find that the market value of equity may not reflect the adjustments in the capital structure made by firms. They note that firms do not rebalance their capital structure in response to equity price movements suggesting that market leverage numbers may not be very important in debt decisions (also see, Bessler *et al.*, 2011).

Despite the above, theories of capital structure are mostly based on the market values of debt (Sweeney *et al.*, 1997; Bowman, 1980); the use of book debt ratio is prevalent in the empirical studies testing those theories (e.g., Titman and Wessels, 1988; Friend and Lang, 1998; Rajan and Zingales, 1995; Ozkan, 2001; Baker and Wurgler, 2002, amongst others). Nevertheless, Bowman (1980) also documents a high correlation between cross-sectional values of book and market debt ratios, which might suggest substituting book debt ratio for market debt ratios. It is likely that this will not have a significant impact on the inferences of the present study. More importantly, the unavailability of data also does not permit the use of market values of debt as a dependent variable. The present study therefore uses book debt ratio as the measurement of capital structure.

Four main empirical proxies are used by previous studies to measure capital structure: total book debt to total book assets (Rajan and Zingales, 1995; Ozkan, 2001; Bevan and Danbolt, 2002; Baker and Wurgler, 2002; Deesomsak *et al.*, 2004), total book debt to total market value of assets (Rajan and Zingales, 1995; Friend and Lang, 1998; Bevan and Danbolt, 2002) and total book long-term debt to either book value or market value of total assets (Titman and Wessels, 1988; Jong *et al.*, 2008). Jong *et al.* (2008) note that differences in the definitions do not have any material impact on the results and they maintain their consistency irrespective of the definition used. Bevan and Danbolt (2002) also find that the market and book measures of the simple debt ratio result in similar signs of coefficients, yet the fit of the model improves when market debt ratios are used instead. To be consistent with prior studies, the dependent variable is measured by book debt ratio where debt ratio is equal to the total debt (sum of short-term debt and long-term debt) scaled by the total assets of a firm, symbolically expressed as:

$$TDTA_{it} = \frac{TD_{it}}{TA_{it}}$$

Where:
$TDTA_{it}$ is the debt ratio of the firm i at time t
TD_{it} is the total book debt of the firm i at time t
TA_{it} is the total book value of the assets of the firm i at time t

The data for the book value of debt are extracted using Datastream code: WC03255, which defines total debt as *'all interest bearing and capitalised lease obligations. It is the sum of long and short term debt'.*[19] The book value of assets for industrial firms (Datastream code: WC02999) as defined by Datastream is *'the sum of total current assets, long term receivables, investment in unconsolidated subsidiaries, other investments, net property plant and equipment and other assets'.*

For a robustness check, the market debt ratio is also used, which is defined as:

$$MDR_{it} = \frac{TD_{it}}{TA_{it} - BVE_{it} + MVE_{it}}$$

Where:
MDR_{it} is the market debt ratio
BVE_{it} is the book value of equity (Datastream code: WC03501)
*MVE_{it} is the market value of equity (market price-year end*common shares outstanding, Datastream code: WC08002).*

Although firms' debts may be argued to be largely composed of long-term debt, and studies generally tend to use long-term debt ratios as a proxy for capital structure (e.g., Titman and Wessels, 1988; Jong *et al.*, 2008), a growing literature suggest that a debt maturity structure has different set determinants and that it should be recognised as separate from the capital structure. Therefore, the present study focuses on analysing the long-term debt ratios of firms separately from a capital structure analysis. Further discussion on the differences between debt ratio and debt maturity ratio is postponed until Subsection 5.2.3.1.

5.2.1.2. Explanatory Variable: Credit Rating

As discussed earlier, the present study uses the issuer's long-term credit ratings since they provide current opinions of rating agencies (at the time of ratings issuance) about firms'

[19] The data for total debt available from Datastream includes convertible debt.

overall ability to meet their financial obligations. Section 5.1.2 has already discussed the rationale for using long-term issuer credit rating data in detail, as well as the data sources for the sample selected.

The individual credit rating is matched with the financial year-end data to ensure that the credit rating always precedes fiscal year-end accounting data. During the data entry of credit ratings, several assumptions are made. First, following Kisgen (2006, 2009) and Hovakimian *et al.* (2009), the difference between the date of the rating and the financial year-end is assumed to be constant. The rating changes can be at any time during the year, whereas financial year-ends are usually between 31st December and 31st March for most UK firms. Kisgen (2006, 2009) and Hovakimian *et al.* (2009) implicitly assume that the period between rating changes and capital structure measures is the same for all firms. Second, in cases where firms have more than one rating change in their financial year, the latest, i.e., the one closest to the financial year-end, is assigned as the rating for that particular year. Third, any rating change on the last day of the financial year is treated as the rating for that particular year. For example, there were a few cases where the date of rating change and the firm's financial year-end were both on 31st March. Since the ratings are communicated to respective firms well before the ratings are announced to the public (Standard and Poor's, 2008), it is assumed that firms have enough time to make the necessary adjustments in their capital structures and therefore the rating is assigned to the same year.

Following a number of studies such as Barclay and Smith (1995), Stohs and Mauer (1996) and Hovakimian *et al.* (2009) amongst others, the main measure of credit ratings is constructed by assigning ordinal numerical codes to the rating agency's alphabetical codes. As shown in Column 2 of Table 5.7, the broad credit rating [AA+, AA, AA-], [A+, A, A] - to [B+, B, B-] are assigned codes from '1' to '5'. Non-rated firms are assigned code '6' and they fall in the lowest category due to assumptions made about their quality, credit worthiness and access to the capital markets (For detailed discussion, refer to Section 5.1.3).

It can be argued that cardinalising the credit ratings by the method discussed above may suffer from some instability issues within the scale. For example, the distance between the rating '1' and '2' might not be the same as the distance between rating '4' and '5'. This may raise issues in interpreting the results within the different broad ratings categories. To address the issue, two robustness checks are used. First, for the purpose of ensuring the reliability of the measure, another set of codes are also assigned to the same data (see Table 5.7, Column 3). Each individual rating is assigned a separate numerical code in an ascending order where code '16' is allocated to the non-rated firms. Previous studies are inconsistent regarding the use of both measures. For example, Hovakimian *et al.* (2009) use individual rating codes 1-19 whereas, Stohs and Mauer (1996) use codes for the broad credit rating and assigned 1-7 codes from highest to lowest credit rating. No preference of coding is noted from the previous studies. However, most studies, examining the influence of changes in credit rating on firm characteristics (Kisgen, 2006 and 2009) or movement of security prices (Goh and Ederington, 1993; Barron *et al.*, 1997), use the second method of coding due to the nature of their research questions. If the results of the second method of coding are similar to results found in the first method, this would show that the method followed does not exhibit any serious problem of stability within rating categories or unequal distances within the rating classes.

Table 5.7
Issuer's Long-term Ratings and Assigned Numerical Code

1	2	3
Credit ratings[20]	**Broad Rating coding**	**Individual Rating Coding**
AA+		1
AA	1	2
AA-		3
A+		4
A	2	5
A-		6
BBB+		7
BBB	3	8
BBB-		9
BB+		10
BB	4	11
BB-		12
B+		13
B	5	14
B-		15
NR	6	16

The second method to reduce potential concerns of unequal distances within rating classes is by constructing a dummy variable for each broad rating category. Each broad rating category [AA+, AA, AA-], [A+, A, A-] to NR is assigned '1' or '0' such that if the firm falls in the first broad category [AA+, AA, AA-], the dummy variable takes the value of

[20] See appendix (2A) for the definitions of the different ratings

‘1’ or ‘0’ otherwise. Similarly, dummy variables are constructed for all broad rating categories and the non-rated firms. The NR dummy takes the value of ‘1’ if the firm is rated and ‘0’ otherwise. The NR dummy, being the most representative category, is taken as a base category. It should be noted that AAA, CCC and CC have to be excluded, as there are no firm-years with these ratings within the sample period. Since this method does not make assumptions regarding the distance between categories, it is likely to eliminate the problem of unequal distances caused by ordinal scale constructed for credit rating.

5.2.1.3. Control variables

The variables chosen are the firm specific factors which have previously been found to explain the capital structure of the firms in general and of the UK firms in particular. These factors, as Frank and Goyal (2003) argue, are a conventional set of factors which explain capital structure choices as they have sustained many tests and have a conventional interpretation. It is acknowledged that there may be many omitted variables not controlled for in the model. For example, Rajan and Zingales (1995) argue that firms’ specific variables are significant, yet the role of country specific variables can also be potentially important in explaining the capital structure of firms. Similarly, Demirguc-Kunt and Maksimovic (1999), Fan *et al.* (2011) and Jong *et al.* (2008) also find that country specific variables play an important role in determining the capital structures of the firms around the world. The country specific variables along with other extraneous firm-level variables may have impacts on the relationship proposed. However, they are not included in the model due to lack of theoretical link as well as to limit the scope of the study due to time constraints. In addition, since the sample is based only on UK firms, country specific factors presumably will not have any impact on cross sectional variation.

Control variables in the present study include: size (LOS), profitability (PROF), tangibility or fixed assets ratio (FAR), growth opportunities (MBR), liquidity (LIQD) and industry dummies ($TECH_{dum}$, IND_{dum}, CS_{dum}, CG_{dum}, HC_{dum}, UTL_{dum}, BM_{dum}, and OG_{dum}). A rating dummy (RAT_{dum}) is also included in the model to understand whether the non-linear relationship (if proved) is dependent on the inclusion of non-rated firms only. Chapters 2 and 3 provide the justification for the use of these control variables, while the following subsections present the definitions of the control variables and discuss the weaknesses, if any, associated with the use of these variables.

i. Size (LOS)

As discussed in Section 3.2.1, the size of the firm is expected to have a positive relationship with the leverage of the firm. In the literature on capital structure, three main proxies are used to capture the size effect: log of sales, log of assets and log of market capitalization. Specifically, for determining the capital structure of the firms, log of sales or log of assets are extensively used by prior studies. Past studies do not report any significant difference in the results when the proxies are interchanged (Titman and Wessels (1988), and, more recently, Frank and Goyal (2009)). Frank and Goyal (2009) and Titman and Wessels (1988) report a correlation between log of sales and log of assets of 0.92 and 0.98, respectively. However, in the final reported regression results, Titman and Wessels (1988) use log of sales to measure the size of the firms. Similarly, Rajan and Zingales (1995), Booth *et al.* (2001), Bevan and Danbolt (2002, 2004), Ozkan (2001), Barclay and Smith (2005) and Hovakimian *et al.* (2009) use log of sales, whereas Fama and French (2002), Deesomsak *et al.* (2004), Fan *et al.* (2011) and Jong *et al.* (2008) employ log of assets to capture the size of the firms. It is noted that there is no consistency in the use of any single proxy for size or any justification for their preference. It is therefore left at the discretion of the researcher to choose between these commonly used proxies. To be consistent with prior studies on UK firms (Rajan and Zingales, 1995; Booth *et al.*, 2001; Danbolt, 2002, 2004; Ozkan, 2001), the present study uses *log of sales* to capture the size effect in the model. It is symbolically represented as LOS_{it}, where LOS_{it} is the natural logarithm of sales or revenue (Datastream code: WC01001). Note that the correlation coefficient of log of sales and log of assets for the present sample is 0.95 (p-value<1%). It is likely that the use of log of assets or sales will not lead to any material differences in the results.

ii. Profitability (PROF)

The study tests the implications of the pecking order theory, which suggests a negative relationship between profitability and a firm's leverage. The proxy of profitability used in this study is identical to the measure used in prior studies to maintain consistency in the model. Following previous studies (Titman and Wessels, 1988; Baskin, 1989; Rajan and Zingales, 1995; Booth *et al.*, 2001; Bevan and Danbolt, 2002 and 2004; Frank and Goyal, 2003; Barclay *et al.*, 2003; Jong *et al.*, 2008; and Fan *et al.*, 2011), profitability is measured as earnings before interest, taxes, depreciation and amortisation, scaled by the total assets of the firm *i* in time *t*, symbolically this is represented as:

$$PROF_{it} = \frac{EBITDA_{it}}{TA_{it}}$$

Where:
$EBITDA_{it}$ *is the earnings before interest, taxes and depreciation (Datastream code: WC18198)*
TA_{it} *is the total assets of the firm i at time t (Datastream code: WC02999)*

iii. Tangibility/ Fixed Assets Ratio (FAR)

Tangibility of assets is regarded as the level of collateral the firms have when they seek external financing. Therefore, tangibility is expected to have a positive association with the leverage of the firms. There has been consensus in the usage of tangibility measures by previous studies (Titman and Wessels, 1988; Rajan and Zingales, 1995; Bevan and Danbolt, 2002; Booth *et al.,* 2001; Deesomsak *et al.,* 2004; and Jong *et al.*, 2008). Following these studies, tangibility is measured as the ratio of the net value of property, plant and equipment by the total assets of the firm, symbolically represented as:

$$TANG_{it} = \frac{PPE_{it}}{TA_{it}}$$

Where:
PPE_{it} *is the net value of property, plant and equipment of firm i at time t (Datastream code:WC02501)*
TA_{it} *is total assets of firm i at time t*

iv. Growth Opportunities (MBR)

Among the proxies widely used by prior studies to capture the investment opportunities set is the market to book value of assets (Rajan and Zingales, 1995; Booth *et al.,* 2001; Fama and French, 2002; Bevan and Danbolt, 2002, 2004; Frank and Goyal, 2009; and Jong *et al.*, 2008). This measure may effectively proxy the investment opportunities set a firm has, as in an efficient capital market the share prices should reflect all the available information and they will capture the capitalised value of future growth opportunities. The balance sheet value of assets does not capture intangibles, such as the option of project expansions, acquisitions of other firms, investment in new product, spending on research and development, and advertising. Such options may increase the market value of the firm's assets relative to the book values reflected in the market prices (Barclay and Smith, 1995).

Adam and Goyal (2008) compare different proxies of investment opportunities and conclude that the market to book value of assets is the most suitable proxy as it has '*the highest information content with respect to investment opportunities'* (p.41). Following previous literature, the investment opportunity set of firms is measured by the ratio of the market value of the assets, divided by the book value of the assets. Market to book value is symbolically represented as:

$$MBR_{it} = \frac{BVA_{it} - BVE_{it} + MVE_{it}}{BVA_{it}}$$

Where:
BVA_{it} *is the book value of the assets (Datastream code: WC02999)*
BVE_{it} *is the book value of the equity (Datastream code: WC03995)*
MVE_{it} *is the market value of equity (Datastream code: WC08002)*

v. Liquidity (LIQD)

The most common proxy used to measure liquidity, is the current ratio defined as current assets divided by current liabilities (Ozkan, 2001; Deesomsak *et al.*, 2004; Jong *et al.*, 2008). It is a rough measure to observe the ability of a firm to meet its obligations when they come due. In line with the prior literature, liquidity of the firms is proxied by the ratio of current asset to current liabilities, symbolically represented as:

$$LIQD_{it} = \frac{CA_{it}}{CL_{it}}$$

Where:
CA_{it} *is the total current assets of the firm (Datastream Code: WC0220)*
CL_{it} *is the total current liabilities of the firm (Datastream Code: WC03101)*

vi. Industry Dummies

Industry dummies are constructed on the basis of the industry classifications available from Datastream (Datastream code: ICBIN). As discussed in Section 5.1.2.3, Datastream code ICBIN classifies industries into nine categories, after excluding financial firms. Eight industry dummies are created: technology ($TECH_{dum}$), industrial (IND_{dum}), consumer services (CS_{dum}), consumer goods (CG_{dum}), health care (HC_{dum}), utility (UTL_{dum}), basic material (BM_{dum}) and oil and gas (OG_{dum}), leaving telecommunication as the base industry in order to avoid the dummy-variable trap.

vii. Rating Dummy (RAT_{dum})

Subsection 5.2.1.2 above mentions that non-rated firms are assumed to have relatively restricted access to debt markets compared with rated firms. With or without the inclusion of non-rated firms, it is hypothesised that firms' credit ratings have a non-linear relationship with firms' leverage. The introduction of a rating dummy in the model isolates the effect of actual credit ratings on leverage and observes whether the non-monotonous relationship (if proved) is driven by the inclusion of a large sample of non-rated firms. The rating dummy (symbolically represented as RAT_{dum}) takes the value of '1' if the firm is rated, and '0' otherwise.

5.2.1.4. Model Specification and Estimation Techniques

To test the potential relationship of credit rating and capital structure, Pooled Ordinary Least Square Regression (OLS) is applied. Equation 1 shows the OLS specification of the model. The components of the model, as stated earlier, are similar to previous studies investigating the capital structure of firms, with additions of the omitted variables deemed important to the capital structure model (i.e., industry dummies and a measure of the liquidity of the firms). Credit rating and its squared form are added to the previously tested models to empirically analyse the relevance of credit ratings in capital structure determination.

The hypotheses to be tested were presented in Section 3.6 of Chapter 3. H_{1a}, H_{1b} and H_{1c} jointly postulate a non-monotonous, inverted U-shaped relationship between credit rating and capital structure, restated here:

> **H_{1a} = *Other things being equal, low rated firms are likely to have low levels of leverage in their capital structure.***
>
> **H_{1b} = *Other things being equal, high rated firms are likely to have low levels of leverage in their capital structures.***
>
> **H_{1c} = *Other things being equal, mid rated firms are likely to have high levels of leverage in their capital structures.***

To empirically test the above hypotheses, the debt ratio is estimated as a function of credit ratings, as specified below:

$$TDTA_{i,t} = \beta_0 + \beta_1 CR_{i,t} + \beta_2 CR_{i,t}^2 + \sum_{i=1}^{n} \beta_i X_{i,t} + \varepsilon_{i,t} \quad ...(1)$$

Where:

$TDTA_{i,t}$	*is the debt ratio of a firm*
β_0	*is a constant term*
$CR_{i,t}$	*is the credit rating of the firm, with cardinalzed values of 1,2,…5, where AA=1 to B=5, or with cardinalzed values of 1,2,…6, where AA=1 to B=5 and NR=6*
$CR_{i,t}^2$	*is the square of the credit rating*
$X_{i,t}$	*represents control variables: size (LOS), profitability (PROF), tangibility or fixed assets ratio (FAR), growth opportunities (MBR), liquidity (LIQD) and industry dummies (technology ($TECH_{dum}$), Industrial (IND_{dum}), consumer service(CS_{dum}), consumer goods (CG_{dum}), health care (HC_{dum}), utility (UTL_{dum}), basic material (BM_{dum}), oil& gas (OG_{dum}) and Rating dummy (RAT_{dum})*

It is expected that $\beta_1 > 0$ and $\beta_2 < 0$ and that the coefficients are significantly different from zero. For the model presented above, two samples are used: a sample of rated firms only and a sample of both rated and non-rated firms. As the data are pooled with cross-sectional and time series elements combined together, pooled ordinary least squares (OLS) will be used to analyse the models. OLS, specifically pooled OLS, is extensively used in capital structure literature (e.g., Berger *et al.*, 1997; Shyam-Sunder and Myers, 1999; Ozkan, 2001; Booth *et al.*, 2001; Bevan and Danbolt, 2002; Jong *et al.*, 2008; Deesomsak *et al.*, 2004; Frank and Goyal, 2009). For comparison purposes, and to be consistent with prior literature, specifically with studies investigating the relationship between credit ratings and capital structures (see Faulkender and Petersen, 2006; Kisgen, 2006, 2009; Tang, 2009, Hovakimian *et al.*, 2009; Judge and Mateus, 2009; Mittoo and Zhang, 2010), it seems appropriate to use OLS as one of the main estimation techniques. However, where the analysis is affected by the limitation of OLS and/or the assumptions of OLS are not satisfied, other estimation techniques such as two-stage least squares will also be used.

OLS rests on several assumptions, one of them being the linearity of parameters. OLS assumes that the regression model is linear in parameters or coefficients. Although linearity in parameters is essential, it does not imply that there should be linearity in the variables as well (Studenmund, 2000). A model may have non-linearity in the variables and it can still be estimated through OLS. In this case, CR is expected to have a non-linear relationship with the dependent variable, and a second degree polynomial form (also called quadratic functional form) is used to quantify the relationship. The model thus remains linear in parameters, regardless that it is non-linear in variables; it does not, therefore, violate the assumption of 'linearity in parameters'. Other assumptions of OLS include the normality of data, and no heteroskedasticity, multicollinearity or serial correlation. Prior to the analysis, tests will be conducted to ascertain whether the data satisfies the assumptions of OLS. Diagnostic tests including examination for the normality of data using visual aids, descriptive statistics of variables, and correlation analysis, VIF and Eigen values, amongst others, will be used to identify any problems with the data. Chapter 6 will provide a detailed discussion of any possible violations of OLS assumptions, their implications, and counteractive measures.

5.2.2. Potential and Actual Credit Rating Change and Capital Structure

The second and third research objectives of the study are to test whether the potential and actual rating changes, respectively, may have an impact on capital structures of the firms. In an attempt to test the predictive ability of potential and actual credit rating changes in influencing firms' debt ratios, the subsections below present the measures for dependent, explanatory and control variables, along with the model specifications.

5.2.2.1. Dependent variable

Potential and actual credit rating changes may force firms to make necessary adjustments to circumvent any possibility of downgrades and enhance the chances of upgrades (Kisgen, 2006). One of the important adjustments firms can make is to the amount of debt they employ, as this factor is argued to influence their credit ratings. Kisgen (2006) finds that firms engage in debt reducing behaviour when they are faced with potential rating changes and continue with the same behaviour even after they have actually been downgraded. Following Kisgen (2006), the present study also hypothesises that potential credit rating changes may have a negative impact on debt ratios, with firms more likely to reduce their amount of leverage when they are expecting a downgrade or an upgrade in the periods to come. Firms faced with actual downgrades are more likely to continue with this behaviour, while rating upgrades are not likely to have an impact on the capital structure of the firms.

To analyse this supposition, two measures of the dependent variable are used. The first measure is the change in the debt ratio, constructed from the balance sheet information. Change in the debt ratio is calculated by the difference of the total debt between time *t* and *t*-1 of firm *i*, scaled by the total assets at time *t*-1, and which is symbolically represented as:

$$\Delta DR_{it} = \frac{TD_{it} - TD_{i,t-1}}{TA_{i,t-1}}$$

The second measure is constructed with cash flow data, which is argued to be a more thorough measure of debt issuance and reduction (Kisgen, 2006). Although these measures are not accurate substitutes for the incremental debt issuance approach, they may provide a more precise estimation of capital structure changes than can be found from simple balance sheet ratios. To elaborate, MacKie-Masson (1990) argues that simple debt ratios are computed with annual balance sheet data and therefore these ratios represent a cumulative outcome of several separate decisions made in the past. Therefore, these ratios may not be appropriate for investigating the effects of a particular event on subsequent financial decisions. Ideally, to understand the effect of potential or actual credit rating changes on financial decisions, incremental issuance data should be used. Studying individual security issuance and purchases may help to understand actual decision making prompted by a specific event (MacKie-Mason, 1990). However, due to data unavailability and in order to be consistent with Kisgen (2006, 2009), the study has to rely on the accounting information contained in financial statements.

Moreover, changes in debt ratios constructed from balance sheet data may contain non-cash changes such as accretion of debt which had initially been issued at discount, differences in marking to market of hedging instruments includable with the debt (e.g., if the hedging instrument is related to debt), or differences in foreign debt due to fluctuation in exchange rates (Kisgen, 2006). Such items may not truly represent any capital structure activity, though they are included in the debt ratio calculated from the balance sheet data. To avoid such misspecifications, a cashflow measure is also used. This measure is likely to better capture the relationship hypothesised for potential and actual credit rating on capital structure as being a direct measure of specific debt issuance and reduction activity. Kisgen (2006) uses both cashflow and balance sheet debt ratios and finds that both the measures produce similar results, although the significance of the measures constructed from balance sheet data is reduced in some cases. Following Kisgen (2006, 2009) the measure is calculated as:

$$KDR_{i,t} = \frac{\Delta L_{i,t} - \Delta E_{i,t}}{TA_{i,t-1}}$$

Where:
KDR is the net debt issuance termed after Kisgen's (2006, 2009) dependent variable as the Kisgen Debt Ratio (KDR)
$\Delta L_{i,t}$ *is long term borrowings (Datastream code:WC04401) minus long-term debt reduction (Datastream code: WC04701) plus increase/decrease in short-term borrowings (Datastream code: WC04821)*
$\Delta E_{i,t}$ *is the net proceeds from sale/issue of common stock (Datastream code:WC04251) minus common/preferred redeemed, retired, converted etc (Datastream code: WC04751)*
$TA_{i,t-1}$ *is the total asset of the firm i at time t-1*

KDR measures the net debt issuance activity of a firm. For example, if a firm issues equal amounts of debt and equity in a specific year, KDR would be zero. If KDR is positive, it would suggest that firms have issued more debt than equity as a proportion of previous year's total assets (i.e., ΔL>ΔE) and *vice versa*. To further distinguish the real financial decisions, which might have taken place following an event, certain criteria have to be laid down. For example, previous studies (Berger *et al.,* 1997; Hovakimian *et al.,* 2001; Korajczyk and Levy, 2003 and Leary and Roberts, 2005) apply a 5% cut-off for the ratio in order to distinguish a real financial decision from any other change in the capital structure not triggered by any specific event. The assumption underlying such a cut-off level is that when firms issue or reduce debt by 5% or more, it should be apparent that a capital structure decision has taken place, which can be distinguished from a small change in the level of debt due to other factors. The cut-off of 5%, although arbitrary, has been shown to produce similar results when analysis is carried out using debt and equity issuances data (Hovakimian *et al.*, 2001). However, in a few instances, Hovakimian *et al.* (2001) also find misspecification using this procedure.

Following Kisgen (2009), binary variables are constructed by splitting the KDR into four separate variables: debt issuance, debt reduction, equity issuance and equity reduction. These are expected to provide further insight into capital structure activities, by analysing each activity individually. Debt issuance according to the criterion is defined as the case where an increase in long-term borrowing is greater than 5% of the total asset of the previous year. If the condition is satisfied, the variable takes the value of '1', or '0' otherwise. Likewise, debt reduction is also a binary variable, which takes the value of '1' if the reduction in the long-term debt is greater than 5% of the total assets. Equity issuance and equity reduction are also defined in a similar manner. Although the 5% cut-off is empirically justified, for the purpose of robustness checks, a 2.5% cut-off is also used to define various financing spikes.

5.2.2.2. Explanatory Variables

The following subsections discuss the proxies used to measure potential and actual credit rating changes. Along with their definitions, the possible limitations of these measures are also discussed.

i. Potential Credit Rating Change

As stated in Subsections 2.1.2 and 5.2.1.2, credit ratings from Standard and Poor's have broad rating categories and within each rating category, symbolic modifiers are assigned to distinguish the firms within one broad rating class. For example, a firm with broad rating category BBB can have any of the three modifiers, BBB+, BBB or BBB-, within this category. Following Kisgen (2006), it is assumed that firms are more likely to be upgraded to the immediately higher broad rating category when they have a '+' sign with their credit rating and are more likely to fall into the next broad category when they have a '-' modifier with their rating. In this case, for example, BBB+ is more likely to achieve an upgrade to the next higher broad category 'A'. Similarly, firms assigned BBB- are expected to be more careful as they are relatively more likely to be downgraded to BB. Consequently, firms with BBB+ and BBB- are expected to have debt reducing behaviour to achieve an upgrade or to avoid downgrade in the subsequent period. There are three proxies to test the impact of potential credit rating change on capital structure: $POM_{i,\ t-1}$, $PLUS_{\ i,\ t-1}$ and $MINUS_{\ i,\ t-1}$. They are dummy variables, where $POM_{\ i,\ t-1}$ is a joint proxy which takes the value of 1 if the firm has a plus or minus sign with its rating, and '0' otherwise. $PLUS_{\ i,\ t-1}$ and $MINUS_{\ i,\ t-1}$ are individual proxies, and are binary variables which take the value of '1' if credit rating has a '+' or a '-' sign, respectively, in the previous period, and '0' otherwise.

This classification scheme is subject to a methodological limitation. The classification scheme assumes that firms are only careful about the changes from one broad rating category to another and are not very concerned about the rating changes within the categories. Another limitation of the measure is that it may not truly capture what it is intended to measure. For example, a strong BBB- may have more chance of gaining an upgrade than a weak BBB+. If this is the case, then the basic assumption underlying the measure will not suffice and it may require more sophisticated measures to capture the potential rating changes. There are two possible measures, which can be used as a proxy of the potential rating change: CreditWatch and Rating Outlooks; however, due to the technical limitations of these measures (discussed below) they are not incorporated in this study.

Credit ratings are placed on CreditWatch if any unexpected event has occurred or when there is a likelihood that it will occur and additional information is necessary to confirm or change the rating. The CreditWatch status lasts less than 90 days and is resolved in most of the cases within this period (Standard and Poor's, 2010b). The nature of the variable is therefore not suitable as a proxy for potential credit rating changes for this study, since these changes are temporary and the status is expected to be resolved within a short period. On the other hand, Outlooks are for a longer time horizon. However, they incorporate trends and developments which have less impact on credit quality compared to CreditWatch (Standard and Poor's, 2010b). Additionally, the data for Outlooks is difficult to isolate from CreditWatch in the main dataset acquired from Standard and Poor's ratings. For these reasons, and for the comparison purposes with prior studies from the US market, potential credit rating changes are measured in a similar manner to Kisgen (2006). It is admitted that the proxy might be noisy but it has some potential to capture the effect the phenomenon it is intended to measure, as depicted by Kisgen's (2006) study.

ii. Actual Credit Rating Change

It is hypothesised (hypotheses 3a and 3b) that firms, which were downgraded in the previous period, have a higher likelihood of decreasing the amount of leverage compared to counterpart firms that were not downgraded. On the other hand, firms which were upgraded in the previous period are expected not to change their leverage significantly, due to the benefits attached with rating upgrades. The actual credit rating changes are measured by two dummy variables, $UG_{i, t-1}$ and $DG_{i, t-1}$. These explanatory variables are lagged to reduce the potential endogeneity issues. The $UG_{i, t-1}$ dummy takes the value of '1', if a firm was upgraded in the previous year, and '0' otherwise. Similarly, for $DG_{i, t-1}$, the dummy takes the value of '1', if a firm was been downgraded in the previous year, and '0' otherwise.

5.2.2.3. Control variables

Kisgen (2006, 2009) employs a set of control variables, which have been demonstrated in prior literature to be important in capital structure decisions. This helps in analysing the relative importance and impact of each variable of interest on the response variable. Following Kisgen, the set of control variables for the present study are the same as those discussed in Subsection 5.2.1.3 above for UK firms. The basic model used to analyse the impact of potential credit rating changes and actual credit rating changes remains the same for both cases except for the proxies for potential and actual credit rating. Given that the dependent variables are measured as change variables and binary variables, the control variables are also measured in changes rather than levels. The control variables for the model are: lagged changes in size ($\Delta LOA_{i,\,t-1}$), profitability ($\Delta PROF_{i,\,t-1}$), tangibility or fixed assets ratio ($\Delta FAR_{i,\,t-1}$), growth opportunities ($\Delta MBR_{i,\,t-1}$) and liquidity ($\Delta LIQD_{i,\,t-1}$). Changes in the ratios are calculated by the difference such as $\Delta PROF_{i,\,t-1}$ is $PROF_{i,\,t-1}$ minus $PROF_{i,\,t-2}$. Kisgen (2009) also uses a similar procedure to calculate change in the variables. However, for the purpose of comparison with Kisgen's studies, the analysis will also be carried out using the set of control variables employed in Kisgen's 2006 and 2009 models.

5.2.2.4. Model Specification

This section specifies the models for estimating the effect of potential and actual credit rating changes. Hypotheses 2a, 2b and 2c state that:

H_{2a} = *Other things being equal, firms with a higher likelihood of rating changes are more likely to reduce the amount of leverage.*

H_{2b} = *Other things being equal, firms with a higher likelihood of downgrade are more likely to reduce the amount of leverage.*

H_{2c}= *Other things being equal, firms with a higher likelihood of upgrade are more likely to reduce the amount of leverage.*

The following equation models the OLS specification for the relationship. Coefficients of POM $_{i,t-i}$, PLUS $_{i,t-i}$ and MINUS $_{i,t-i}$ are expected to have a negative relationship with the change in debt. All the explanatory and control variables are lagged by one year.

$$\Delta DR_{i,t} = \beta_0 + \beta_1 POM_{i,t-1} + \sum_{i=1}^{n} \beta_i \Delta X_{i,t-1} + \varepsilon_{i,t-1} \quad \text{(2a)}$$

$$\Delta DR_{i,t} = \beta_0 + \beta_1 PLUS_{i,t-1} + \beta_2 MINUS_{i,t-1} + \sum_{i=1}^{n} \beta_i \Delta X_{i,t-1} + \varepsilon_{i,t-1} \quad \text{(2b)}$$

Where:

$\Delta DR_{i,t}$	*is the change in debt ratio either measured by change in simple debt ratio (CDR) or net debt issuance (KDR)*
β_0	*is the constant term*
$POM_{i,\ t-1}$	*a dummy variable which takes the value of 1 if a firm as a '+' or a '– 'sign with its credit rating in the previous year or zero otherwise*
$PLUS_{i,\ t-1}$	*is a dummy variable taking the value of 1 if firm has a '+' sign with its credit rating in the previous year or zero otherwise*
$MINUS_{i,\ t-1}$	*a dummy variable taking the value of 1 if the firm has a '–' sign with its credit rating in the previous year or zero otherwise*
$X_{i,t-1}$	*is a set of control variables including lag change in log of sales (ΔLOS_{t-1}), lag change in profitability ratio ($\Delta PROF_{t-1}$), lag change in fixed assets ratio (ΔFAR_{t-1}), lag change in market to book value (ΔMBR_{t-1}) and lag change in liquidity ratio($\Delta LIQD_{t-1}$)*

As discussed in Section 5.2.2.1, the individual components of Kisgen's Debt Ratio (KDR) are also tested in order to provide a detailed examination of the effects of rating changes on capital structure activities. As dependent variables are binary in nature, they are analysed by logistic regressions. Logistic regression is an appropriate model to test such relationships, as it has the ability to predict the likelihood of certain events occurring. Further, logistic regression also requires less restrictive assumptions than OLS as homogeneity of variance and normality of errors are not assumed. Logistic regressions, however, do require other assumptions than OLS (Menard, 2001). Diagnostic tests are performed to ensure that the assumptions of logistic regression are fully met. The general relationship to be tested is presented in logistic function as:

$$Log\left(\frac{\rho}{1-\rho}\right) = Logit\ (\rho) = \beta_0 + \beta_1 PLUS_{i,t-1} + \beta_2 MINUS_{i,t-1} + \sum_{i=1}^{n} \beta_i X_{i,t-1} \ \textbf{...(3)}$$

The above equation shows the general relationship of a potential credit rating downgrade or upgrade with the likelihood of any capital structure activity. The above equation can be split into four separate models, for debt issuance, debt reduction, equity issuance and equity reduction. In the above logistic function, ρ is the probability of success which represents the probability that the firm will issue 5% or more debt, reduce 5% or more debt, issue 5% or more equity or reduce 5% or more equity, depending on the formulation of the model. $\frac{\rho}{1-\rho}$ represents the odd of ρ, β_2 is the coefficient of potential upgrade (PLUS) and β_3 is the coefficient of potential downgrade (MINUS). The *credit rating – capital structure hypothesis* (CR-CS) predicts a higher likelihood of debt reduction and equity issuance and a lower likelihood of debt issuance and equity reduction if firms have higher probability of rating changes.

The actual credit rating changes can be modelled in a similar manner to the potential rating changes. The hypothesis H_{3a} postulates a negative relationship between an actual credit rating downgrade and the subsequent year's debt ratios, while H_{3b} predicts a significant change in capital structure when firms are upgraded. The hypotheses are restated here as:

H*3a* = *Other things being equal, downgraded firms will decrease the amount of leverage in their capital structure.*

H*3b* = *Other things being equal, upgraded firms are likely to have significant change in their capital structure.*

Similar procedures for analysing the impact of potential credit rating changes are followed in order to test the impact of actual credit rating changes on capital structure activities. The first specification is therefore an OLS regression equation which tests the relationship between an actual credit rating change and changes in debt ratios in the subsequent year. The model is specified below as:

$$\Delta DR_{i,t} = \beta_0 + \beta_1 UG_{i,t-1} + \beta_2 DG_{i,t-1} + \sum_{i=1}^{n} \beta_i X_{i,t-1} + \varepsilon_{i,t-1} \ldots \textbf{(4)}$$

Where:

ΔDR	*is the change in debt ratio either measured by change in simple debt ratio (CDR) or net debt issuance (KDR)*
β_0	*is the constant term*
$UG_{i,\,t-1}$	*a dummy variable which takes the value of 1 if a firm was upgraded in the previous year or zero otherwise*
$DG_{i,\,t-1}$	*is a dummy variable taking the value of 1 if firm was downgraded in the previous year or zero otherwise*
$X_{i,t-1}$	*is a set of control variables including lag change in log of sales (ΔLOS_{t-1}), lag change in profitability ratio ($\Delta PROF_{t-1}$), lag change in fixed assets ratio (ΔFAR_{t-1}), lag change in market to book value (ΔMBR_{t-1}) and lag change in liquidity ratio($\Delta LIQD_{t-1}$)*

The coefficient of $DG_{i,t-1}$, β_2, is expected to have a significant negative relationship, whereas the coefficient of $UG_{i,t-1}$, β_1, is expected not to be significantly different from zero. Similar to Equations 2 to 4, the set of control variables are measured in changes rather than levels and all explanatory and control variables are lagged by one year to avoid any possible endogeneity problems or spurious correlation.

Similar to the procedure followed for potential credit rating changes, an in-depth analysis is also carried out by individually testing each component of KDR through the logistic regression models to understand the capital structure activities of the UK firms. The general logistic model is specified as:

$$Log\left(\frac{\rho}{1-\rho}\right) = Logit\ (\rho) = \beta_0 + \beta_1 UG_{i,t-1} + \beta_2 DG_{i,t-1} + \sum_{i=1}^{n} \beta_i X_{i,t-1} \textbf{ ... (5)}$$

$\dfrac{\rho}{1-\rho}$ is the odds of 5% or more debt issuance, debt reduction, equity issuance and equity reduction. These individual tests, in the case of either potential or actual credit rating changes, do not suggest any specific capital structure activity as they are only intended as an elaboration of what kind of mechanism firms choose to alter their capital structure if they are faced with rating changes. Also, these tests are used to assess the relative predictive ability of rating changes when compared with factors proposed by traditional theories of capital structure. However, the *credit-rating capital structure hypothesis* predicts a higher likelihood of debt reduction and equity issuance and a lower likelihood of debt issuance and equity reduction following a downgrade.

5.2.3. Influence of Credit Rating on Debt Maturity Structure

The fourth objective of the study is to examine the relationship between credit ratings and the debt maturity structures of UK firms. This section stipulates the dependent, explanatory and control variables for testing the potential impact of credit ratings on the debt maturity structure of the firms.

5.2.3.1. Dependent variable

It is hypothesised (hypothesis H_4) that the credit rating of a firm is expected to have an inverted U-shaped relationship with its debt maturity structure, where the debt maturity structure can be defined as the proportion of long-term debt in the total debt of a firm. It is measured by several different proxies in the prior empirical studies investigating the determinants of maturity structure. Similarly to capital structure measures, no single definition is generally accepted or commonly used. Prior studies on capital structure (Titman and Wessels, 1988; Jong *et al.*, 2008) use a long-term debt ratio measured by total long-term debt to total assets, to proxy the capital structure. Such measures might work well to understand the capital structure but it should be noted that they might provide only a limited understanding of the debt maturity structure of the firms. The long-term debt ratio may change due to variations in equity, while no long-term debt issuance or reduction decision has in fact taken place. Moreover, the specification does not provide a clear representation of the variations of long and short-term debt due to firm characteristics (Barclay and Smith, 1995). On the other hand, the ratio of long-term debt to total debt may offer an exhaustive measure to identify the use of long-term debt and short-term debt as a proportion of total debt and how firm characteristics influence the choice between the two.

Although there is no established measure for debt maturity structures, two main approaches are followed in the literature for measuring the maturity of the capital structure: (1) the balance sheet approach and (2) the incremental debt issuance approach. The balance sheet approach, which involves using balance sheet information concerning the long-term debt proportion within a capital structure, is dominant in the prior studies, with several variations in the definitions within this approach. For instance, Scherr and Hulburt (2001), Antoniou *et al.* (2006), Cai *et al.* (2008) and Fan *et al.* (2011) regard debt as long-term if it is payable in more than one year, Barclay and Smith (1995) consider debt to be long-term if it is payable in more than three years, while Schiantarelli and Sembenelli (1997) and

Ozkan (2000 and 2002) use a five years criteria. Since balance sheet maturity ratios cannot distinguish between debt maturing within alternative periods (i.e., no distinction is made between debt maturing in 3 years and in 20 years), Stohs and Mauer (1996) and Scherr and Hulburt (2001) use an average maturity of a firm's liabilities to proxy the debt maturity structure.[21] Although superior to the rest of the maturity measurements, due to the data unavailability and the complexity of the measure it has not been used frequently in maturity structure literature.

The incremental debt issuance approach for measuring debt maturity structures has received little importance in the debt maturity structure literature compared to capital structure literature. A few studies have used long-term debt issuance data (e.g., Guedes and Opler, 1996). Each approach has its own advantages and limitations, all of which need to be considered. For example, for signalling models for debt maturity structure, incremental debt issuance is more suitable as these models are based on informational asymmetry issues between management and outsiders. However, the approach is not suitable for theories such as the maturity matching theory since the maturity of the new issuance might be quite different from the present assets structure (Guedes and Opler, 1996). Debt issuance data also poses limitations because of the variations in debt issue characteristics (Rokkanen, 2010) and when issuance data is matched with the firm level characteristics, whose data are less frequently available.

Ideally, for testing Diamond's theory for the credit rating – maturity structure relationship, incremental debt issuance data should be used. Diamond's theory is based on two periods, where firms, in the presence of information asymmetry, select maturity structures based on the liquidity risk they face. This would require firms to make decisions about the maturity structure of their debt given the occurrence of such conditions. Given that the ratios calculated from balance sheet data are likely to be a mixture of several maturity structure decisions accumulated over the years, it would be difficult to isolate the effect for any given occurrence of such risk. This may underestimate the effects of liquidity risk on maturity structure decisions and may also pose problems in the interpretation of the results. However, due to the unavailability of incremental debt issuance data, the present study has to rely on the balance sheet approach.

[21] The weight average maturity ratio is calculated by weighing the average maturities of all individual debt instruments, debt like obligations such as capital and operating leases and current liabilities.

In analysing the effects of credit ratings on the debt maturity structure of firms, the debt maturity ratio is calculated as the ratio of long-term debt payable in more than one year, scaled by the total debt of the firm in that particular year. Datastream also offers some data for debt payable in more than one year, debt due in 2-5 years, in 6-10 years and over 10 years. However, Datastream only infrequently reports debt values within each maturity band. Whether this is due to the data being missing or not fully reported, it is difficult to economically identify the information. Therefore, previous UK studies by Ozkan (2000 and 2002) had to rely on very small and balanced samples with criteria of 5 years and above. This potentially introduces survivorship bias into their studies. Antoniou *et al.* (2006), examining the determinants of the debt maturity structures of French, German and UK firms, also used one year and above criteria to define long-term debt ratios. Barclay and Smith (1995), however, argue that the choice of long-term debt maturing in more than one year, three years, and five years or more is purely arbitrary and that the results are qualitatively similar using different measures. Therefore, using one year and above as the criteria for categorising long-term debt seems reasonable and empirically justified. Consequently, the debt maturity ratio used here is defined as the ratio of long-term debt payable in more than one year by the total debt, symbolically represented as:

$$DMR_{it} = \frac{LTD_{it}}{TD_{it}}$$

Where:
LTD_{it} *is the total long-term debt payable in more than one year (Datastream code: WC03255)*
TD_{it} *is the total debt of the firm (Datastream code: WC03251)*

5.2.3.2. Explanatory variable

To analyse the relationship of credit rating with debt maturity structure, the measures for the credit ratings are the same as those described in Subsection 5.2.1.2, above. The main measure is the ordinal numerical coding assigned to each broad rating category from 1 to 5, assigning the lowest number to the highest broad category. Following Stohs and Mauer (1996), non-rated firms are assigned the lowest code, assuming them to have relatively higher liquidity risk than rated firms. Prior studies, investigating debt maturity structure, such as Barclay and Smith (1995), Stohs and Mauer (1996) and Bali and Skinner (2006) amongst others, have used similar coding procedures particularly for the rated firms with differences in coding broad rating categories or micro/individual ratings.

5.2.3.3. Control variables

The control variables of the models are drawn from the earlier studies on debt maturity structures around the world and specifically in the UK. Some variables are defined in the same manner as with the capital structure models, although their implication for the case of debt maturity structure may vary due to the choice between short-term debt and long-term debt. Most of the variables are based on theories which are empirically tested to explain the debt maturity structure of firms. The definitions of the corresponding proxies of variables are discussed below:

i. Size (LOS)

Size is expected to have a positive relationship with the debt maturity structure of firms. Similar to capital structure literature, no consistent measure is used for firms' size by the previous studies. For example, Deesomsak *et al.* (2009) and Fan *et al.* (2011) use logs of total assets, Barclay and Smith (1995) and Stohs and Mauer (1996) use logs of market value, and Cai *et al.* (2008), Scherr and Hulburt (2001), Guedes and Opler (1996), Ozkan (2000 and 2002) and Antoniou *et al.* (2006) use logs of sales. Following prior UK studies (Ozkan, 2000, 2002; Antoniou *et al.*, 2006), the size of a firm is measured in this study by the natural logarithm of sales (LOS_{it}).

ii. Assets Maturity (AMAT)

It is expected that assets maturity and debt maturity have a direct relationship. The ratio of property, plant and equipment, scaled by annual depreciation, is commonly used as the proxy for assets maturity with the underlying rationale that assets with longer maturity depreciate at a slower rate. It is however argued that this proxy tends to be noisy, as the lives of the assets are mostly determined by the tax authorities (Guedes and Opler, 1996). The measures also assume that all other assets, such as intangibles, do not have any maturity, which otherwise would have a meaningful implication for the debt maturity structure. Guedes and Opler (1996), therefore, incorporate the maturity of the short-term debt into their calculations. However, their results remain qualitatively similar to the traditional assets maturity ratio which substantiates the ability of the proxy to measure the maturity structure of the firms' assets. Despite the limitations of the traditional asset maturity ratio, it is consistently used in previous literature, specifically in explaining the factors affecting the UK firms' debt maturity structures. Therefore, following the empirical literature (Guedes and Opler, 1996; Ozkan, 2000, 2002; Antoniou *et al.*, 2006; Cai *et al.*, 2008) and due limitation of the available data, the proxy is measured as:

$$AMAT_{it} = \frac{PPE_{it}}{D_{it}}$$

Where:
PPE_{it} *is the value of net property, plant and equipment (Datastream code: WC02501)*
D_{it} *is the total annual depreciation (Datastream code: WC01148)*

iii. Quality (QUAL)

The implications of Flannery's (1986) study suggest that firms' quality is likely to be negatively related to their debt maturity structures. Most of the prior literature relies on future change in earnings (EPS_{t+1}- EPS_{t}) as a measure of firms 'quality' (Barclay and Smith, 1995; Stohs and Mauer, 1996; Cai *et al.*, 2008; Ozkan, 2000 and 2002). However, there are variations in the dominator. For example, Ozkan (2000, 2002) used change in earning per share (EPS) between time *t+1* and *t* divided by EPS at time *t* to measure firms' quality. It should be noted that this proxy might work well when EPS is positive, but it fails providing spurious values when firms report losses or zero EPS. To eliminate the possibility of flawed results, change in earnings (*t*+1 and *t*) is divided by the share price at time *t*. The justification of using this measure is based on the assumption that, unlike outsiders (investors), insiders or management can anticipate next year's earnings, and based on this information, they then make their maturity structure decisions.

A possible concern with using EPS change might be the inability of the measure to capture the true quality of a firm, as the quality of firms is a long-term phenomenon and changes in earnings might not be an appropriate proxy for capturing this long term quality. However, it should be noted that Flannery's (1996) model is a two-period model where firms, due to information asymmetry, choose a maturity structure in order to signal to outsiders about the quality of their firm. In the next period, the true quality of the firm is revealed to the outsiders. If the long-term debt ratio is defined by long-term debt payable in more than one year, where annual data are used, next year's earnings will be known to outsiders at the time of refinancing the firm's short-term debt. Therefore, it can arguably capture what it intends to measure despite being a rough measure. The proxy is symbolically represented as:

$$QUAL_{it} = \frac{EPS_{i,t+1} - EPS_{it}}{SP_{it}}$$

Where:
$EPS_{i,t+1}$ *is the earning per share in t+1*
EPS_{it} *is the earning per share in time t (Datastream code: EBIT (WC18191)-Interest expense (WC01451)-Income Taxes (WC01451)/Common shares outstanding (WC05301))*
SP_{it} *is the share price at time t (Datastream code: Market Capitalization -Fiscal Period End (WC08002)/ Common shares outstanding (WC05301))*

iv. Growth Opportunities (MBR)

Growth opportunities are expected to have a negative relationship with the debt maturity structure of firms. Following previous studies (Barclay and Smith, 1995 and 1996; Guedes and Opler, 1996; Scherr and Hulburt, 2001; Ozkan, 2000 and 2002; Antoniou *et al.,* 2006; Fan *et al.,* 2011; Cai *et al.,* 2008 and Deesomsak *et al.,* 2009), and as discussed in Subsection 5.2.1.3 above, the market to book value of assets is used as the proxy for growth opportunities.

v. Rating Dummy (RAT_{dum})

Following the assumptions made about the non-rated firms (see Subsection 5.2.1.2 above) and to be consistent with prior studies testing Diamond's theory (Stohs and Mauer, 1996; Barclay and Smith, 1995), the rating dummy is used in the model.

vi. Industry Dummies

As discussed in Section 3.2.6, prior studies (Schwartz and Aronson, 1967; Balakrishnan and Fox, 1993; Scott, 1972; Scott and Martin, 1975; Bradley *et al.*, 1984) suggest that debt ratios differ across industries, due to the regulations related to specific industries and economic and global influences affecting each industry differently so the proportion of long-term debt may differ too. Some industries may rely more on, or have better access to, public debt markets. For example, some firms may find it easier to issue public debt, which is arguably more long-term debt, when its competitors have also public debt outstanding (Faulkender and Petersen, 2006). In such cases, the bond market can easily recognise the risk associated with the instruments issued by those firms, and the costs of monitoring and evaluating these firms are also lower. To capture this industry-level heterogeneity, industry dummies are incorporated in the debt maturity structure models. For a detailed discussion, definitions and sources of data, see Subsection 5.2.1.3 above.

5.2.3.4. Model Specification

The hypothesis H_4, presented in Section 4.3.1 of Chapter 4, postulates a non-monotonous, inverted U-shaped relationship between credit ratings and the debt maturity structure of firms:

> **H_{4a}: *If other things remain constant, there is a non-linear, inverted U-shaped relationship between the credit ratings and debt maturity structure of firms*.**

To empirically test the above hypothesis, the debt maturity ratio is estimated as a function of credit rating, as specified below, as an OLS equation:

$$DMR_{i,t} = \beta_0 + \beta_1 CR_{i,t} + \beta_2 CR_{i,t}^2 + \sum_{i=1}^{n} \beta_i X_{i,t} + \varepsilon_{i,t} \quad \textbf{...(6)}$$

Where:

$DMR_{i,t}$	*is the debt maturity ratio of the firm*
β_0	*is the constant term*
$CR_{i,t}$	*is the credit rating of a firm with cardinalsed values of 1,2,…5, where AA=1 to B=5 or with cardinalsed values of 1,2,…6, where AA=1 to B=5 and NR=6*
$CR_{i,t}^2$	*is the square of the credit rating*
$X_{i,t}$	*is the set of control variables: size (LOS), assets maturity (AMAT), growth opportunities (MBR), firms quality (QUAL) and industry dummies (technology ($TECH_{dum}$), Industrial (IND_{dum}), consumer service (CS_{dum}), consumer goods (CG_{dum}), health care (HC_{dum}), utility (UTL_{dum}), basic material (BM_{dum}), oil& gas (OG_{dum}) and Rating dummy (RAT_{dum})*

Following most of the previous studies, which have used OLS with panel data as one of the main estimation techniques (Barclay and Smith, 1995, 1996; Stohs and Mauer, 1996; Guedes and Opler, 1996; Demirguc-Kent and Maksimovic, 1999; Scherr and Hulburt, 2001; Ozkan, 2002; Cai *et al.*, 2008), the present study also uses OLS for analysing the relationship between credit ratings and debt maturity structures. To minimise the time invariant firm-level heterogeneity, a few studies have also used fixed effects regression. However, they do not find any variation in the results with alternative estimation techniques (e.g., Barclay and Smith, 1995; Stohs and Mauer, 1996; Cai *et al.*, 2008). For a direct comparison with the previous studies on debt maturity structures, the analysis of the credit rating – maturity structure relationship in this study relies on more commonly used estimation techniques, i.e., OLS.

5.3. Outliers Diagnostics and Treatment

As discussed in Section 5.1.1, two data sets are used in the study: a whole sample of rated and non-rated firms (42,872 firm-year observations) and a sample with rated firms only (874 firm-year observations). Both datasets require different outlier treatment procedures depending on the size of sample, as is discussed further below.

The initial sample contained 42,872 firm-year observations. As was discussed in the previous chapter, the sample selected for the study contains several outliers. These extreme values can be due to incorrect data entry, or might be correct values which are distant from the rest of the observations. Such observations may cause potential problems in the analyses by influencing the results. Further, it may increase the heteroskedasticity problem in the models and thus make the results biased (Gujarati, 2004, p.390). Since the control variables proposed in the study are mostly in the form of ratios, which have a tendency to be skewed, flat or dominated by issues of sample variance (Frecka and Hopwood, 1983), they are likely to decrease precision in the study irrespective of the fact that the present study uses a large dataset.[22]

Various techniques can be employed to resolve the concern of extreme values in the data, including winsorising, trimming, and transformation into logarithmetic, squared or inverse form. In the literature of capital structure, studies do not generally use transformation of data and tend to use winsorising and trimming, depending on the sample size. It is argued that the issue of extreme observations may not be completely resolved by simple log or square transformation (Deakin, 1976; Frecka and Hopwood, 1983) and that elimination of the outliers is possibly a better solution (Frecka and Hopwood, 1983). Conversely,

[22] Gujarati (2004) argues that when the data set is small, outliers' inclusion and exclusion may have a more significant effect on the regression model than in a large dataset.

Bollinger and Chandra (2005) and others argue that trimming or winsorising data may induce bias in the data.

Previous studies do not suggest any consistent procedure for the detection and treatment of outliers. However, two measures are relatively common in the literature: eliminating the outliers by winsorising at certain percentages, or deleting specific (or a certain percentage of) observations. Titman and Wessels (1988) and Barclay and Smith (1995) have trimmed the data at certain percentages, whereas others (Bevan and Danbolt, 2002; Johnson, 2003; Aivazian *et al.*, 2005; Frank and Goyal, 2009) have winsorized the variables at various percentages. For the whole sample, data trimming is used, which appears to be superior compared to winsorising given that the study utilises a large sample size. Moreover, theoretical and empirical literature support the use of this method (Frecka and Hopwood, 1983; Titman and Wessels, 1988; Barclay and Smith, 1995; Booth *et al.*, 2001; Baker and Wulgler, 2002; Alti, 2006; Frank and Goyal, 2009). To maintain the integrity of data, most of the variables are trimmed at 0.50% at either or both sides of the distribution. This percentage would only remove the most extremely misrecorded data; using a higher percentage may induce bias in the sample. A summary of the method followed to identify outliers and treatment and the effect outlier treatment on the number of observations is presented in Table 5.8 and Table 5.9.

The first dataset contains 4,169 firms over an extended period of 22 years. Visual aids such as scattered plots and box plots and logical reasoning are used to assess the outlying observations. In the case of the debt ratio, outcomes of more than one and less than zero do not theoretically make sense, as the assets have to be financed by equity or debt or by a combination of both. The possible reason for this may be that firms are experiencing negative equity or there might be recording error in the database. Likewise, the total debt maturity ratio may be composed of either short-term debt or long-term debt, or both, and cannot exceed the total debt. Following previous studies (Baker and Wulgler, 2002; Alit, 2006; Aivazian *et al.*, 2005) such firm-year observations are discarded from the sample.

For the MB ratio (MBR), the quality of firm (QUAL), the profitability ratio (PROF), the assets maturity ratio (AMAT) and the liquidity ratio (LIQD), 0.50% of both tails or either tail are discarded depending on the distribution of outlier, while for the fixed assets ratio (FAR), values above 1 and below 0 are discarded. Only the top three values are discarded which were found to be greater than one. After trimming the profitability ratio by 0.50%, the dataset still contained values above +1 or below -1. Thus, all values above or below one are discarded. Berger and Ofek (1995) also truncate the values lying above or below 1 and -1 respectively.

The second dataset contains only 104 firms, with 874 firm-year observation. Relative to the first dataset containing rated and non-rated firms, this dataset is very small and contains few outliers. The size of the dataset does not allow trimming as this would seriously affect the sample size. In this case, therefore, winsorising is used for extreme values, using a 0.50% cut off where variables have extreme observations. The profitability (PROF) and the market to book ratio (MBR) are winsorised at both tails while the liquidity (LIQD) is winsorised at right tail. Similar to the procedure used for the combined sample of rated and non-rated firms, profitability is further truncated at ±1.

For the analyses of potential and actual rating changes, the dependent variables (change in debt ratio (CDR) and Kisgen's debt Ratio (KDR)) had a few observations greater than ±1 which do not make theoretical sense. Therefore, they are truncated to ±1. Debt issuance and reduction ratios had also a few observations above 1 which are truncated to 1. Lagged change in the fixed assets ratio (ΔFAR_{t-1}) and the market to book ratio (ΔMBR_{t-1}) do not indicate any outlying observation, but lagged change in log of sales (ΔLOS_{t-1}), liquidity ($\Delta LIQD_{t-1}$) and profitability ($\Delta PROF_{t-1}$) had a few extreme observations at both ends and therefore they have been winsorised at 0.50%. A detailed analysis on the effects of outlier treatment is presented within each empirical chapter.

5.4. Conclusion

This chapter presented the research design and methodology of the present study. It began by discussing data sources, followed by a detailed discussion of the sampling procedures. The study utilises two types of data: Standard and Poor's long-term issuers' ratings and accounting data sourced from Datastream. The final sample consists of 4,169 firms over a period of 22 years (42,872 firm-years), from which 104 are rated firms and 4,065 are non-rated firms. The chapter also discussed various elements of the models used in the study. It explained in detail the methodological choices made for measurements of the proxies for the dependent, independent and control variables, along with the model specifications for the four main research questions of the study.

Table 5.8
Variables, Outlier Treatment and its Effects (Rated and Non-Rated Firms)

Variables	Definition	Outlier treatment	Number of Observations Before and After Outlier Treatment		
			Before	After	Difference
Panel A: Credit Rating and Capital Structure Analysis					
TDTA	*total debt to total assets*	Values above +1 and below -1 are discarded	42,872	42,346	436
LOS	*natural logarithm of sales*	do not suggest the presence of outliers	40,971	40,971	0
PROF	*earnings before interest, taxes and depreciation, to total assets*	trimmed at 0.50% at each tail and used ±1 criteria	42,869	41,767	1,103
FAR	*fixed assets ratio (FAR) is the ratio of fixed assets to total assets*	Values below zero and above one are discarded	42,872	42,869	3
MBR	*book value of the assets minus the book value of the equity minus market value of equity divided by book value of assets*	trimmed at 0.50% at each tail	42,851	42,423	428
LIQD	*current assets to total assets.*	trimmed at 0.50% at right tail	42,056	41,846	210
Panel B: Credit Rating and Debt Maturity Structure Analysis					
DMR	*total long-term debt (payable in more than one year) to total debt*	do not suggest the presence of outliers	37,405	37,405	0
LOS	*natural logarithm of sales*	do not suggest the presence of outliers	40,989	40,989	0
QUAL	*difference between earnings before interest and taxation $EBIT_{t+1}$ and $EBIT_t$ scaled by share price at time t*	trimmed at 0.50% at each tail	38,024	37,644	380
AMAT	*total property, plant and equipment to total annual depreciation*	trimmed at 0.50% at right tail	30244	30,093	151
MBR	*book value of the assets minus the book value of the equity plus market value of equity divided by book value of assets*	trimmed at 0.50% at each tail	42,872	42,444	428
ETR	*total amount of tax charged by total taxable income*	winsorised at 0 and 1	42,345	42,345	0

Table 5.9
Variables, Outlier Treatment and its Effects (Rated Firms Sample)

Variables	Definition	Outlier treatment	No. of Observation Affected
Panel A: Credit Rating and Capital Structure Analysis			
TDTA		winsorised using ±1 criteria	9
LOS		do not suggest the presence of outliers	0
PROF		0.50% of both tails and used ±1 criteria	17
FAR		Values below zero and above one are winsorized to 0 and 1 respectively	3
MBR		winsorised at 0.50% at each tail	8
LIQD		winsorised at 0.50% at right tail	8
Panel B: Credit Rating and Debt Maturity Structure Analysis			
DMR		do not suggest the presence of outliers	0
LOS		do not suggest the presence of outliers	0
QUAL		winsorised at 0.50% at each tail	8
AMAT		winsorised at 0.50% at each tail	8
MBR		winsorised at 0.50% at each tail	8
ETR		winsorised using 0 and 1criteria	19
Panel C: Credit Rating Changes and Capital Structure Analysis			
CDR	*first difference in the total debt scaled by previous year's total assets*	winsorised using ±1 criteria	2
KDR	*(long term borrowings minus long-term debt reduction plus increase/decrease in short-term borrowings)-(net proceeds from sale/issue of common stock minus common/preferred redeemed, retired, converted etc) scaled by previous year's total assets*	winsorised using ±1 criteria	3
DITA	*long-term borrowing by the total assets of previous year*	winsorised using 0 and 1 criteria	3
DRTA	*long-term debt reduction by the total assets of previous year*	winsorised using 0 and 1 criteria	2
EITA	*net proceeds from sale/issue of common stock by the total assets of previous year*	winsorised using 0 and 1 criteria	0
ERTA	*common/preferred redeemed, retired, converted etc by the total assets of previous year*	winsorised using 0 and 1 criteria	0
Δ**LOS**$_{t-1}$	*lag of first difference in the log of sales*	winsorised at 0.50% at each tail	8
Δ**PROF**$_{t-1}$	*lag of first difference in the profitability*	winsorised at 0.50% at each tail	8
Δ**FAR**$_{t-1}$	*lag of first difference in the fixed assets ratio*	do not suggest the presence of outliers	0
Δ**MBR**$_{t-1}$	*lag of first difference in the market to book ratio*	do not suggest the presence of outliers	0
Δ**LIQD**$_{t-1}$	*lag of first difference in the liquidity ratio*	winsorised at 0.50% at each tail	8

To test the implications of the *credit rating – capital structure hypothesis* (CR-CS), credit ratings are incorporated into previously tested models for capital structure and debt maturity structure. Specifically, to test the relationship between levels of credit ratings and leverages, quadratic regression models are proposed in order to capture the hypothesised non-linearity between the two variables. As the quadratic regression models are used for the first time to analyse the impact of credit ratings on capital structure, they are likely to extend the limited view of the relationship between the two variables. This will ensure correct inferences about the capital structure determinants and will provide a comprehensive depiction of actual capital structure decision making behaviour. These models are tested in Chapter 6.

The chapter also presented the methodology followed to test the implications of the *credit rating – capital structure hypothesis* for the relationship between credit rating changes and the capital structure decisions of firms. Despite an extension of Kisgen's (2006 and 2009) studies to a different market, the proxies of rating changes are incorporated in models which have been specifically tested in the UK market. However, control variables in the model are measured as lagged change variables due to the nature of the dependent variables. For consistency with Kisgen (2006, 2009), similar models are also tested to ensure direct comparison with US studies. These models are tested in Chapter 7.

Finally, the chapter also presented a detailed discussion of the measurement of variables and the model proposed to test Diamond's 1991 liquidity risk hypothesis. The proposed relationship between credit ratings and the debt maturity structures of firms are modelled using a quadratic regression model, which is likely to capture the non-linear relationship hypothesised between the two variables. Chapter 8 provides empirical results for the model proposed.

Chapter 6
Credit Ratings and Capital Structure

6. Introduction

The overall objective of this chapter is to present and discuss a detailed empirical analysis of the potential impact of credit ratings on the capital structures of UK firms. Since early 2000, there has been a growing theoretical and empirical literature on the importance of credit ratings for the financial structure of the firms. Specifically, after Graham and Harvey's (2001) survey study, highlighting the relevance of credit ratings for capital structure determination, a shift can be noted towards exploring the influence of credit ratings on capital structures and their components. However, so far studies are largely concentrated on the US market and provide limited insight into the relationship and its applicability to other markets, which are also actively using credit ratings. In this regard, the hypotheses presented in Chapter 3 extend the previous studies investigating the credit rating – capital structure relationship. Unlike previous studies, which implicitly or explicitly postulate a linear relationship between credit ratings and capital structures, the present study predicts a non-monotonous relationship between the two variables, as discussed in Section 3.3.1. This chapter specifically provides detailed univariate and multivariate analyses to examine the hypothesised relationship between credit ratings and the capital structures of UK firms.

The present chapter is divided into four main sections. Section 6.1 provides a detailed description of the selected sample to analyse the impact of credit ratings on the amount of leverage in firms' capital structures. It also discusses in detail the potential issues concerning the estimation techniques and limitation of the methodologies with the possible remedies to address those concerns. Section 6.2 presents a multivariate analysis of the impact of credit ratings on overall capital structures to affirm or negate the non-linearity hypothesis for credit ratings and capital structures. Section 6.3 presents and discusses the robustness and sensitivity checks against the alternative coding schemes and estimation techniques. Particular emphasis will be placed on addressing the potential reverse causation of credit rating in the models. Section 6.4 concludes the chapter.

6.1. Sample Statistics and Diagnostics

This section presents descriptive statistics for the variables selected for the proposed models when testing the impact of credit ratings on the capital structure of firms. The section is divided into two main subsections. Subsection 6.1.1 presents the descriptive statistics of the variables before and after outlier treatment with other descriptive analysis related to the study. Subsection 6.1.2 presents diagnostic tests for the sample suitability of the specific estimation techniques and suggests possible remedial measures, if the data violate any assumptions for the estimation techniques used.

6.1.1. Descriptive Statistics of the Dependent, Independent and Control Variables

This section presents detailed descriptive statistics of the variables of the study along with the graphical presentation of debt ratios of UK firms and a comparison of the firm-level characteristics of rated and non-rated firms.

6.1.1.1. Descriptive Statistics Before and After the Outlier treatment

As discussed in the previous Chapter (Section 5.3), the sample selected for testing the relationship of credit ratings on the capital structures of UK firms, contains several outlying observations. The observations sometimes theoretically do not make sense and their inclusion may distort the analysis. Therefore, they are either trimmed or truncated depending on the nature and severity of the extreme values. (For a detailed discussion on the outlier treatment, see Chapter 5, Section 5.3). Panel A (B) of Table 6.1 reports the descriptive statistics of the sample before (after) the trimming.

As can be observed from the table, all variables except for LOS have extreme observations, which necessitate an outlier treatment. For example, TDTA ranges from 0.00 to 170.20, where several observations lie above 1 which theoretically and economically do not make sense. Similarly, the PROF also has several extreme values (above +1 and below -1). Consequently, means and standard deviations of the variables are seriously affected by such observations. As regression procedures incorporate such statistics in the calculations, the outcomes thus generated may not be reliable and accurate as they may not be representative of the sample as a whole.

Table 6.1
Descriptive Statistics of Variables Before and After Trimming

	N	Range	Minimum	Maximum	Mean	Median	S.D
Panel A: Before Trimming							
TDTA	42,872	170.20	0.00	170.20	0.25	0.17	1.49
LOS	40,971	24.53	0.69	25.23	12.07	11.63	3.41
PROF	42,869	562.28	-412.00	150.28	-0.02	0.11	3.83
FAR	42,872	2.55	0.00	2.55	0.31	0.26	0.25
MBR	42,851	13937.00	-960.47	12976.53	2.48	1.37	65.75
LIQD	42,056	2974.35	0.00	2974.35	2.64	1.38	21.05
Panel B: After Trimming							
	N	**Range**	**Minimum**	**Maximum**	**Mean**	**Median**	**S.D**
TDTA	42,346	1.00	0.00	1.00	0.20	0.18	0.18
LOS	40,971	24.53	0.69	25.23	12.07	11.69	3.41
PROF	41,767	1.56	-1.00	0.56	0.08	0.12	0.19
FAR	42,869	1.00	0.00	1.00	0.31	0.27	0.25
MBR	42,423	20.04	0.12	20.15	1.91	1.37	1.83
LIQD	41,846	36.94	0.00	36.94	2.10	1.37	2.94

Notes: This table displays the descriptive statistics of variables of the sample before and after the outlier treatment. Variables are defined as the total debt to total assets (TDTA) as dependent variable, log of sales (LOS) refers to natural logarithm of sales, profitability (PROF) is the ratio of earnings before interest, taxes and depreciation, to total assets, fixed assets ratio (FAR) is the ratio of fixed assets to total assets, market to book ratio (MBR) is the book value of the assets minus the book value of the equity minus market value of equity divided by book value of assets while and liquidity ratio (LIQD) is the ratio of current assets to total assets.

Following the trimming and truncation procedures proposed in Chapter 5, the overall statistics of the variables have considerably improved. Panel B of Table 6.1 reports the statistics after the outlier treatment. As can be noted, the mean of the dependent variable, total debt to total assets ratio (TDTA), has been reduced from 0.25 to 0.20, which suggests that 526 firm-year observations that were lying outside the range of 0 and 1 were inflating the average TDTA of the remaining sample of 42,346 observations by 5 percentage points. Similarly, other variables such as the market to book ratio (MBR) and liquidity (LIQD) also show extreme values, which after trimming (excluding 428 and 214 firm-year observations, respectively), has reduced the standard deviation from 65.75 and 21.05 to 1.83 and 2.94, respectively. Table 6.2 reports the final sample with the balanced firm-year observations for each variable, as used in the regression analysis.

When comparing with Table 6.1, it can be noticed in Table 6.2 that the statistics of the data are not strikingly changed even after losing approximately 7% of data. This may suggest that the variables are fairly well distributed. Moreover, by observing the mean and median statistics of the dependent and control variables, it seems to indicate that the outlier problem is now minimal. As can be seen in Table 6.2, the average debt ratio of the sample of UK firms is 0.20, which is comparable to previous studies by Rajan and Zingales (1995) and Bevan and Danbolt (2002), who report mean debt ratios for UK firms of 0.21 and 0.18, respectively. However, the average debt ratio is slightly higher than Ozkan (2001) reporting 0.16 for the UK sample firms. The standard deviation of book debt ratios shows that there is variety of firms in terms of their capital structures. Although the variable has been trimmed, it shows that there are firms that do not have debt at all in their capital structure, compared to firms which have all their assets financed by debt. Other variables, including log of sales (LOS), profitability (PROF), fixed assets ratio (FAR), market to book value (MBR) and liquidity (LIQD), show considerable variation among themselves but they are generally consistent with the reported statistics by the previous UK studies (Ozkan, 2001; Bevan and Danbolt, 2002). Thus, the results of the present study can be directly compared to prior studies investigating the capital structures of UK firms.

Table 6.2
Descriptive Statistics of Variables (Final Sample)

	N	Range	Minimum	Maximum	Mean	Median	S.D
TDTA	38,880	1.00	0.00	1.00	0.20	0.18	0.17
LOS	38,880	24.53	0.69	25.23	12.22	11.73	3.32
PROF	38,880	1.56	-1.00	0.56	0.09	0.12	0.18
FAR	38,880	1.00	0.00	1.00	0.32	0.28	0.24
MBR	38,880	20.04	0.12	20.15	1.81	1.35	1.57
LIQD	38,880	36.81	0.00	36.81	1.89	1.37	2.20

Notes: This table displays the mean, median, minimum values, maximum values and standard deviation over the sample period from 1988-2009 the whole sample of rated and non-rated firms. Variables are defined as total debt to total assets (TDTA) as dependent variable, log of sales (LOS) refers to natural logarithm of sales, profitability (PROF) is the ratio of earnings before interest, taxes and depreciation, to total assets, fixed assets ratio (FAR) is the ratio of fixed assets to total assets, market to book ratio (MBR) is the book value of the assets minus the book value of the equity minus market value of equity divided by book value of assets while and liquidity ratio (LIQD) is the ratio of current assets to total assets.

To examine the effect of credit ratings on the capital structures of the firms, two sample sets are used to construct the credit rating coding scheme. The first dataset consists of only the rated firms while the second dataset contains all rated and non-rated firms. The reasons underlying the combination of the two sample sets are discussed in detail in the previous chapter. Table 6.3 displays the descriptive statistics of both groups separately to highlight the differences, if any. Panel A consists of the descriptive statistics of rated firms, Panel B displays the descriptive statistics for the non-rated firms only and Panel C reports the independent sample t-tests for the differences in mean values of the firm level characteristics of rated and non-rated firms.

As can be seen in Table 6.3, rated firms have on average 33% of assets financed by debt, which is significantly higher (as indicated in Panel C) than the sample of non-rated firms, having an average debt ratio of 20%. The higher average debt ratios for rated firms indicate their better access to debt markets. These statistics are comparable to the mean of 30.40%

reported in a previous UK study by Judge and Mateus (2009)[23] for firms having access to debt markets (as measured by the possession of credit ratings or not) and 21.86% for firms having no access (non-rated firms). The mean debt ratios of the present study are also close to the previous studies on the US market (Faulkender and Petersen, 2006) reporting 37.2% for rated firms and 26.1% for non-rated firms and Canadian firms with market debt ratio of 30.91% and 15.25%, respectively (Mittoo and Zhang, 2010).

Table 6.3
Comparison of Rated and Non-Rated Firms

Panel A: Rated firms						
Variables	**N**	**Range**	**Minimum**	**Maximum**	**Mean**	**S.D**
TDTA	844	0.96	0.00	0.96	0.33	0.17
LOS	844	9.13	9.97	19.09	15.15	1.19
PROF	844	1.37	-0.87	0.51	0.13	0.11
FAR	844	0.94	0.01	0.95	0.42	0.25
MBR	844	11.57	0.41	11.97	1.80	1.11
LIQD	844	9.40	0.00	9.40	1.12	0.56
Panel B: Non-Rated firms						
Variables	**N**	**Range**	**Minimum**	**Maximum**	**Mean**	**S.D**
TDTA	38,036	1.00	0.00	1.00	0.20	0.17
LOS	38,036	24.53	0.69	25.23	12.16	3.32
PROF	38,036	1.56	-1.00	0.56	0.09	0.18
FAR	38,036	1.00	0.00	1.00	0.32	0.24
MBR	38,036	20.04	0.12	20.15	1.81	1.58
LIQD	38,036	36.81	0.00	36.81	1.91	2.22

Panel C: Independent Sample t-test for comparing of means				
	Status	**N**	**Sample Mean**	**Mean Difference**
TDTA	Rated	844	0.33	0.13***
	Non-rated	38,036	0.20	
LOS	Rated	844	15.15	3.00***
	Non-rated	38,036	12.16	
PROF	Rated	844	0.13	0.04***
	Non-rated	38,036	0.09	
FAR	Rated	844	0.42	0.10***
	Non-rated	38,036	0.32	
MBR	Rated	844	1.80	-0.01
	Non-rated	38,036	1.81	
LIQD	Rated	844	1.12	-0.79***
	Non-rated	38,036	1.91	

*Notes: Panel A and B displays the mean, minimum values, maximum values and standard deviations over the sample period from 1988-2009 for the rated and non-rated UK firms respectively. Panel C reports the independent t-test of mean values for the rated and non-rated firms. *** denotes that p-values are significant at 1% level.*

[23] The sample of Judge and Mateus (2009) consists of only the top 500 UK firms with 821 firm-year observations of rated firms and 2,959 of non-rated firms. The present sample is, however, much more diversified with 844 firm-years of rated firms and 38,036 of non-rated. Given that the mean debt ratios of the present study are comparable to Judge and Mateus (2009), it lends support to the inclusion of the large number of non-rated firms suggesting that it will not significantly change the results. However, a larger dataset will ensure precision in the results and will strengthen the statistics.

Other firm-level characteristics are also different between the two groups of firms. It can be noted, that the rated firms are significantly larger than the counterpart non-rated firms ($p<0.01$). This suggests that larger firms are more likely to get credit ratings. Diamond and Verrecchia (1991) argue that large firms acquire ratings to attract large institutional investors. Moreover, it can be argued that large firms have higher credit quality and are also more confident about their creditworthiness, thereby being more likely to get rated. Such firms are also likely to have a lower degree of information asymmetry compared to small firms as they are inclined towards disclosing more information than the small firms through the use of rating services. The size effect is also reported by prior US, UK and Canadian studies by Faulkender and Petersen (2006), Judge and Mateus (2009) and Mittoo and Zhang (2010), respectively.

Moreover, rated firms have higher tangibility in their assets structures (0.42 versus 0.32, $p<0.01$) and are more profitable (13% versus 9%, $p<0.01$) than non-rated firms. However, rated firms are less liquid than non-rated firms, possibly because non-rated firms are expected to have higher cost of financial distress and therefore they are likely to maintain larger proportion of liquid assets, which can minimise such costs. These differences are in line with the findings in prior literature (Faulkender and Petersen, 2006; Judge and Mateus 2009; Mittoo and Zhang, 2010). Given that rated firms have such firm characteristics, which predict higher leverage according to the previous theoretical evidence, it becomes essential to control for these characteristics when evaluating the relative importance of credit ratings for the capital structures of the firms.

6.1.1.2. Capital Structure During the Sample Period

Figure 6.1 displays the average debt ratios of the UK firms over the sample period and shows that the average total debt to total assets ratio (TDTA) is relatively consistent during the sample period with minor changes from year to year. The average debt ratio rose during the start of the sample period from 1988 to 1991, and remained above 20% till 1993. One of the reasons for the initial change may be the decline in the interest rates during that period. Another reason for slightly inflated statistics might be the numbers of sample firms (both rated and non-rated) in the first three years of the sample period which are 11, 24 and 56, respectively. After 1993, there was a slight decline but the ratio remains stable for the next five years. The range of the average debt ratio is 17% to 22% for the period of 22 years suggesting that the level of gearing of UK firms is stable over time.

From year to year, the maximum change in the leverage is 1 percentage point, which does not suggest any major variation over the sample period.

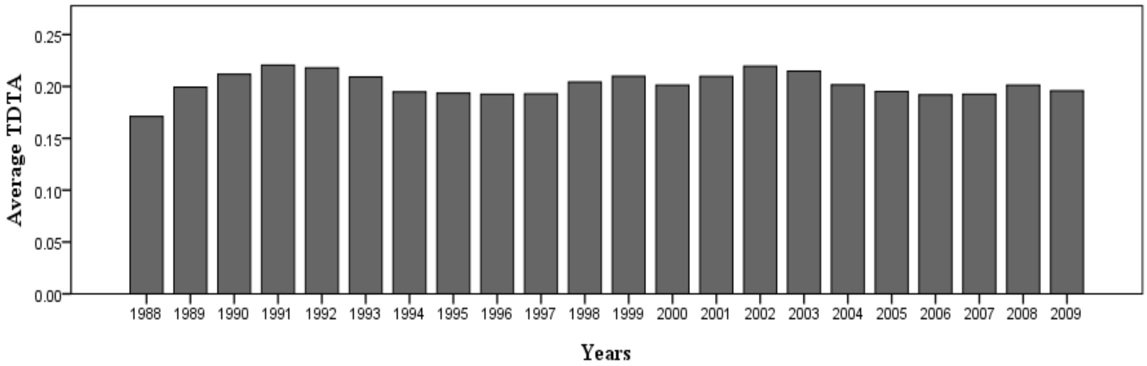


Figure 6.1: Average Debt Ratio of the UK Firms over the Sample Period

Table 6.4 presents the mean, median and standard deviation of debt ratios over the years. It can be noted that overall the mean level of leverage of the UK firms consistently ranges from 17% to 22%, although considerable variations, as shown by standard deviation, can be noted within each year. The median debt ratios generally are close to the mean debt ratios. However, minor differences in mean and median suggest that the debt ratios of the UK firms are slightly positively skewed which can be expected from a diverse sample of firms observed over a longer period of time. As it will be discussed in detail later, skewness in the data is not likely to affect the models tested.

Table 6.4
Descriptive Statistics of the Average Debt Ratio over the Sample Period

Years	Mean	Median	S.D	Years	Mean	Median	S.D
1988	0.17	0.15	0.14	**1999**	0.21	0.19	0.17
1989	0.20	0.18	0.15	**2000**	0.20	0.17	0.18
1990	0.21	0.20	0.16	**2001**	0.21	0.18	0.18
1991	0.22	0.20	0.16	**2002**	0.22	0.19	0.19
1992	0.22	0.20	0.16	**2003**	0.21	0.18	0.20
1993	0.21	0.19	0.16	**2004**	0.20	0.17	0.19
1994	0.19	0.17	0.16	**2005**	0.20	0.16	0.19
1995	0.19	0.18	0.15	**2006**	0.19	0.16	0.19
1996	0.19	0.18	0.16	**2007**	0.19	0.16	0.18
1997	0.19	0.17	0.16	**2008**	0.20	0.17	0.18
1998	0.20	0.18	0.17	**2009**	0.20	0.17	0.19
				Total	**0.20**	**0.18**	**0.17**

Notes: This table displays the mean, median and standard deviation over the sample period from 1988 to 2009.

Sector-wise distribution presented in Table 6.5 also indicates substantial variation in the average debt ratio between different sectors. The technology sector has the lowest average ratio of 13% while utility firms have the highest average gearing ratio of 33%.

Nevertheless, utility firms, being highly geared, show less deviation within the group. This indicates that within the industry, utility firms tend to have a similar level of gearing compared to other industries where the deviation is larger. For example, firms in the technology and healthcare sector on average vary the most among themselves, having a standard deviation (mean) of 0.16 (0.13) and 0.17 (0.17), respectively. This suggests that among the industries there are differences in the leverage ratios and that may negate the earlier assumption made that firms in one industry have similar leverages. Nevertheless, this also provides further motivation to include industry dummies in the regression models. Separate regression analyses are also conducted at industry-level to assess the impact of the firm-level factors specifically to determine the non-linearity affect of credit ratings on the gearing ratios of the firms within the industries. Appendix 6A also presents the sector-wise descriptive statistics of the control variables.

Table 6.5
Descriptive Statistics: Sector-wise

Industries	Mean	Median	S.D
Basic Materials	0.23	0.21	0.17
Consumer Goods	0.21	0.20	0.15
Consumer Services	0.22	0.19	0.19
Healthcare	0.17	0.14	0.17
Industrials	0.20	0.18	0.16
Oil & Gas	0.21	0.18	0.18
Technology	0.13	0.06	0.16
Telecommunications	0.30	0.31	0.20
Utilities	0.33	0.33	0.18

Notes: This table displays the descriptive statistics of dependent variable for the nine sectors as classified by DataStream code: ICBIN. Financial firms are excluded from the sample.

6.1.1.3. Credit Rating and Average Debt Ratios

Table 6.6 illustrates the capital structures of the firms with respect to their credit ratings. Panel A of Table 6.6 shows the average debt ratios with respect to credit ratings coded 1 to 6 and Panel B shows the average debt ratios with respect to credit ratings codes 1-16. Panel A shows that firms with the highest credit ratings have lower average debt ratios while the change in mean debt ratio between each broad rating category is close to 9 percentage points, on average. For example, from AA to A, the difference in the average debt ratio is 9 percentage points and then continues to increase by 7 and 10 percentage points until the B category. After broad rating category B, the average ratio starts declining. Also to note, the standard deviation of the debt ratio for top rated firms is very low, suggesting that such firms attempt to keep the amount of leverage not only low but also close to other firms in the market having higher ratings. As the credit ratings decline, the debt ratio gradually starts increasing. At the same time, the standard deviation and coefficient of variation start increasing, implying that low rated firms and non-rated firms have more dispersion between themselves with respect to capital structure, compared to high rated firms.

Table 6.6
Alternative Credit Ratings codes and Debt Ratios

Panel A: Broad Credit Ratings Categories and Debt Ratios

CR	Codes 1-6	Mean	Median	Std. Dev
AA	1	0.21	0.23	0.08
A	2	0.30	0.28	0.13
BBB	3	0.37	0.35	0.15
BB	4	0.47	0.49	0.24
B	5	0.43	0.44	0.20
NR	6	0.20	0.17	0.17

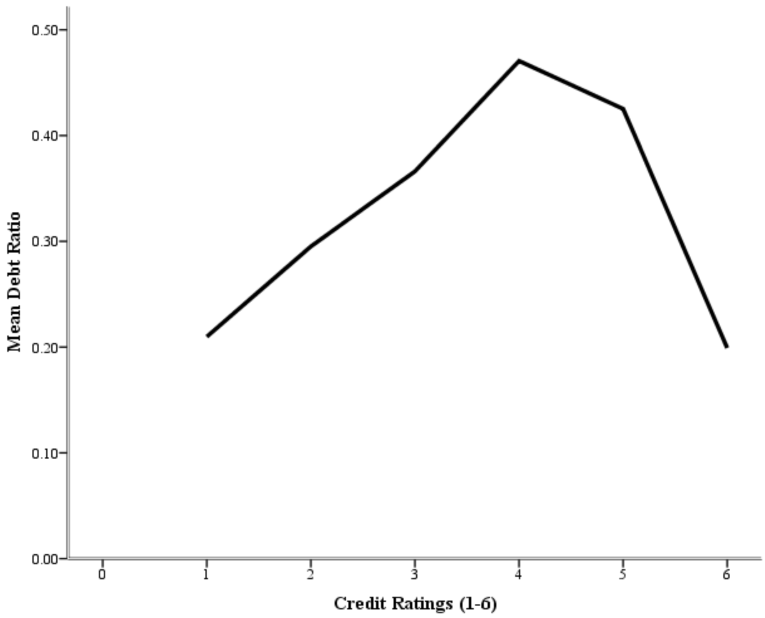
Panel B: Individual Credit ratings and Debt Ratios

CR	Codes 1-16	Mean	Median	Std. Dev
AA+	1	0.10	0.10	0.06
AA	2	0.23	0.24	0.06
AA-	3	0.24	0.25	0.07
A+	4	0.27	0.27	0.11
A	5	0.30	0.29	0.14
A-	6	0.32	0.30	0.14
BBB+	7	0.33	0.31	0.15
BBB	8	0.39	0.37	0.14
BBB-	9	0.38	0.37	0.18
BB+	10	0.46	0.48	0.22
BB	11	0.42	0.39	0.26
BB-	12	0.51	0.51	0.23
B+	13	0.56	0.64	0.20
B	14	0.33	0.36	0.14
B-	15	0.39	0.42	0.20
NR	16	0.20	0.17	0.17

Notes: This table displays the descriptive statistics for the dependent variable (total debt by total assets) with respect to the broad rating categories (1-6) and individual ratings (1-16) where the last code in both the scales is assigned to the non-rated firms.

A similar pattern can be noted for individual credit ratings. Panel B of Table 6.6 indicates that the average debt ratio is lower for the top rated firms and increases as the rating declines. Firms with B+ rating have the highest debt ratios at an average of 0.56 whereas the firms with AA+ have the lowest debt ratio at 0.10. In some broad rating categories firms with a'+' sign appear to have lower leverage than other ratings i.e., AA, A and BBB categories, but this trend is not consistent. Similarly, for some ratings categories, the mean debt ratio is also lower when the firms have a '-' sign with their credit rating, although it is less common. This does not provide any clear evidence whether firms have lower leverage when they are near upgrades and downgrades. Formal analysis in the next chapter will further explore the relationship and the discussion on the possible reverse causation is postponed until then.

Figure 6.2 (a) and (b) presents a graphical representation of debt ratios with respect to broad and individual credit ratings and Figure 6.3 presents the average debt ratios of the UK firms with respect to credit ratings over the sample period.



Broad Credit Ratings

Figure 6.2 (a): Broad Credit Ratings and Average Debt Ratios

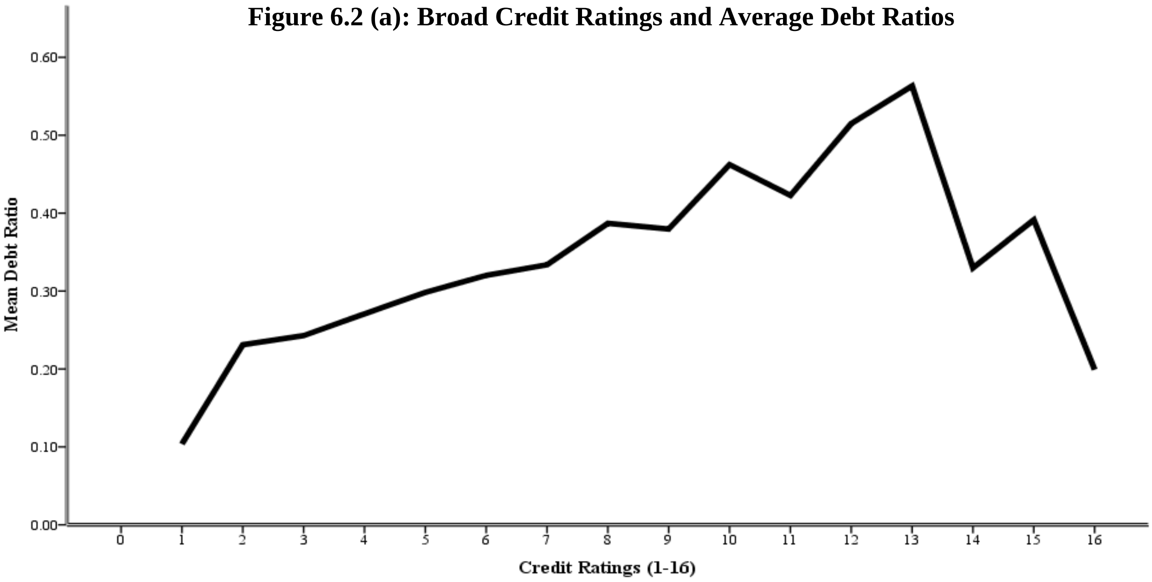


Figure 6.2 (b): Individual Credit Ratings and Average Debt Ratios

All three figures show a clear non-linear pattern of average debt ratios with respect to the credit ratings. As can be observed, non-rated firms have the lowest level of gearing compared to all broad rating categories which indicates that such firms have lesser access to debt markets compared to rated firms, whether investment grade or speculative grade firms. This supports Lemmon and Zender (2010) who find that the rated firms, irrespective of their ratings, have higher debt capacity compared to the non-rated firms. On the other hand, the top rated firms have an extremely low level of leverage, which indicates other motives of top rated firms for acquiring credit ratings, besides accessing debt markets. Further discussion is postponed until Section 6.2.

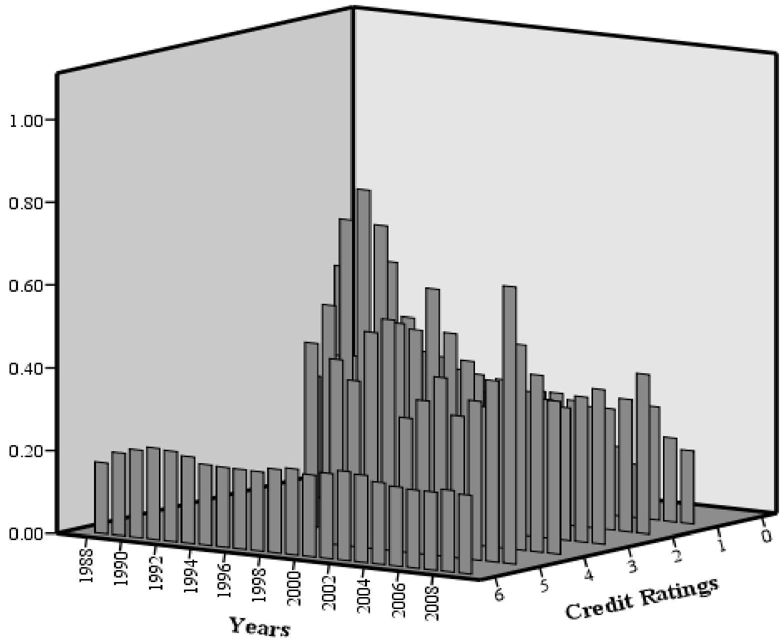


Figure 6.3: Broad Credit Ratings and Mean Debt Ratios over the Sample Period

Figure 6.3 shows that the debt ratio of the non-rated firms remain on average around 0.20 in almost all the years, whereas the firms with credit ratings do not just change over years, but also with each ratings category. However, the figures have to be interpreted with caution, as the rated firm-years are relatively fewer than non-rated firm-years, which affect the average debt ratio of both the groups. A slight non-linearity can be observed in the debt ratio with reference to the credit ratings, irrespective of the years or the inclusion of non-rated firms. Moreover, the rated firms also show higher leverage at the start of the sample period which over the years has a decreasing trend. It is likely that during the initial few years of rating services in the UK market, newly rated firms widely accessed the debt market resulting in higher gearing ratios. However, the decreasing trend in the debt ratios suggests that firms had to maintain relatively conservative debt ratios in order to maintain their current ratings status or achieve higher ratings as per the threshold of the rating agencies. Prior evidence from the US and UK market suggests that rating agencies over the period have become stringent (Blume *et al.,* 1998; Gonis and Taylor, 2009). Gonis and Taylor (2009) also document that UK firms' credit quality has also deteriorated over the past few years. This might be another reason for the decreasing trend in the debt ratios.

6.1.2. Testing OLS assumptions

Ordinary least square (OLS) is used as the main estimation technique for the present study, specifically for the analysis of the factors affecting the capital structure and debt maturity structure of the firms. Using OLS as an estimation technique, it necessitates that all the assumptions regarding the data are met, failing which the results may be misleading. Therefore, all OLS assumptions are tested before applying the model; results for the main diagnostic tests are presented in Appendices 6B to 6E. The following is the discussion on some of the diagnostics of the assumptions, which need special attention and discussion before proceeding further with the analysis of the proposed models. Any violations of the assumptions may require some adjustments and remedies, which will be discussed within the analysis section.

An important assumption for the OLS is 'no multicollinearity' which requires that the explanatory variables and control variables are not perfectly or highly intercorrelated with each other (Gujarati, 2004, p.342). Different tests are conducted to examine multicollinearity issues in the sample, such as bi-variate matrix, Eigenvalues and VIF. The Pearson correlation matrixes of dependent, interest and control variables for the whole sample (rated and non-rated firms) are displayed in Table 6.7 and for rated firms are displayed in Table 6.8. As can be seen in both the tables, none of the variables indicates any serious collinearity issues other than the polynomials and rating dummy (RAT_{dum}). Most of the variables are correlated at the 1% or 5% level, but the coefficients mostly lie close to or below 0.30, which seems tolerable for the OLS. A correlation coefficient close to or equal to +1 and -1 suggests high collinearity or perfect multicollinearity among the variables.

Table 6.7
Pearson's Correlation Matrix of Dependent, Explanatory and Control Variables (Rated and Non-Rated Firms)

	TDTA	**CR**	**CR^2**	**RAT_{dum}**	**LOS**	**PROF**	**FAR**	**MBR**	**LIQD**	**$TECH_{dum}$**	**IND_{dum}**	**CS_{dum}**	**CG_{dum}**	**HC_{dum}**	**UTL_{dum}**	**BM_{dum}**	**OG_{dum}**	**$TELE_{dum}$**
TDTA	1																	
CR	-.092**	1																
CR^2	-.099**	.995**	1															
RAT_{dum}	.111**	-.963**	-.981**	1														
LOS	.261**	-.133**	-.134**	.132**	1													
PROF	-.024**	-.038**	-.037**	.033**	.309**	1												
FAR	.244**	-.066**	-.063**	.060**	.101**	.152**	1											
MBR	-.164**	-.001	.000	-.001	-.100**	-.025**	-.184**	1										
LIQD	-.279**	.052**	.053**	-.053**	-.234**	-.172**	-.252**	.199**	1									
$TECH_{dum}$	-.165**	.049**	.050**	-.047**	-.083**	-.069**	-.258**	.189**	.114**	1								
IND_{dum}	-.008	.053**	.053**	-.053**	.003	.057**	-.106**	-.089**	-.073**	-.242**	1							
CS_{dum}	.043**	-.031**	-.036**	.041**	-.067**	.019**	.134**	-.013*	-.121**	-.190**	-.331**	1						
CG_{dum}	.012*	-.006	-.007	.004	.065**	.042**	-.034**	-.076**	.00	-.152**	-.266**	-.208**	1					
HC_{dum}	-.041**	.002	.007	-.012*	-.085**	-.126**	-.106**	.154**	.186**	-.097**	-.169**	-.132**	-.106**	1				
UTL_{dum}	.119**	-.107**	-.103**	.097**	.110**	.024**	.238**	-.060**	-.054**	-.063**	-.109**	-.085**	-.069**	-.044**	1			
BM_{dum}	.041**	-.009	-.007	.004	.089**	.003	.170**	-.062**	.016**	-.109**	-.190**	-.149**	-.120**	-.076**	-.049**	1		
OG_{dum}	.005	-.011*	-.008	.005	-.025**	-.013*	.120**	-.016**	.054**	-.074**	-.130**	-.101**	-.082**	-.052**	-.033**	-.058**	1	
$TELE_{dum}$	.090**	-.028**	-.032**	.043**	.088**	.019**	.058**	.018**	-.041**	-.059**	-.102**	-.080**	-.065**	-.041**	-.026**	-.046**	-.031**	1

Notes
**Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)
Variables are defined as total debt to total assets (TDTA) as dependent variable, numerical code 1-6 for credit rating (CR), credit rating square (CR^2),rating dummy (RAT_{dum}), log of sales (LOS) refers to natural logarithm of sales, profitability (PROF) is the ratio of earnings before interest, taxes and depreciation to total assets, fixed assets ratio (FAR) is the ratio of fixed assets to total assets, market to book ratio (MBR) is the book value of the assets minus the book value of the equity minus market value of equity divided by book value of assets and liquidity ratio (LIQD)is the ratio of current assets to total assets, technology dummy ($TECH_{dum}$), industrial dummy (IND_{dum}), consumer services dummy (CS_{dum}), consumer goods dummy (CG_{dum}), heath care dummy (HC_{dum}), utility dummy (UTL_{dum}), basic material dummy (BM_{dum}), oil and gas dummy (OG_{dum}), and telecommunication dummy ($TELE_{dum}$).

Table 6.8
Pearson's Correlation Matrix of Dependent, Explanatory and Control Variables (Rated Firms only)

	TDTA	CR	CR^2	LOS	PROF	FAR	MBR	LIQD	$TECH_{dum}$	IND_{dum}	CS_{dum}	CG_{dum}	HC_{dum}	UTL_{dum}	BM_{dum}	OG_{dum}	$TELE_{dum}$
TDTA	1																
CR	.397**	1															
CR^2	.364**	.974**	1														
LOS	-.368**	-.443**	-.454**	1													
PROF	.065	-.226**	-.241**	.072*	1												
FAR	.061	-.168**	-.122**	-.101**	.041	1											
MBR	.061	-.112**	-.094**	-.009	.278**	-.326**	1										
LIQD	-.158**	.068*	.092**	-.200**	-.083*	-.213**	.122**	1									
$TECH_{dum}$	.031	.250**	.299**	-.116**	-.085*	-.074*	-.017	.108**	1								
IND_{dum}	-.050	.051	.036	-.116**	-.022	-.054	-.112**	.025	-.053	1							
CS_{dum}	-.001	.146**	.097**	-.039	-.036	-.115**	.143**	-.044	-.095**	-.268**	1						
CG_{dum}	.168**	-.026	-.065	.069*	.106**	-.288**	.046	-.035	-.059	-.167**	-.301**	1					
HC_{dum}	-.121**	-.271**	-.207**	.180**	.252**	-.073*	.339**	.030	-.029	-.081*	-.146**	-.091**	1				
UTL_{dum}	.040	-.148**	-.131**	-.153**	-.067*	.414**	-.173**	-.086*	-.053	-.149**	-.269**	-.168**	-.081*	1			
BM_{dum}	-.104**	-.123**	-.112**	.149**	.044	.105**	-.052	.056	-.041	-.116**	-.210**	-.131**	-.063	-.117**	1		
OG_{dum}	-.047	-.138**	-.097**	.087*	.056	.149**	-.071*	.074*	-.029	-.082*	-.148**	-.092**	-.045	-.083*	-.064	1	
$TELE_{dum}$	.002	.226**	.248**	.016	-.216**	.011	-.100**	.011	-.037	-.105**	-.189**	-.118**	-.057	-.105**	-.082*	-.058	1

Notes
**Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)
Variables are defined as total debt to total assets (TDTA) as dependent variable, numerical code 1-5 for credit rating (CR), credit rating square (CR^2), log of sales (LOS) refers to natural logarithm of sales, profitability (PROF) is the ratio of earnings before interest, taxes and depreciation to total assets, fixed assets ratio (FAR) is the ratio of fixed assets to total assets, market to book ratio (MBR) is the book value of the assets minus the book value of the equity minus market value of equity divided by book value of assets and liquidity ratio (LIQD)is the ratio of current assets to total assets, technology dummy ($TECH_{dum}$), industrial dummy (IND_{dum}), consumer services dummy (CS_{dum}), consumer goods dummy (CG_{dum}), heath care dummy (HC_{dum}), utility dummy (UTL_{dum}), basic material dummy (BM_{dum}), oil and gas dummy (OG_{dum}), and telecommunication dummy ($TELE_{dum}$).

In this case, CR and CR^2 show very high correlation of 99.5% which is because the CR^2 is derived from the CR, and due to the functional relationship between them in the form of squared or cubed transformation, both variables by construction will have a very high correlation.[24] Gujarati (2002) states that multicollinearity can exist only when variables have linear relationship as opposed to variables, which are functionally related.

Formal tests for multicollinearity diagnostics, Variance Inflation Factor (VIF) and Eigenvalues for both the sample sets also suggest that the variables do not suffer from multicollinearity except the CR, CR^2 and $RAT_{dum,}$ which shows high VIF (exceeding 10) and near zero Eigenvalues (Gujarati, 2004, p.362). RAT_{dum} is also highly correlated with the CR and CR^2 because the dummy is constructed from these variables where approximately 98% of the observations are based on the non-rated firm-years. This high correlation or near multicollinearity does not make the estimators biased (Studenmund, 2000, p.249) although it will make it difficult to estimate the parameters with precision due to the high standard errors of the highly correlated variables in the model. Moreover, the actual contribution of the variable cannot be interpreted from the model due to the large standard errors of the actual and function term of the variables (Gujarati, 2004). Due to underestimation of the standardized beta coefficients, small *t*-statistics and large *p*-values in the presence of high standard error, it may not be possible to gauge the actual contribution of the proposed variable CR, CR^2 and the $RAT_{dum.}$[25]

Another assumption of OLS requires that the error terms follow a normal distribution, $u_i \sim N(0, \sigma^2)$. To test the assumption of normality, histogram of residuals, Normal P-P plots, Skewness, Kurtosis statistics and Jarque-Bera are conducted for both samples. All tests show non-normality in the distribution of residuals and hence the null hypothesis of normality of residuals is rejected. It should be noted however, that the present case non-

[24] Also to note, CR on its own has a negative relationship with the TDTA showing that as CR moves from 1 to 6, the debt ratio gradually start declining. The CR^2 also shows similar sign and coefficient. Columns 3 and 4 show that CR and CR^2 both have similar sign and coefficients with all the variables in the model proposed. This is because of the nature of the variable itself and by construction, the variable should have the same sign when independently analysed. In the regression model, this functional form of the variable serves to capture the quadratic nature of the relationship and may show a different sign based on the actual relationship between the two.

[25] A possible and widely used remedy is centring or standardizing the actual term i.e., CR in this case, and constructing the polynomials from these centred or standardized values. This may possibly reduce the multicollinearity issue between the variables, increase the precision (in terms of the contribution) of the estimated model and make the interpretation straightforward. In this case, centring and standardizing the variable did not reduce the correlation coefficient (became inverse from 99.5% to -98.5%) yet the VIF improved considerably (although still very high and above the tolerance level of 10). This indicates that the method is not suitable in this case.

normality of the residuals is not likely to create any serious concerns in the whole sample due to the large sample size of 38,800.[26] Conversely, the rated firms' sample can be affected by non-normality in the distribution of residuals. The statistics and plots also show a mild level of non-normality in comparison with the whole sample, which may somewhat affect the reliability of the results.

Another possible concern in Model (1), which will be tested to examine the relationship of credit ratings and capital structures, is the non-independence of the error term and the independent variables. In case the error terms and explanatory variables are correlated with each other, OLS estimates may attribute to the independent variables some of the variation in the dependent variable which actually comes from the residuals (Studenmund, 2000, p.88). This would make the estimators biased or inconsistent (Verbeek, 2008, p.129). Among other causes of the problem such as omitted variables and measurement errors, the most important in the present case is the simultaneous nature of the model or reverse causality among the dependent and some explanatory variables. In the Model (1) theoretically, credit rating and the leverage of the firms might have a causal relationship where credit ratings determine the leverage of the firm and the leverage of the firm in turn influences the credit ratings of the firms. Therefore, this is not truly a unidirectional cause and effect relationship and thus calls for appropriate treatment to minimise such errors.

Credit ratings (CR) and its squared form, CR^2, are the endogenous variables in the model. A formal test for identifying endogeneity is the Durbin–Wu–Hausman test for linear models (Wooldridge, 2002). Due to the quadratic nature of the model however, the test cannot be directly applied to this case. Therefore, it is necessary to rely upon the theoretical evidence (see for example, Kaplan and Urwitz (1979), Ederington (1985), Molina (2005) and Gray *et al.* (2006) on the importance of leverage for credit ratings). Due to the simultaneous nature of the relationship, the estimators produced will be biased and inconsistent. To resolve the endogeneity issue, the two-stage least squares (2SLS) may be estimated for the rated firms only. This will help establish the relationship of credit rating and capital structure by ruling out any endogeneity bias present in the initial model. More details on the technique and results are provided in Section 6.3.4.2 below.

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[26] As Brooks (2008) states, '*for sample size that are sufficiently large, violation of the normality assumption is virtually inconsequential'* (p.164). This is because *'the law of large numbers states that the average of a sample (which is a random variable) will converge to the population mean (which is fixed), and the central limit theorem states that the sample mean converges to a normal distribution'* (p.164).

Overall diagnostics for the assumptions suggests that the OLS as a main estimation is still valid and statistically justified despite some of the assumptions not being met. The problems associated with certain assumptions highlighted above are resolved by appropriate remedial measures as discussed above and will further be discussed in the analysis section.

6.2. Testing the Impact of Credit Rating on the Capital Structure

In this section, the three main hypotheses specified in Chapter 3 are tested using Model (1). The hypotheses are re-stated as follows:

H*$_{1a}$* = *Other things being equal, low rated firms are likely to have low levels of leverage in their capital structures.*

H*$_{1b}$* = *Other things being equal, high rated firms are likely to have low levels of leverage in their capital structures.*

H*$_{1c}$* = *Other things being equal, mid rated firms are likely to have high levels of leverage in their capital structures.*

As discussed in Section 5.2.1.4 of Chapter 5, Model 1 explores the relationship between credit ratings and the leverage of the firms. The model is re-stated as:

$$TDTA_{i,t} = \beta_0 + \beta_1 CR_{i,t} + \beta_2 CR_{i,t}^2 + \sum_{i=1}^{n} \beta_i X_{i,t} + \varepsilon_{i,t} \text{ ..... } \mathbf{(1)}$$

As already stated in Chapter 5 (Section 5.1) and Section 6.1.1.1 above, the model will be tested both for rated firms and for a combination of rated and non-rated firms.

6.2.1. Regression Results for Rated Firms

Table 6.9 presents the results of the pooled OLS for Model (1) based on the book debt ratio for the sample of rated firms only. Column 1 shows the OLS results of the book debt ratio regressed upon credit ratings and their squares. Column 2 shows the results of the full model, containing all the control variables, and Column 3 displays the results for Model (1) based on the rated firms’ sample without the inclusion of the utility firms.

Column 1 shows that the F-value is significant at the 1% level, suggesting that the model without control variables is significant in explaining variations in capital structures. Therefore, the null hypothesis, that the slopes of the explanatory variables are simultaneously zero, is rejected. An adjusted-R^2 of 16.6% suggests that CR and CR^2 can jointly explain 16.6% of the variation in the debt ratio of rated firms. Consistent with the hypotheses, the coefficient of CR is positive and significant at the 1% level while the coefficient of CR^2 is negative and significant at the 1% level, indicating an inverted U-shaped relationship between the credit ratings and capital structures of UK firms.

Table 6.9
Pooled Time-series Cross-sectional Regression of Book Debt Ratio on Credit Ratings and Control Variables (Rated Firms only)

Variables	**1**	**2**	**3**
(Constant)	0.029 (0.84)	0.533 (5.11)***	0.565 (4.88)***
CR	0.167 (6.62)***	0.187 (6.99)***	0.169 (5.84)***
CR^2	-0.017 (-3.85)***	-0.021 (-4.45)***	-0.017 (-3.40)***
LOS		-0.041 (-7.57)***	-0.041 (-6.95)***
PROF		0.099 (2.07)**	0.128 (2.48)**
FAR		0.107 (4.19)***	0.078 (2.95)***
MBR		0.025 (5.22)***	0.023 (4.65)***
LIQD		-0.046 (-6.68)***	-0.043 (-5.98)***
$TECH_{dum}$		0.003 (0.07)	-0.013 (-0.31)
IND_{dum}		-0.007 (-0.27)	-0.006 (-0.22)
CS_{dum}		0.002 (0.11)	0.005 (0.24)
CG_{dum}		0.105 (4.25)***	0.104 (4.17)***
HC_{dum}		0.024 (0.68)	0.023 (0.64)
UTL_{dum}		0.037 (1.43)	
BM_{dum}		0.022 (0.81)	0.027 (0.98)
OG_{dum}		0.074 (2.29)**	0.077 (2.36)**
Adj R^2	.166	.338	.429
F	87.516	21.963	30.741
Sig	.000	.000	.000
N	874	874	760

*Notes: This table displays the OLS regression results for the rated firms only with (Columns 1 and 2) and without utility firms (Column 3) for Model (1). Coefficients are reported outside parenthesis while t-values are in the parenthesis. ***, ** and * denotes p-values significant at the 1%, 5% and 10% levels, respectively. Variables are defined as total debt to total assets (TDTA) as dependent variable, numerical code 1-5 for credit rating (CR), credit rating square (CR^2), log of sales (LOS) refers to natural logarithm of sales, profitability (PROF) is the ratio of earnings before interest, taxes and depreciation to total assets, fixed assets ratio (FAR) is the ratio of fixed assets to total assets, market to book ratio (MBR) is the book value of the assets minus the book value of the equity minus market value of equity divided by book value of assets and liquidity ratio (LIQD)is the ratio of current assets to total assets, technology dummy ($TECH_{dum}$), industrial dummy (IND_{dum}), consumer services dummy (CS_{dum}), consumer goods dummy (CG_{dum}), heath care dummy (HC_{dum}), utility dummy (UTL_{dum}), basic material dummy (BM_{dum}) and oil and gas dummy (OG_{dum}).*

After adding the restrictions of firm-level factors into the model, the adjusted-R^2 increases from 16.6% to 33.8% with an F-*value* of 21.96 at p<0.01.This adjusted-R^2 is higher than the prior UK studies reporting 18% (Rajan and Zingales, 1995), 8.22% (Bevan and Danbolt, 2002) and 31% (Jong *et al.*, 2008) adjusted-R^2. This is possibly because the inclusion of credit ratings as a determinant of rated firms' capital structures has improved the overall model. Such differences however, can also be attributable to a different sample period and sample size along with differences in the specification of the model. For example, these studies do not control for industry effects and/or liquidity in their models.

The coefficients of CR and CR^2 remain qualitatively similar after other firm-level factors are controlled for in the model. The coefficients are highly significant and are of expected signs. The positive coefficient on CR and the negative coefficient on CR^2 indicate that the leverage increases with 18.7 percentage points but the rate of increase simultaneously decreases by 2.1 percentage points with each consecutive squared rating. After it has attained its peak, leverage then diminishes with the increase in CR (i.e., with a decrease in the credit quality of the firm) which would imply a non-linear relationship. This suggests that firms with high and low credit ratings have lower leverage in their capital structures compared to their counterpart mid rated firms. This provides strong evidence for the *credit rating – capital structure hypothesis* (CR-CS) in predicting that concerns for the costs and benefits of credit ratings drive firms to follow conservative debt policies despite having better access to debt markets, as is suggested by the *credit rating – market access hypothesis* (CR-MA).

The non-linear relationship between the credit ratings and capital structures of firms suggests that previous studies such as that by Mittoo and Zhang (2010) have been unable to fully capture the complex relationship between the credit ratings and capital structures of firms. For example, they empirically find a negative relationship between credit ratings and leverage. Mittoo and Zhang argue that before acquiring credit ratings, speculative grade firms were constrained by debt capacity and their rating status facilitated them in accessing public debt markets, resulting in high levels of gearing. However, inconsistently with Mittoo and Zhang (2010), the results of the present study (Table 6.9) indicate that, similar to high rated firms, lowest rated firms within the speculative grade have also relatively low levels of leverage. Low rated firms are likely to face supply-side constraints due to their credit ratings relative to medium rated and high rated firms. Moreover, they can be expected to have higher concerns for the costs imposed by their credit ratings, as downgrades would have relatively more serious implications than their counterpart high rated and medium rated firms. Consistent with the CR-CS hypothesis, the results indicate that they will prefer to have low gearing ratios. For such firms, as predicted by the CR-CS hypothesis, the costs of low ratings and any subsequent downgrades are higher than the benefits of employing more leverage. As discussed in Chapter 2, the institutional settings of the UK market would also increase the concerns over low ratings. For example, the creditor friendly bankruptcy code and lower proportion of low rated firms would make low rated firms particularly concerned about their credit ratings leading to low gearing ratios. This finding, however, is inconsistent with Lemmon and Zender (2004), who argue that rated firms, irrespective of whether they are investment grade or speculative grade, will have better access to debt markets and have high levels of leverage.

Consistent with the hypothesis and prior study by Mittoo and Zhang (2010), high rated firms seem to have relatively low gearing ratios. This suggests that despite having better access to debt markets, as is suggested by the CR-MA hypothesis, high rated firms have a preference for low gearing ratios, which appears to be due to the higher incentive to maintain their credit ratings. The CR-CS hypothesis implies that for high rated firms, the benefits of high ratings outweigh the benefits of high leverage. High rated firms arguably have low cost of capital, easier access to the commercial paper market, favourable terms and conditions in debt contracts, access to alternative sources of financing and they can also benefit from greater financial flexibility due to their high credit ratings. Apart from these financial benefits, high rated firms can also enjoy the non-financial benefits of high ratings, such as a good managerial reputation in the labour market, employee loyalty and favorable suppliers' terms and conditions. As high rated firms, over a period of time, have gained a market reputation for being successful and highly creditworthy firms, they should therefore have more incentive to maintain their credit ratings than other rated firms. As predicted by the CR-CR hypothesis, these benefits of high credit ratings induce high rated firms to choose low gearing ratios.

It should be noted that the implications of the CR-CS hypothesis differ from traditional trade-off theory. The trade-off theory, which predicts a negative relationship between risk and leverage, implies that high rated firms, which arguably have low chances of bankruptcy, have high leverage. However, the implications of the CR-CS hypothesis are distinct from the trade-off theory as it suggests that the benefits of high ratings are material for high rated firms, which would lead high rated firms to choose low levels of gearing.

Mid rated firms seem to have a preference for high gearing ratios. Given that these firms have better credit ratings than low rated firms, they have less constrained access than low rated firms. Despite the fact that the CR-CS hypothesis predicts that considerations for ratings in capital structure decisions should be somewhat similar across different rating levels, mid-rated firms arguably have less concern for their credit ratings. Mid-rated firms would be likely to require large changes in their capital structures to get into a category where they would benefit from being top rated. Moreover, the high gearing ratios of mid rated firms also suggest that they are stable firms with a limited risk of falling towards low ratings. As these firms are far from low and high ratings categories, their good credit ratings help them in accessing more debt. This imply that the results of prior empirical studies (Faulkender and Petersen, 2006; Judge and Mateus, 2009; Mittoo and Zhang, 2010) are dominated by mid-rated firms. Overall, the results of the present study suggest that credit ratings have a non-linear relationship with the capital structures of firms.

An interesting observation about the capital structures of rated firms is that the characteristics, which appear to affect the capital structures of rated firms, are different from those suggested by prior studies. For example, for the rated firms' sample, large firms have less debt and the coefficient is significantly different from zero. This is inconsistent with prior literature, which suggests that larger firms have higher leverage due to their better access to debt markets, more remote chance of failure and economies of scale. One possible reason could be due to the positive relationship between size and leverage; large firms are expected to have high credit ratings and therefore have low leverage in their capital structure. Nevertheless, it is noted that even after controlling for the size of the firm, which has previously been used as a proxy for firms' access to capital markets and chances of bankruptcy (see for example, Titman and Wessels, 1988; Rajan and Zingales, 1995; Bevan and Danbolt, 2002, amongst others), the credit ratings variables maintain their statistical significance. The size variable does not have any serious multicollinearity or abnormal correlation with the credit ratings as suggested by the bi-variate analysis, VIF and Eigenvalues presented in Section 6.1.2, Appendices 6A and 6B. Consolidating the findings of correlation, multicollinearity statistics and the regression output of Table 6.9, the results suggest that firms' credit ratings offer some unique benefits and costs to the firms at each rating level, which can play a role in determining the capital structures of the firms.

Similarly, significant at the 5% level, profitability has a positive sign, which means that when rated firms are profitable they have higher leverage. Although this is inconsistent with the pecking-order theory and prior empirical evidence (Jong *et al.*, 2008; Rajan and Zingales, 1995; Bevan and Danbolt, 2002), the results are more supportive of the trade-off theory. Profitable firms are less likely to fail but they may have to pay high corporate taxes because of their high profits. Such firms have therefore a higher incentive to safely employ more leverage, in order to reduce their tax burdens. As hypothesised, the coefficient of tangibility has a positive relationship with the leverage of the firms. The significance and sign of the coefficient signifies the role of collateralisable assets towards the leverage.

Inconsistently with Myers (1984), rated firms with high growth opportunities are shown to be likely to have high debt as well. It seems that, when firms have an advantageous position in the market by possessing credit ratings, they are likely to behave differently when faced with a higher growth opportunities set. It indicates that rated firms possibly have less underinvestment problems that lead these firms to choose high gearing in the presence of growth opportunities. The relationship of liquidity and leverage is also found to be negative and significant at the 1% level which is in line with past studies such as Ozkan (2001) and Deesomsak *et al.* (2004), who report a negative relationship. Most of the industry dummies on the other hand are insignificant, which is either due to the small sample size or implies that the rated firms generally have similar capital structures across the industries.

The inclusion of utility firms in the sample may receive some criticism. The utility firms, being largely regulated, are governed under a different set of regulations than the non-regulated firms. Therefore, they are likely to have different capital structures, which cannot be directly compared with other rated firms. Previous studies investigating firms' capital structures tend to exclude utility firms from their sample (Stohs and Mauer, 1996; Ozkan, 2000, 2001 and 2002; Shyam-Sunder and Myers, 1999). To be consistent with the prior literature, Column 3 presents the regression results for Model (1), estimated only for the sample without the utility firms. It can be noted that the results remain qualitatively similar those reported in to Column 2. However, the fit of the model has considerably improved. The CR and CR^2 have a similar sign to Column 3 and remain statistically significant at the 1% level. Moreover, the control variables also possess similar signs and significance levels, suggesting that the inclusion of the utility firms has not distorted the previous analysis. Also worth mentioning here is that the utility firms also show that the credit ratings have a non-linear relationship with leverage.

Overall, the results of the present section provide strong support to accept hypotheses H_{1a}, H_{1b} and H_{1c} that the implications of the CR-CS hypothesis induce a non-linear relationship between the credit ratings and capital structures of UK firms. It can be noted that relative to the factors proposed by traditional theories of capital structure, credit ratings seem to have a higher contribution in explaining the capital structure decisions of rated firms. The results of the control variables seem to indicate that rated firms have a different capital structure and are affected by the same firm characteristics in different ways as well. Caution has to be exercised when attempting to understand the capital structure of such firms, as this small group has unique characteristics which may not be observed collectively with other firms and may require a separate analysis.

6.2.2. Regression Results for Non-Rated and Rated Firms

This section presents empirical results for Model (1) based on the sample containing both non-rated firms and rated firms. Non-rated firms are assigned the lowest code in the credit rating scheme (i.e., 6). Although these firms, being non-rated, are unlikely to have credit rating considerations in mind when they make their capital structure decisions, they can still be expected to have low leverage in their capital structure. Prior literature has suggested that rated firms, whether investment grade or speculative grade, are more creditworthy than non-rated firms and therefore they do not have constrained debt capacity (Lemmon and Zender, 2010). The CR-MA hypothesis presented by Faulkender and Petersen (2006) further suggests that rated firms have less information asymmetry compared with their counterpart non-rated firms. This implies that non-rated firms are likely to have lower gearing ratios and, if categorised as the lowest rated firms, would not significantly change the results of the previous section. It is expected, therefore, that credit ratings have a non-linear relationship with capital structures where the lowest rated category indicates the non-rated firms (for a detailed discussion see Section 5.1.4).

Table 6.10 presents the results of pooled OLS for Model (1) based on the book debt ratio (TDTA) for the whole sample of rated and non-rated firms. Column 1 contains the results where the leverage of the firm is regressed upon the credit rating and its square only, without controlling for other firm level factors. Column 2 presents the results after controlling for other firm-level factors and Column 3 shows the results when the rating dummy (RAT_{dum}) is introduced into the main model. Finally, Column 4 presents the results for the main model without the utility firms.

Column 1 shows that the adjusted-R^2 is 1.5% and the model is still significant with F-value 291.21 at $p<0.01$. The adjusted-R^2 is lower than what has been reported in Column 1 of

Table 6.9 because the sample consists of both rated and non-rated firms, with the proportion of rated firm-years being only 2.25% in the whole sample. As hypothesised, CR and CR^2 without restrictions in the model have the predicted signs and are statistically significant at the 1% level, indicating that credit ratings have an inverted U-shaped relationship with the capital structures of firms.

Table 6.10
Pooled Time-series Cross-sectional Regression of Book Debt Ratio on Credit Ratings and Control Variables (Rated and Non-Rated Firms)

Variables	1	2	3	4
(Constant)	-0.046 (-1.58)	-0.196 (-7.13)***	-0.308 (-8.55)***	-0.338 (-8.77)***
CR	0.246 (13.93)***	0.251 (15.61)***	0.161 (6.53)***	0.152 (5.70)***
CR^2	-0.034 (-15.74)***	-0.033 (-16.47)***	-0.014 (-3.42)***	-0.012 (-2.64)***
RAT_{dum}			0.209 (4.81)***	0.250 (5.35)***
LOS		0.012 (44.79)***	0.012 (44.79)***	0.012 (43.89)***
PROF		-0.153 (-32.05)***	-0.153 (-32.02)***	-0.151 (-31.44)***
FAR		0.112 (29.59)***	0.112 (29.49)***	0.108 (28.25)***
MBR		-0.007 (-13.82)***	-0.007 (-13.81)***	-0.007 (-13.91)***
LIQD		-0.015 (-37.74)***	-0.015 (-37.76)***	-0.015 (-37.87)***
$TECH_{dum}$		-0.097 (-17.07)***	-0.096 (-16.89)***	-0.097 (-17.01)***
IND_{dum}		-0.060 (-11.16)***	-0.058 (-10.93)***	-0.059 (-10.99)***
CS_{dum}		-0.056 (-10.26)***	-0.054 (-10.01)***	-0.054 (-10.02)***
CG_{dum}		-0.058 (-10.44)***	-0.056 (-10.17)***	-0.056 (-10.20)***
HC_{dum}		-0.043 (-7.09)***	-0.042 (-6.93)***	-0.042 (-6.95)***
UTL_{dum}		-0.013 (-1.84)*	-0.012 (-1.68)*	
BM_{dum}		-0.062 (-10.69)***	-0.061 (-10.47)***	-0.061 (-10.38)***
OG_{dum}		-0.058 (-8.92)***	-0.057 (-8.77)***	-0.057 (-8.70)***
Adj R^2	.015	.194	.195	.184
F	291.210	625.758	588.427	570.480
Sig	.000	.000	.000	.000
N	38880	38880	38880	37814

*Notes: This table displays the OLS regression results of Model 1 for the whole sample (Columns 1-3) and without utility firm (Column 4). Coefficients are reported outside parenthesis while t-values are in the parenthesis. ***, ** and * denotes p-values significant at the 1%, 5% and 10% levels, respectively. Variables are defined as total debt to total assets (TDTA) as dependent variable, numerical code 1-6 for credit rating (CR), credit rating square (CR^2), rating dummy (RAT_{dum}), log of sales (LOS) refers to natural logarithm of sales, profitability (PROF) is the ratio of earnings before interest, taxes and depreciation to total assets, fixed assets ratio (FAR) is the ratio of fixed assets to total assets, market to book ratio (MBR) is the book value of the assets minus the book value of the equity minus market value of equity divided by book value of assets and liquidity ratio (LIQD)is the ratio of current assets to total assets, technology dummy ($TECH_{dum}$), industrial dummy (IND_{dum}), consumer services dummy (CS_{dum}), consumer goods dummy (CG_{dum}), heath care dummy (HC_{dum}), utility dummy (UTL_{dum}), basic material dummy (BM_{dum}) and oil and gas dummy (OG_{dum}).*

Column 2 reports the results with all restrictions except RAT_{dum} and shows that CR and CR^2 maintain not only the expected relationship but also remains significant at the 1% level. The positive coefficient of the CR suggests that as credit ratings move from 1 to 6 or from AA to NR, initially the leverage increases but at a decreasing rate. Although evident from Table 6.9 that rated firms on their own have a non-linear relationship, the inclusion of a large number of non-rated firms (approximately 98% of the total sample) may pose problems in interpretation. For example, it can be argued that non-rated firms, which are typically less leveraged than an average rated firm (see, Faulkender and Petersen, 2006;

Judge and Mateus, 2009; Mittoo and Zhang, 2010), may underestimate the relative contribution of credit ratings in determining the capital structure. Therefore in Column 3, Rating Dummy (RAT_{dum}) is introduced in the model to control for the effects of the inclusion of a large proportion of the firms which do not possess a credit rating, on the regression output of the model.

Column 3 reports the results for the full model. After the inclusion of the RAT_{dum}, CR and CR^2 still maintains the expected sign and are significantly different from zero. Though RAT_{dum} is statistically significant at the 1% level, the model estimations show that the results are independent of the inclusion of non-rated firms. Rather, the significance of the RAT_{dum} tends to support the assumption made about non-rated firms as having inferior credit quality, constrained debt capacity and less access to debt markets. The RAT_{dum} is significant at the 1% level, suggesting that rated firms have higher leverage than the non-rated firms. The significance of CR^2 for the sample including non-rated firms suggests that non-rated firms have lower leverage than the lowest grade firms available in the sample. It is noted that the inclusion of RAT_{dum} has had an impact on the *t*-statistics of the CR and CR^2, lowering it from 15.61 and -16.47 to 6.53 and -3.42, respectively. These results are expected as the CR is constructed from the inclusion of non-rated firms and the assumption will only suffice when the rating dummy is significant. This suggests that the coding procedure for the credit ratings is sufficiently reliable and does not suffer from any serious shortcoming due to the inclusion of a large number of non-rated firms. Moreover the results are consistent with Faulkender and Petersen (2006), Judge and Mateus (2009), Mittoo and Zhang (2010) and Judge and Korzhenitskaya (2011), and supports the *credit rating – market access hypothesis* (CR-MA) which suggests that rated firms have better access to debt markets with lower cost compared to the firms, which do not have credit ratings at all. Notwithstanding the difference in the sample, control variables and credit rating coding selected for the model, the coefficient of rating dummy in Table 6.10 is far higher than what has been reported in these studies.

Unlike the results for the sample of rated firms, control variables, firms' size, profitability, tangibility, the market to book ratio and liquidity, have expected coefficients and are significantly different from zero. Consistent with prior literature (Bennett and Donnelly 1993; Rajan and Zingales, 1995; Wald, 1999; Bevan and Danbolt, 2002; Fama and French, 2002; Deesomsak *et al.*, 2004), the positive sign of log of sales (LOS) indicates that large firms have significantly higher leverage than small firms. The negative and significant sign of profitability is consistent with the predictions of Myer's (1984) pecking order theory. It suggests that when firms have internal resources available, they are more likely to rely on such resources and will not depend on external financing. The result is also in line with the previous studies on UK firms such as Jong *et al.* (2008), Rajan and Zingales (1995) and Bevan and Danbolt (2002). Similarly, firms with more collateralisable assets have more debt. These results are consistent with prior studies (Titman and Wessels, 1988; Rajan and Zingales, 1995; Wald, 1999; Bevan and Danbolt, 2002; Jong *et al.*, 2008).

Also in line with the theoretical and empirical findings (Rajan and Zingales, 1995; Ozkan, 2001; Jong *et al.*, 2008), growth opportunities have a significant negative relationship with the leverage of the firms. This is consistent with the hypothesis that firms whose total values are largely composed of growth options tend to have lower leverage. The significance of industry dummies in the model shows that the leverage is different across different industries implying some common debt policy or norm of firms within each industry. All industry dummies are significant at the 1% level and have a negative coefficient, indicating that these industries have significantly less leverage than the base industry, telecommunication.

In sum, several interesting observations emerge from Table 6.10. First, irrespective of the sample of rated firms, the coefficients on both CR and CR^2 are highly significant for the whole sample, before and after controlling for other firm-level factors important for capital structure determination. This provides sufficient evidence to conclude that credit ratings are relevant for the capital structure of UK firms. Second, CR and CR^2 maintain their significance and sign in the model after controlling for the rating status. The significance of the rating dummy suggests that compared with nonrated firms, rated firms have higher leverage irrespective of their ratings. Third, the positive coefficient of CR and the negative coefficient of CR^2 provide sufficient support to reject the null hypothesis in favour of the alternative hypotheses that, credit ratings have a non-linear relationship with the capital structures of UK firms.

6.3. Robustness and Sensitivity Checks

This section presents several robustness and sensitivity checks to ensure the results are robust to different coding schemes, alternative measures of leverage and estimation techniques. The section also presents yearly and sector-wise analysis to assess the relevance of credit ratings for the capital structure over years and within industries, respectively. Moreover, the section also addresses the possible violations of OLS in the data or/and model and presents remedial alternative analysis depending on the severity of the violation.

6.3.1. Regression Results based on Alternative Measures of Credit Ratings

It can be argued that the coding procedure for the credit ratings may have a shortcoming due to unequal distances between the points on the scale. Credit rating (CR) is an ordinal variable where it has a clear order but the spacing between these points may not be the same across all the levels of the variable. For example, AA is better than A, BBB is better than BB but the difference between AA and A might not be the same as the distance between BBB and BB. These inconsistencies within the scale may pose problems in interpreting the results, specifically if the results are strongly dependent on the type of scale chosen for the analysis.

To minimise any such concerns, two measurement techniques are used. First, a 15 points scale (16 points scale) is used instead of the initial credit ratings codes for rated firms only (whole sample). This 15 points scale is constructed by assigning a numerical code to each individual rating within the broad rating category and code 16 is assigned to non-rated firms when the 16 points scale is used. This scale will serve two purposes. One, if using this scale provides qualitatively similar results as above, it may suggest that the initial coding does not suffer from any serious flaw in the measurement. Second, if results are similar to the previous analysis in Tables 6.9 and 6.10, the non-linearity in the leverage structure can also be confirmed for individual credit ratings. The second remedy to minimise the potential coding error is using a sequence of dummy variables for broad credit ratings (AA_{dum}, A_{dum}, BBB_{dum}, BB_{dum}, B_{dum} and NR). Dummy variables are constructed by assigning a binary code to each broad ratings category. For example, if firms have credit ratings within AA broad ratings category, it will take the value of one for the AA_{dum} and zero otherwise. The dummy for A rated firms and non-rated firms are used as base categories when the models are tested for the rated sample and combined sample of both rated and non-rated firms, respectively. Both base categories are well-defined groups in their respective samples with a sufficient number of cases to make precise estimates about the other groups in the model (for detailed discussion on the selection of base category, see Hardy, 1993, p.10).

6.3.1.1. Regression Results based on Individual Rating Categories

Table 6.11 presents the results based on individual rating coding. Columns 1-3 present the results for the rated firms' sample and Columns 4-7 present the results for the whole sample i.e., including non-rated firms. As can be noted, the statistical significance and the direction of coefficients on both CR and CR^2 remain qualitatively similar throughout all the columns in Table 6.11 as in Table 6.9 and 6.10. Similarly and in line with the predictions, credit rating shows a non-linear relationship with the leverage of the firms. However, the adjusted R squares in the case of the rated firms' sample have slightly improved from the reported results in Table 6.9. As can also be observed in Figure 6.2 (b), the non-linearity in the relationship between credit ratings and leverage is better captured by individual rating coding than with the broad rating coding. Nevertheless, given the results offer similar findings, it can be concluded that the scale based on broad credit rating categories used earlier do not bias the results and they remain robust with alternative credit rating schemes.

Furthermore, the results offer support to acceptance the hypotheses for individual credit ratings and capital structures, where firms with low and high credit ratings within their broad ratings category have also low leverage, whereas mid rated firms have high leverage. It is noted that the *t*-values in all the columns have actually improved, although the coefficients of CR and CR^2 have decreased. This is due to the differences in the scale where the broad rating coding carry less data points than the individual rating coding, thus making the relationship of CR and CR^2 with the capital structure less steep than the original scale (It can also be observed in Figure 6.2 (a & b)). In other words, the debt ratio with respect to the individual rating coding will have less absolute change than the broad rating coding.

6.3.1.2. Regression Results based on Broad Rating Dummy Techniques

The second measurement technique, containing dummy variables for each broad rating category, will essentially reduce the inconsistency issue within both of the scales. Table 6.12 reports the results using the second method. Columns 1-3 report the results for the rated firms' sample and Columns 4-6 present the results for a combined sample of both rated and non-rated firms. Columns 3 and 6 report the results for the samples without the inclusion of the utility firms.

Table 6.11
Pooled Time-series Cross-sectional Regression of Book Debt Ratio
on Credit Ratings and Control Variables Using Credit Rating Coding 1-15 (for Rated Firms) and 1-16 code (for Rated and Non-Rated Firms)

	Rated Firms			Rated and Non-Rated Firms			
Variables	**1**	**2**	**3**	**4**	**5**	**6**	**7**
(Constant)	0.074 (2.86)***	0.459 (4.43)***	0.466 (3.98)***	-0.002 (-0.09)	-0.144 (-6.10)***	-0.259 (-8.18)***	-0.277 (-8.22)***
CR	0.055 (7.56)***	0.063 (8.18)***	0.060 (7.08)***	0.086 (14.70)***	0.086 (16.15)***	0.059 (8.15)***	0.058 (7.56)***
CR^2	-0.002 (-4.34)***	-0.002 (-5.04)***	-0.002 (-4.09)***	-0.005 (-16.64)***	-0.004 (-17.06)***	-0.003 (-4.64)***	-0.003 (-4.11)***
RAT_{dum}						0.185 (5.45)***	0.207 (5.80)***
LOS		-0.033 (-6.29)***	-0.033 (-5.56)***		0.012 (44.85)***	0.012 (44.84)***	0.012 (43.93)***
PROF		0.103 (2.20)**	0.128 (2.54)**		-0.153 (-32.01)***	-0.153 (-31.98)***	-0.150 (-31.41)***
FAR		0.110 (4.45)***	0.082 (3.15)***		0.112 (29.53)***	0.112 (29.45)***	0.108 (28.22)***
MBR		0.023 (4.86)***	0.021 (4.31)***		-0.007 (-13.80)***	-0.007 (-13.79)***	-0.007 (-13.90)***
LIQD		-0.045 (-6.58)***	-0.040 (-5.68)***		-0.015 (-37.78)***	-0.015 (-37.80)***	-0.015 (-37.90)***
$TECH_{dum}$		0.004 (0.10)	-0.008 (-0.19)		-0.097 (-17.13)***	-0.096 (-16.82)***	-0.096 (-16.94)***
IND_{dum}		-0.009 (-0.38)	-0.007 (-0.28)		-0.06 (-11.26)***	-0.058 (-10.88)***	-0.058 (-10.94)***
CS_{dum}		0.004 (0.18)	0.008 (0.36)		-0.056 (-10.33)***	-0.054 (-9.95)***	-0.054 (-9.96)***
CG_{dum}		0.124 (5.05)***	0.125 (4.95)***		-0.058 (-10.47)***	-0.056 (-10.07)***	-0.056 (-10.11)***
HC_{dum}		0.064 (1.80)*	0.065 (1.78)*		-0.043 (-7.10)***	-0.042 (-6.83)***	-0.042 (-6.85)***
UTL_{dum}		0.044 (1.74)*			-0.014 (-1.91)*	-0.012 (-1.66)*	
BM_{dum}		0.026 (0.98)	0.032 (1.18)		-0.063 (-10.75)***	-0.061 (-10.40)***	-0.06 (-10.32)***
OG_{dum}		0.082 (2.58)***	0.087 (2.69)***		-0.058 (-8.93)***	-0.057 (-8.69)***	-0.056 (-8.62)***
Adj R^2	.177	.351	.494	.015	.194	.195	.185
F	94.788	32.523	16.713	294.490	626.609	589.738	571.511
Sig	.000	.000	.000	.000	.000	.000	.000
N	874	874	760	38880	38880	38880	37814

*Notes: This table displays results for OLS regression for Model 1, using 1-15 for credit rating coding for the rated firms sample (Columns 1-3) and 1-16 for credit ratings coding for the whole sample (rated and non-rated firms) (Columns4-7) Columns 3 and 7 reports the results for samples excluding utility firms. Variables are defined as total debt to total assets (TDTA) as dependent variable, numerical code 1-15 or 1-16 for credit rating (CR), credit rating square (CR^2), log of sales (LOS) refers to natural logarithm of sales, profitability (PROF) is the ratio of earnings before interest, taxes and depreciation to total assets, fixed assets ratio (FAR) is the ratio of fixed assets to total assets, market to book ratio (MBR) is the book value of the assets minus the book value of the equity minus market value of equity divided by book value of assets and liquidity ratio (LIQD)is the ratio of current assets to total assets, technology dummy ($TECH_{dum}$), industrial dummy (IND_{dum}), consumer services dummy (CS_{dum}), consumer goods dummy (CG_{dum}), heath care dummy (HC_{dum}), utility dummy (UTL_{dum}), basic material dummy (BM_{dum}) and oil and gas dummy (OG_{dum}). Coefficients are reported outside parenthesis while t-values are in the parenthesis. ***, ** and * denotes p-values significant at the 1%, 5% and 10% levels, respectively.*

Table 6.12
Pooled Time-series Cross-sectional Regression of Book Debt Ratio on Explanatory and Control Variables (Using Broad Dummy Variable Technique)

	Rated Firms			Rated and Non-Rated Firms		
Variables	**1**	**2**	**3**	**4**	**5**	**6**
(Constant)	0.288 (33.99)***	0.803 (8.68)***	0.823 (8.21)***	0.199 (225.06)***	0.134 (20.17)***	0.137 (20.50)***
AA_{dum}	-0.088 (-4.78)***	-0.094 (-5.01)***	-0.063 (-2.92)***	0.011 (0.59)	-0.070 (-4.25)***	-0.061 (-3.37)***
A_{dum}				0.096 (10.43)***	0.021 (2.50)**	0.016 (1.73)*
BBB_{dum}	0.089 (7.00)***	0.094 (7.40)***	0.102 (7.83)***	0.167 (16.19)***	0.121 (12.87)***	0.122 (12.92)***
BB_{dum}	0.180 (9.11)***	0.174 (8.90)***	0.211 (9.76)***	0.271 (14.14)***	0.204 (11.72)***	0.235 (12.38)***
B_{dum}	0.132 (4.89)***	0.114 (3.88)***	0.127 (4.11)***	0.226 (7.63)***	0.181 (6.76)***	0.182 (6.80)***
LOS		-0.039 (-7.49)***	-0.040 (-7.09)***		0.012 (44.77)***	0.012 (43.88)***
PROF		0.086 (1.83)*	0.123 (2.42)**		-0.153 (-32.02)***	-0.151 (-31.45)***
FAR		0.113 (4.48)***	0.082 (3.14)***		0.112 (29.48)***	0.108 (28.25)***
MBR		0.022 (4.66)***	0.018 (3.74)***		-0.007 (-13.83)***	-0.007 (-13.96)***
LIQD		-0.043 (-6.28)***	-0.038 (-5.39)***		-0.015 (-37.75)***	-0.015 (-37.86)***
$TECH_{dum}$		0.011 (0.26)	0.001 (0.03)		-0.096 (-16.87)***	-0.097 (-16.98)***
IND_{dum}		-0.011 (-0.44)	-0.011 (-0.46)		-0.058 (-10.92)***	-0.059 (-10.97)***
CS_{dum}		-0.004 (-0.18)	-0.002 (-0.08)		-0.054 (-10.01)***	-0.054 (-10.02)***
CG_{dum}		0.113 (4.61)***	0.116 (4.72)***		-0.056 (-10.15)***	-0.056 (-10.16)***
HC_{dum}		0.028 (0.80)	0.020 (0.56)		-0.042 (-6.95)***	-0.042 (-6.97)***
UTL_{dum}		0.031 (1.22)			-0.012 (-1.64)	
BM_{dum}		0.019 (0.70)	0.025 (0.92)		-0.061 (-10.45)***	-0.060 (-10.35)***
OG_{dum}		0.061 (1.89)*	0.059 (1.78)*		-0.058 (-8.78)***	-0.057 (-8.71)***
Adj R^2	.171	.343	.429	.016	.195	.185
F	46.141	27.851	10.432	124.416	573.471	504.299
Sig	.000	.000	.000	.000	.000	.000
N	874	874	760	38880	38880	37814

*Notes: This table displays OLS regression results for dummy variable technique for Model 1. Columns 1-3 report results for rated firms only and Columns 4-6 report results for the whole sample. Columns 3 and 6 report the results for samples without utility firms. Variables are defined as: dependent variable (TDTA) is total debt to total assets, AA_{dum}, A_{dum}, BBB_{dum} BB_{dum}, and B_{dum} takes the value of 1, if firm has a rating within broad rating category AA, A, BBB, BB or B respectively or 0 otherwise. 'A' rated firms (A_{dum}) and non-rated firms' NR are the base categories for rated firms sample and combined sample of rated and non-rated firm, log of sales (LOS) refers to natural logarithm of sales, profitability (PROF) is the ratio of earnings before interest, taxes and depreciation to total assets, fixed assets ratio (FAR) is the ratio of fixed assets to total assets, market to book ratio (MBR) is the book value of the assets minus the book value of the equity minus market value of equity divided by book value of assets and liquidity ratio (LIQD)is the ratio of current assets to total assets, technology dummy ($TECH_{dum}$), industrial dummy (IND_{dum}), consumer services dummy (CS_{dum}), consumer goods dummy (CG_{dum}), heath care dummy (HC_{dum}), utility dummy (UTL_{dum}), basic material dummy (BM_{dum}) and oil and gas dummy (OG_{dum}). Coefficients are reported outside parenthesis while t-values are in the parenthesis. ***, ** and * denotes p-values significant at the 1%, 5% and 10% levels, respectively.*

The results of Table 6.12 are consistent with Tables 6.9, 6.10 and 6.11. Non-linearity is observed between the relationship of the dummy variables of broad ratings categories and firms' leverage. Column 1 shows that AA rated firms have approximately 20% assets financed by debt. BB rated firms have highest leverage in their capital structure, whereas AA rated firms have the lowest leverage across the rating scales. When firm-level factors are controlled for in the model, the coefficients of the rating dummies still suggest a non-linear pattern in the debt ratios where BB rated firms on average have the highest leverage.

Compared to the base category of A rated firms, the results in Column 2 indicate that AA rated firms have 9 percentage points less leverage, BBB have 9 percentage points more leverage and BB rated firms have 17 percentage points more leverage. The coefficients start dropping after BB rated firms. B rated firms have 11 percentage points more leverage than the base category firms. Similar results are noted for the rated firms' sample without utility firms in Column 3.

Turning to the results for the sample of rated and non-rated firms combined in Column 4, the AA_{dum} is insignificant in the reduced model but becomes significant when restrictions are added to the model. The results of the full model in Columns 5 and 6 show a strong non-linear relationship for the dummy variables of rating categories. The coefficients of the dummy variables show an increase in leverage from AA_{dum} to BB_{dum} with respect to the base category NR, but the coefficients start to decline after BB rated firms.

Overall, this not only suggests that rated firms have higher leverage, but also suggests that the trend is not consistent in all the rating categories. The results provide strong support against the null hypothesis in favour of the alternative hypotheses that credit ratings have a non-linear relationship with capital structures. Other variables in the model tend to behave in a similar way as before. Interestingly, the control variables have very similar coefficients and signs as in Tables 6.9 and 6.10. The adjusted R^2 with the inclusion of control variables also show similar statistics and the model remains highly significant in both the partial and full versions of the model. This suggests that the results are robust to any coding procedure used for the credit ratings.

6.3.4. Regression Results based on Alternative Measures of Leverage

As already discussed in Subsection 5.2.1.1 of Chapter 5, the debt ratios of firms are mainly measured using book values of debt as they are argued to be the most realistic measure of firms' debt. Moreover, prior theoretical and empirical literature (Myers, 1977; Taggart, 1977; Baskin, 1989; Marsh, 1982; Stonehill *et al.*, 1975) also suggests that management actively use book values of leverage in their decision-making processes, while Kisgen (2006) argues that credit rating agencies also base their judgement on book values of debt. Since the present study examines firms' financial behaviour with respect to the credit ratings they possess, book debt ratios seem the most appropriate measure to test the relationship (for a more detailed discussion, see Chapter 5).

The unavailability of data, however, has possibly restricted the use of ratios which are computed with actual market values of debt. Prior studies (e.g., Rajan and Zingales, 1995; Friend and Lang, 1998; Bevan and Danbolt, 2002) have therefore extensively used market debt ratios to substitute ratios based on actual market values of debt. Generally, market debt ratios are calculated as: total book debt scaled by book value of assets minus book values of equity plus market value of equity. Following these studies, market debt ratios (MDR) are substituted in Model (1) to allow examination of the effects of credit ratings on firms' financing patterns.

As can be observed from Figure 6.4, market values of equity scaled by book value of total assets differ across rating levels, where high rated firms have high market values of equity but lower book values of equity compared with their counterpart low rated firms. As the market debt ratios are computed by using book values of debt scaled by market values of equity, it can be expected that market debt ratios will be lower for high rated firms and higher for low rated firms. Moreover, the relationship between credit ratings and market debt ratios is expected to be linear instead of nonlinear as in the case of book debt ratios (total debt to total assets, TDTA)

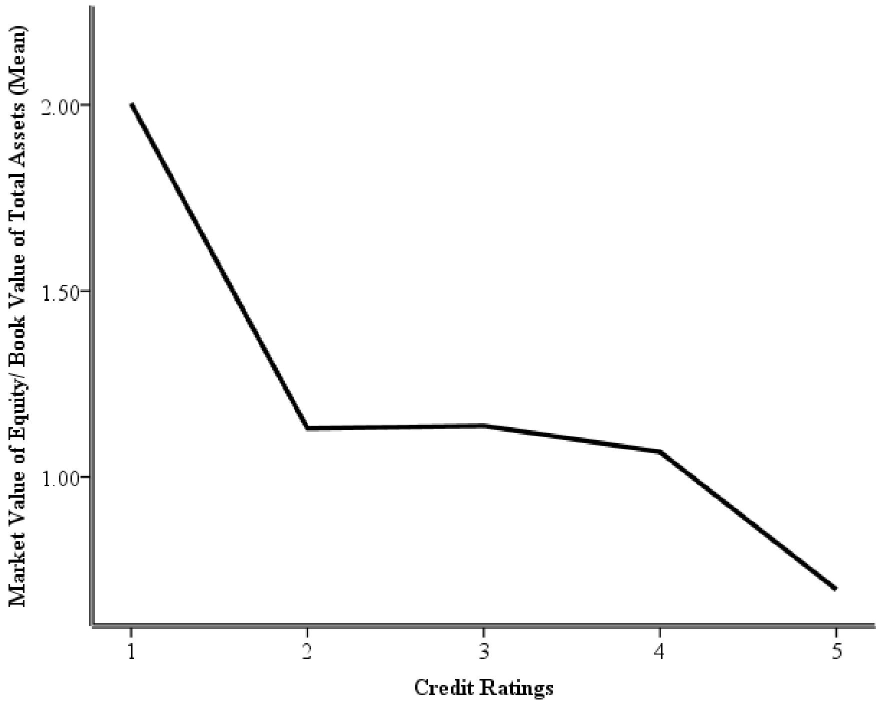


Figure 6.4: Market Values of Equity/Book Value of Assets across Credit Ratings

Figure 6.5 (a & b) shows average market debt ratios across broad credit ratings and individual credit ratings. As expected, market debt ratios are lower on average for high rated firms compared with lower rated firms. Moreover, they indicate that credit ratings are linearly related with capital structures. Table 6.13, which displays the regression results to test the relationship between credit ratings and market debt ratio (MDR), also suggest linear patterns between the two variables.

The regression results reported in Columns 1-3 based on the rated firms' sample, indicate that broad credit ratings do not significantly explain the variation in debt ratios, while individual credit ratings are positively associated with the level of debt in the capital structures. However, in Column 3, dummy variables for broad rating categories, also show that the market debt ratio tends to increase with a decrease in each broad rating category, suggesting a linear relationship between the two variables. For example, AA rated firms have 5 percentage points less leverage while BBB, BB and B rated firms have 5, 11 and 20 percentage points more leverage respectively, than A rated firms.

Similar patterns are observed when non-rated firms are added to the sample. Columns 4-6 report the results for the combined sample of rated and non-rated firms. The significance of the rating dummy in Columns 4 and 5 shows that rated firms have higher leverage than non-rated firms. However, inconsistent with the results of Table 6.9, CR has a positive coefficient significant at the 1% level while CR^2 has a negative coefficient but is insignificant in the model.

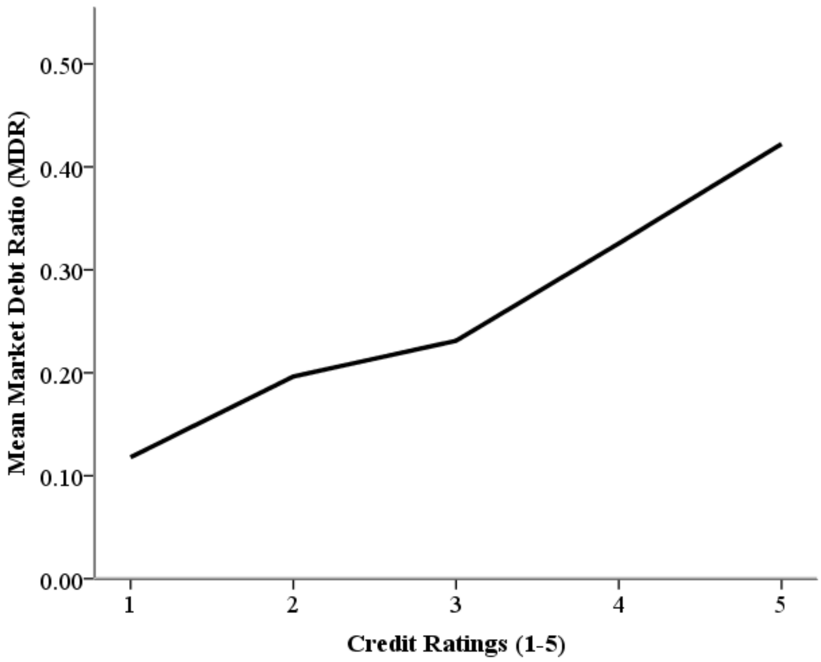


Figure 6.5 (a): Broad Credit Ratings and Market Debt Ratios

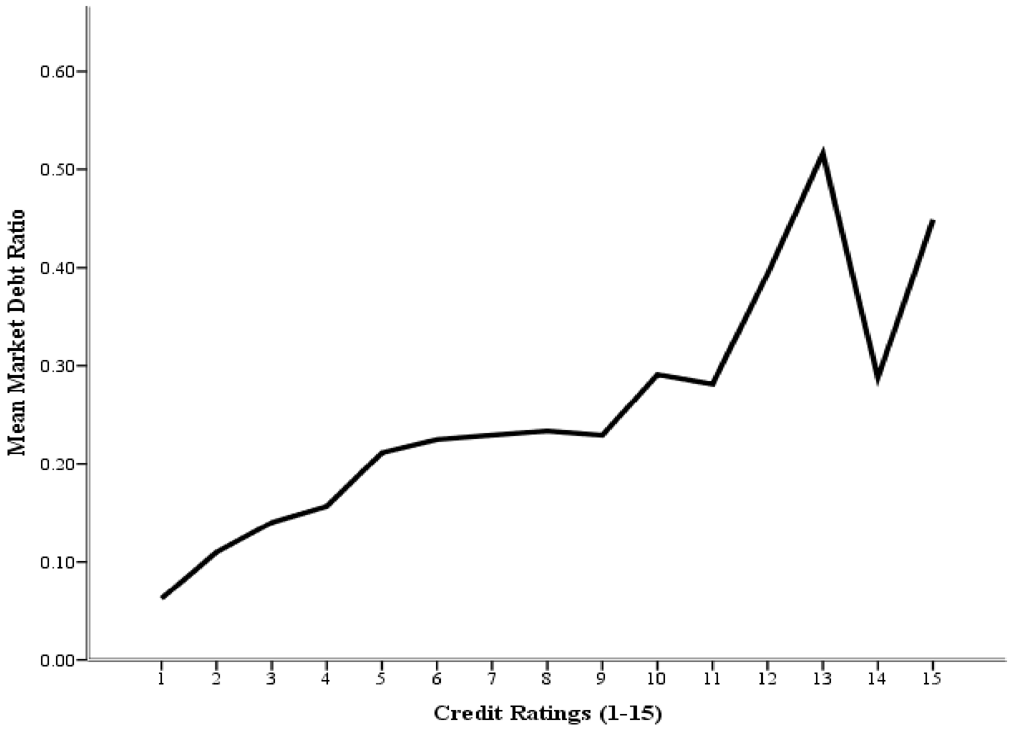


Figure 6.5 (b): Individual Credit Ratings and Market Debt Ratios

Table 6.13
Pooled Time-series Cross-sectional Regression of Market Debt Ratio (MDR) on Credit Ratings and Control Variables

	Rated Firms Only			Rated and Non-Rated Firms		
	1	2	3	4	5	6
Variables	**CR (1-5)**	**CR (1-15)**	**CR (Dummy Variables)**	**CR (1-6)**	**CR (1-16)**	**CR (Dummy Variables)**
(Constant)	0.54 (7.01)***	0.455 (5.84)***	0.624 (8.96)***	-0.235 (-7.27)***	-0.201 (-7.06)***	0.145 (24.27)***
CR	0.030 (1.54)	0.021 (3.61)***		0.070 (3.15)***	0.028 (4.30)***	
CR^2	0.005 (1.54)	0.000 (0.10)		-0.001 (-0.27)	-0.000 (-0.94)	
RAT_{dum}				0.225 (5.75)***	0.196 (6.42)***	
AA_{dum}			-0.053 (-3.76)***			-0.085 (-5.74)***
A_{dum}						-0.021 (-2.78)***
BBB_{dum}			0.052 (5.44)***			0.041 (4.86)***
BB_{dum}			0.119 (8.10)***			0.114 (7.31)***
B_{dum}			0.205 (9.27)***			0.176 (7.30)***
LOS	-0.026 (-6.64)***	-0.023 (-5.70)***	-0.026 (-6.63)***	0.008 (33.27)***	0.008 (33.32)***	0.008 (33.27)***
PROF	-0.099 (-2.80)***	-0.091 (-2.59)***	-0.098 (-2.77)***	-0.153 (-35.66)***	-0.153 (-35.63)***	-0.153 (-35.65)***
FAR	0.138 (7.31)***	0.141 (7.59)***	0.137 (7.21)***	0.124 (36.33)***	0.124 (36.31)***	0.124 (36.30)***
MBR	-0.037 (-10.45)***	-0.037 (-10.58)***	-0.037 (-10.37)***	-0.028 (-59.57)***	-0.028 (-59.56)***	-0.028 (-59.56)***
LIQD	-0.018 (-3.51)***	-0.018 (-3.52)***	-0.019 (-3.57)***	-0.009 (-26.64)***	-0.009 (-26.67)***	-0.009 (-26.65)***
$TECH_{dum}$	-0.111 (-3.51)***	-0.085 (-2.77)***	-0.113 (-3.54)***	-0.060(-11.83)***	-0.060(-11.72)***	-0.060 (-11.8)***
IND_{dum}	-0.022 (-1.19)	-0.017 (-0.93)	-0.020 (-1.11)	-0.036 (-7.46)***	-0.035 (-7.35)***	-0.036 (-7.41)***
CS_{dum}	-0.003 (-0.19)	0.005 (0.29)	-0.002 (-0.10)	-0.035 (-7.27)***	-0.035 (-7.15)***	-0.035 (-7.22)***
CG_{dum}	0.050 (2.74)***	0.064 (3.48)***	0.05 (2.72)***	-0.034 (-6.78)***	-0.033 (-6.63)***	-0.033 (-6.73)***
HC_{dum}	0.045 (1.70)*	0.068 (2.56)***	0.048 (1.78)*	-0.035 (-6.38)***	-0.034 (-6.24)***	-0.035 (-6.35)***
UTL_{dum}	0.014 (0.71)	0.024 (1.25)	0.014 (0.73)	0.015 (2.39)**	0.016 (2.47)**	0.016 (2.45)**
BM_{dum}	-0.016 (-0.79)	-0.005 (-0.27)	-0.015 (-0.77)	-0.032 (-6.12)***	-0.031 (-6.00)***	-0.032 (-6.08)***
OG_{dum}	0.018 (0.76)	0.031 (1.30)	0.021 (0.87)	-0.035 (-5.99)***	-0.035 (-5.88)***	-0.035 (-5.96)***
Adj R^2	.248	.470	.469	.469	.248	.248
F	803.239	52.577	53.923	46.342	803.239	802.049
Sig	.000	.000	.000	.000	.000	.000
N	38880	874	874	874	38880	38880

*Notes: This table displays results for OLS regression for Model 1 using Market Debt Ratio as the dependent variable. Columns 1-3 shows the results for the rated firms only and Columns 4-6 shows the results for the combined sample of rated and non-rated. Coefficients are reported outside parenthesis while t-values are in the parenthesis. ***, ** and * denotes p-values significant at the 1%, 5% and 10% levels, respectively.*

Similarly, Column 6 reports the results for the broad rating dummy technique and indicates a linear relationship between credit ratings and the market debt ratio, where non-rated firms have significantly less leverage than rated firms. The results, therefore, do not provide enough support to accept the alternative hypotheses that credit ratings and capital structures have a non-linear relationship when capital structures are measured by markets debt ratios.

6.3.4. Yearly and Sector-wise Analysis

Yearly regressions of Model (1) for the combined sample of both rated and non-rated firms presented in Table 6.14 also confirm the results of Table 6.9 and the preliminary results of Figure 6.3. Only the results of CR and CR^2 are reported in the table although the analysis has been based on the full model (without Rating Dummy) as in Column 2 of Table 6.9. For each individual year, the sign of CR and CR^2 is as expected and is significantly different from zero, with the exception of the first three years. The insignificance of the coefficients of credit ratings in the initial years may be because acquiring ratings were relatively new for UK firms at that time. It can be expected that the effects of credit ratings would be more pronounced after the initial period. From 1994 onwards, it can be noted that the CR and CR^2 becomes significant in the model. Although yearly regression results tend to support the non-linearity hypothesis for Model 1, the results should be interpreted with caution as the rating dummy RAT_{dum} is not included in the model due to the limited number of rated firm-years in the sample. The inclusion of RAT_{dum} automatically excludes either CR or CR^2 or both from some yearly regression output due to serious partial correlation of the variables not tolerable for estimating OLS.[27] However, in most of the cases the inclusion of RAT_{dum} does not change the expected relationship of CR and CR^2 but occasionally makes the variables insignificant. When the model is tested for the rated firms' sample only, the results do not provide support for the expected relationship suggesting that the non-linearity in yearly regressions is solely driven by the inclusion of non-rated firms in the sample.

[27] Regressions have also been conducted with year dummies for the rated sample and the whole sample. The results remain unchanged; CR and CR^2 are highly significant with positive and negative coefficient, respectively.

Table 6.14
OLS Regression Results of Model (1)-Yearly Comparisons

Years	CR	CR^2	F	Sig	R^2
1988-1990	-0.087 (-0.53)	0.009 (0.40)	137.941	.000	0.18
1991	0.137 (0.82)	-0.018 (-0.82)	48.302	.000	0.18
1992	0.132 (0.98)	-0.018 (-1.00)	67.726	.000	0.23
1993	0.145 (1.12)	-0.019 (-1.13)	72.995	.000	0.24
1994	0.189 (1.83)*	-0.025 (-1.84)*	76.277	.000	0.24
1995	0.224 (2.52)**	-0.029 (-2.59)***	66.690	.000	0.22
1996	0.194 (2.15)**	-0.026 (-2.19)**	58.302	.000	0.17
1997	0.390 (4.66)***	-0.052 (-4.83)***	57.661	.000	0.16
1998	0.409 (5.18)***	-0.054 (-5.41)***	64.881	.000	0.18
1999	0.328 (4.55)***	-0.042 (-4.68)***	70.169	.000	0.20
2000	0.307 (4.88)***	-0.040 (-5.11)***	87.410	.000	0.24
2001	0.272 (4.36)***	-0.035 (-4.59)***	85.763	.000	0.23
2002	0.340 (5.01)***	-0.043 (-5.28)***	67.836	.000	0.19
2003	0.272 (3.96)***	-0.035 (-4.27)***	53.662	.000	0.15
2004	0.238 (3.58)***	-0.031 (-3.89)***	65.673	.000	0.18
2005	0.224 (3.35)***	-0.029 (-3.67)***	68.726	.000	0.19
2006	0.251 (3.55)***	-0.032 (-3.83)***	67.108	.000	0.18
2007	0.226 (3.26)***	-0.030 (-3.63)***	71.793	.000	0.20
2008	0.233 (3.09)***	-0.03 (-3.41)***	76.749	.000	0.23
2009	0.171 (1.89)*	-0.024 (-2.19)**	39.918	.000	0.25

*Notes: This table displays OLS results of Model (1) for the combined sample. Only Coefficients of CR and CR^2 are reported for brevity reasons. Coefficients are reported outside parenthesis while t-values are in the parenthesis. ***, ** and * denotes p-values significant at the 1%, 5% and 10% levels, respectively. Variables are defined as total debt to total assets (TDTA) as dependent variable, credit rating 1-6 (CR), credit rating square (CR^2).*

Sector wise regression results in Table 6.15 support to some extent the initial results. The results for the rated firms' sample indicate a non-linear relationship for firms in consumer goods, and the industrial and utility sectors. Firms in the oil and gas and telecommunication sectors have also the expected sign but the coefficients of CR and CR^2 are not significant, possibly due to the small sample size. The results are also presented for the combined sample but they do not include the rating dummy. The coefficients of CR and CR^2 for the combined sample show the expected signs and significances in all the industries except for the basic materials, healthcare and, partially, for the technology sector, where the coefficients possess the expected sign but are not significant. However, the results are sensitive towards the inclusion of the non-rated firms. The results show that rated firms have higher leverage than non-rated firms, but once the effect of their inclusion is controlled in the model, the results no longer hold.

Table 6.15
OLS Regression Results of Model (1) - Sector-wise Comparison

Industry	CR	CR^2	F-Value	Sig.	Adj-R^2
Panel A: Rated Firms					
Basic Materials	0.015 (0.32)	-0.005 (-0.62)	8.200	.000	.407
Consumer Goods	0.309 (2.85)***	-0.035 (-1.97)*	23.114	.000	.525
Consumer Services	0.116 (2.30)**	0.002 (0.24)	31.714	.000	.413
Health Care	+	0.009 (0.55)	4.456	.002	.387
Industrials	0.214 (3.09)***	-0.030 (-2.49)**	19.013	.000	.496
Oil & Gas	0.010 (0.24)	-0.001 (-0.21)	78.935	.000	.937
Technology	-0.721 (-1.47)	0.096 (1.53)	2.155	.152	.421
Telecommunications	0.040 (0.25)	-0.008 (-0.33)	8.195	.000	.463
Utilities	0.234 (3.57)***	-0.025 (-1.97)*	16.713	.000	.429
Panel B: Rated and Non-rated Firms					
Basic Materials	0.016 (0.28)	-0.002 (-0.33)	111.531	.000	.201
Consumer Goods	0.470 (7.84)***	-0.061 (-8.37)***	226.819	.000	.155
Consumer Services	0.372 (9.56)***	-0.047 (-10.19)***	181.413	.000	.163
Health Care	0.155 (1.58)	-0.021 (-1.54)	69.1769	.000	.202
Industrials	0.269 (6.33)***	-0.034 (-6.55)***	418.569	.000	.187
Oil & Gas	0.346 (5.35)***	-0.046 (-5.38)***	49.789	.000	.138
Technology	0.228 (1.57)	-0.034 (-2.14)**	109.176	.000	.129
Telecommunications	0.219 (2.41)**	-0.025 (-2.31)**	21.003	.000	.199
Utilities	0.188 (3.71)***	-0.024 (-3.73)***	38.878	.000	.201

*Notes: The table displays the results of Model (1) for rated firms' sample and combined sample of both rated and non-rated firms. Coefficients are reported outside parenthesis while t-values are in the parenthesis. ***, ** and * denotes p-values significant at the 1%, 5% and 10% levels, respectively. Variables are defined as total debt to total assets (TDTA) as dependent variable, credit rating (CR), credit rating square (CR^2) (broad credit ratings)*
+:OLS do not report results due to partial correlation

6.3.4. Addressing the Violations of OLS

This section presents the remedies to address the violations of OLS.

6.3.4.1. Addressing Heteroskedasticity

As discussed in Subsection 6.1.2, OLS assumptions are tested to identify possible violation and to assess the suitability of OLS as an estimation technique. Having established that data do not meet homoscedasticity of variances and independence of error term assumptions, measures are taken to alleviate such concerns. Both graphical presentation and the White Heteroskedasticity test suggest that the combined sample of rated and non-rated firms suffers from serious heteroskedasticity, while the rated firms' sample suffers from mild heteroskedasticity. Therefore, White Heteroskedasticity-Consistent Standard Errors and Covariance, also known as white standard errors or robust standard errors (Gujarati, 2004) are obtained to ensure reliable and efficient estimators from OLS in the presence of Heteroskedasticity. Table 6.16 displays the OLS results after correcting any Heteroskedasticity present in the model.

Columns 1 and 4 present the results for the full model with CR code 1-6. Columns 2 and 5 present the results for CR code 1-16 whereas Columns 3 and 6 show results for the broad rating dummy method used instead of codes. The results in all the columns substantiate the results reported earlier in Tables 6.9 to 6.12. The coefficients of credit ratings maintain their significance in the model at the 1% level, where CR has a positive relation and CR^2 has a negative relation with the leverage of the firm, irrespective of the CR coding. Similarly, the results of the broad rating dummy technique indicate an increase in leverage with a decrease in broad rating categories. The leverage starts to decline after BB rated firms. The remaining firm-level factors possess the expected signs and significances and remain similar to the results reported earlier. The correction of heteroskedasticity, however, has slightly lowered the t-statistics of most of the variables.

6.3.4.2. Addressing Endogeneity

Concerning the non-independence of error terms, the two most common formal techniques used are the Instrumental Variable Technique (IV) and the Two-Stage Least Square method (2SLS) (Wooldridge, 2002). Both the techniques result in unbiased and consistent estimators. In the present case, 2SLS is used instead of IV due to several different reasons. For example, credit ratings are dependent on many different factors including external or country-level factors and each factor is expected to have a limited contribution to the overall model of credit ratings. Any surrogate used as an instrument for credit ratings is thus likely to have a weak correlation with credit ratings. This may lead to large standard errors resulting in more serious consequences than using OLS instead (Wooldridge, 2002). Moreover, if the instrument is even moderately correlated with the error term, it can result in bias in the estimates (Wooldridge, 2002, p.470). Given that an appropriate instrument is difficult to find, 2SLS is used to obtain an instrumental variable such that it is uncorrelated with the error term and highly correlated with the exogenous variable. The use of such an instrument is likely to produce unbiased and consistent estimators. Finally, using 2SLS is also consistent with previous studies (Faulkender and Petersen, 2006; Judge and Mateus 2009; Mittoo and Zhang, 2010), addressing endogeneity concerns when examining the relationship of credit ratings and capital structures.

Table 6.14
Pooled Time-series Cross-sectional Regression of Book Debt Ratio on Explanatory and Control Variables (Heteroskedasticity Corrected Standard Errors)

Variables	1	2	3	4	5	6
(Constant)	0.535 (5.60)***	0.459 (4.86)***	0.513 (3.89)***	-0.308 (-6.99)***	-0.259 (-6.84)***	0.134 (17.11)***
CR	0.175 (6.26)***	0.063 (7.57)***		0.161 (6.99)***	0.059 (9.54)***	
CR^2	-0.018 (-3.41)***	-0.002 (-4.17)***		-0.016 (-3.33)***	-0.003 (-4.86)***	
RAT_{dum}				0.209 (3.91)***	0.185 (4.52)***	
AA_{dum}			-0.059 (-2.91)***			-0.070 (-7.29)***
A_{dum}						0.021 (3.11)***
BBB_{dum}			0.096 (6.33)***			0.121 (11.60)***
BB_{dum}			0.159 (5.88)***			0.204 (7.35)***
B_{dum}			0.091 (3.21)***			0.181 (5.23)***
LOS	-0.039 (-8.40)***	-0.033 (-7.05)***	-0.065 (-5.06)***	0.012 (43.28)***	0.012 (43.31)***	0.012 (43.25)***
PROF	0.085 (1.11)	0.103 (1.32)	0.069 (1.39)	-0.153 (-26.71)***	-0.153 (-26.67)***	-0.153 (-26.70)***
FAR	0.110 (4.27)***	0.110 (4.30)***	0.019 (1.98)**	0.112 (25.38)***	0.112 (25.34)***	0.112 (25.37)***
MBR	0.023 (2.82)***	0.023 (2.87)***	0.014 (2.74)***	-0.007 (-11.78)***	-0.007 (-11.78)***	-0.007 (-11.81)***
LIQD	-0.045 (-6.65)***	-0.045 (-6.10)***	-0.033 (-3.42)***	-0.015 (-25.78)***	-0.015 (-25.79)***	-0.015 (-25.78)***
$TECH_{dum}$	-0.007 (-0.12)	0.004 (0.08)	-0.018 (-0.40)	-0.096 (-14.40)***	-0.096 (-14.35)***	-0.096 (-14.4)***
IND_{dum}	-0.009 (-0.33)	-0.009 (-0.36)	-0.048 (-1.37)	-0.058 (-9.18)***	-0.058 (-9.14)***	-0.058 (-9.18)***
CS_{dum}	-0.001 (-0.05)	0.004 (0.16)	-0.037 (-1.62)	-0.054 (-8.32)***	-0.054 (-8.28)***	-0.054 (-8.33)***
CG_{dum}	0.108 (4.02)***	0.124 (4.72)***	0.106 (2.89)***	-0.056 (-8.69)***	-0.056 (-8.61)***	-0.056 (-8.68)***
HC_{dum}	0.038 (1.01)	0.064 (1.75)*	0.039 (1.49)	-0.042 (-5.93)***	-0.042 (-5.84)***	-0.042 (-5.94)***
UTL_{dum}	0.033 (1.13)	0.044 (1.55)	0.051 (1.37)	-0.012 (-1.47)	-0.012 (-1.46)	-0.012 (-1.44)
BM_{dum}	0.019 (0.69)	0.026 (0.99)	0.026 (0.79)	-0.061 (-8.98)***	-0.061 (-8.93)***	-0.058 (-7.66)***
OG_{dum}	0.068 (2.42)**	0.082 (2.96)***	0.052 (1.83)*	-0.057 (-7.64)***	-0.057 (-7.58)***	-0.061 (-8.97)***
Adj R^2	0.349	0.362	0.322	0.194	.195	.195
F	30.700	32.523	17.648	588.427	573.471	523.471
Sig	.000	.000	.000	.000	.000	.000
N	874	874	874	38880	38880	38880

*Notes: The table displays results for OLS regression results with heteroskedasticity corrected standard errors for Model (1) for both samples. Columns 1 and 4 reports the results for broad rating coding, Columns 2 and 5 for individual credit rating coding and Column 3 and 6 for broad rating dummy technique. Coefficients are reported outside parenthesis while t-values are in the parenthesis. ***, ** and * denotes p-values significant at the 1%, 5% and 10% levels, respectively.*

i. Estimating the Two-stage Least Square (2SLS)

The two-stage least squares (2SLS) estimation is used only for the rated firms' sample and not for the whole sample of rated and non-rated firms. If 2SLS is directly applied to the whole sample of rated and non-rated firms, the predicted categories will always be very close to or equivalent to the last category as a large proportion in the sample consists of the non-rated firms (approx. 98% of the total sample). Consequently, the variation in the credit ratings will not be observable. Moreover, as stated in Section 6.2.2, the non-linearity in the relationship between credit ratings and capital structures should hold with or without the inclusion of the non-rated firms. In addition, it is already established from the previous studies (Faulkender and Petersen, 2006; Judge and Mateus 2009; Mittoo and Zhang, 2010) and from the empirical evidence provided in Section 6.2.2 that the non-rated firms have lower leverage even after controlling for credit ratings. Therefore, the exclusion of non-rated firms for 2SLS seems an appropriate solution in this case. Model (1) is restated here as:

$$TDTA_{i,t} = \beta_0 + \beta_1 CR_{i,t} + \beta_2 CR^2_{i,t} + \sum_{i=1}^{n} \beta_i X_{i,t} + \varepsilon_{i,t} \textbf{ ... (1)}$$

The two systems of equations estimated by 2SLS are:

$$CR_{i,t} = \beta_0 + \beta_1 ICR_{i,t} + \beta_2 TZS_{i,t} + \sum_{i=1}^{n} \beta_i X_{i,t} + \varepsilon_{i,t} \textbf{ ... (1a)}$$

$$CR^2 = \beta_0 + \beta_1 (PCR)^2_{i,t} + \varepsilon_{i,t} \textbf{ ...(1b)}$$

$$TDTA_{i,t} = \beta_0 + \beta_1 PCR_{i,t} + \beta_2 PCR^2_{i,t} + \sum_{i=1}^{n} \beta_i X_{i,t} + \varepsilon_{i,t} \textbf{ ... (1c)}$$

where TDTA and CR are mutually dependent or endogenous variables in the system and $X_{i,t}$ are assumed to be all exogenous variables in Model (1). The first equation (1a) or stage 1 of 2SLS, models the credit ratings by incorporating the Interest coverage ratio (ICR) and Taffler's *z-score* (TZS) along with the exogenous variables from Model (1). As suggested by Winship and Mare (1984), the predicted categories of credit ratings (PCR) and their squared form (PCR^2) are obtained from Model (1a) by ordinal logistic regressions and are used as instruments in the second equation (1c).

These two additional variables may potentially be important in determining the credit ratings of the firms. Prior studies have noted that the interest coverage ratio is one of the most pronounced factors in determining the credit rating (see for example, Gray *et al.*, 2006). Although Standard and Poor's do not disclose their rating models, Standard and Poor's corporate credit rating criteria mentions ten financial ratios important for the rating analysis, out of which five are different measures of the interest coverage ratio (Standard and Poor's, 2008). As these ratios measure the firm's ability to service its debt and other financial obligations, credit ratings are likely to be very sensitive to the coverage ratios. The ICR here is defined as earnings before interest, taxes and depreciation (DataStream code: WC18198) divided by the interest expenses (DataStream code: WC01251). This ratio is also one of the measures mentioned in Standard and Poor's Corporate Credit Rating Criteria.

Another possible variable, which may determine the financial health of the firms specifically in the UK, is *Taffler's z-score* as developed by Taffler (1983). Taffler's z score is a UK version of the Altman (1968) z-score, given as:

$$= 3.20 + 12.18\ (\textit{profit before tax/current liabilities}) + 2.50\ (\textit{current assets/total liabilities}) \\ - 10.68\ (\textit{current liabilities/total assets}) + 0.029\ (\textit{no-credit interval})^{28}$$

It has been argued that the score facilitates discrimination between firms close to failure and those that are not at risk of failure (Taffler, 1982). Initially the model was developed only for the industrial firms, but later it was also tested for other non-financial firms and proved to work well (Agarwal and Taffler, 2007). In a recent paper, Agarwal and Taffler (2007) retested the original Taffler z-score model to evaluate its predictive ability 25 years after it was first developed. They find that the model, even after more than two decades, works well for the prediction of the failure of UK firms. Taffler's z-score provides a continuous score from below zero to positive values. Firms that have scores towards the negative end, have higher chances of failure than the firms with a positive score. Moreover, the lower the score of the firm, the higher the chances of failure and *vice versa*.

After inclusion of the ICR and TZS[29] as additional explanatory variables for CR, the equation is correctly identified which satisfies the requirements necessary for conducting

[28] Where, no-credit interval = (quick assets – current liabilities)/daily operating expenses. Daily operating expenses is calculated by subtracting profit before taxes and depreciation divided by 365.

2SLS estimations (Brooks, 2008, p. 286). In estimating the first stage (Model 1a), ordinal logistic regressions are used to obtain the predicted values of the endogenous variable CR and CR^2. The square of the predicted values of CR is used as an explanatory variable for the functional form of the endogenous variable, CR^2 (Model 1b). The quadratic model such as in this case, requires that the functional forms of the original term should be treated as separate endogenous variables in the model (Wooldridge, 2002). Therefore, a set of predicted values for CR^2 is generated by a separate ordinal logistic regression for CR^2 (for a detailed discussion on the methodology, see Wooldridge, 2002, p. 230-237). In the second stage of the 2SLS, model (1c) is estimated by OLS using the predicted values of the CR and CR^2 obtained from the first stage.

Table 6.15 reports the results for 2SLS and confirms the previous findings in the chapter. Results of stage I show that the model is significant at explaining variation in credit ratings with Cox and Snell R^2 and Nagelkerke R^2 at 46% and 50% respectively. The results of stage II shows that CR and CR^2 have similar sign and significance as Table 6.9; CR has a positive sign and is significant at the 1% level and CR^2 is also significant and as expected, has a negative coefficient. The positive coefficient of the CR and negative coefficient of CR^2 implies that the leverage will increase as the CR increases but at a decreasing rate. Table 6.12 suggests that this point or peak is at BB rated firms in the broad ratings category. As the firms fall below the BB rating, the leverage ratios of these firms start declining. The results, after eliminating the concerns for endogeneity, are still supportive of the alternative hypotheses for an inverted U-shaped relationship of the credit ratings and capital structures of the firms.

[29] It may be argued that the Taffler's z-score (TZS) can be used as a direct instrument for CR by replacing CR with TZS. However, there are three main reasons for not using TZS either instead of CR or as an instrument for CR. First, TZS has a low correlation with CR (2%) and therefore, the measure can be used as one of the explanatory variables for credit ratings but not 'the instrument' for credit ratings. Second, TZS is an accounting measure, which does not incorporate the external factors whereas credit ratings are a relatively comprehensive measure of financial health taking into account firm level as well as external factors (Standard and Poor's, 2008). Hence, an accounting measure cannot be an appropriate surrogate for credit ratings. Third, the premise of the study is to evaluate the impact of an external measure of credit worthiness, which firms acquire and pay for, and to analyse whether such measures can influence the financial decision of the firms. An accounting measure may not serve the same purpose.

Table 6.15
Regression Results of the Two-Stage Least Squares Estimation (2SLS)
(Models 1a, 1b and 1c)

Variables	Estimate	Wald	Variables	Coefficients
	Panel A: Stage I		**Panel B: Stage II**	
ICR	-.020***	10.159	**(Constant)**	0.588 (3.16)***
TZS	.008***	13.873	**PCR**	0.157 (5.17)***
LOS	-.930***	158.590	**PCR^2**	-0.017 (-3.37)***
PROF	-.734	1.075	**LOS**	-0.040 (-5.03)***
FAR	-1.914***	31.844	**PROF**	0.128 (2.50)**
MBR	-.150**	4.480	**FAR**	0.111 (3.69)***
LIQD	-.174	1.527	**MBR**	0.020 (3.92)***
$TECH_{dum}$	-1.500**	6.632	**LIQD**	-0.042 (-5.26)***
IND_{dum}	1.762***	30.538	**$TECH_{dum}$**	-0.046 (-0.88)
CS_{dum}	1.054***	13.767	**IND_{dum}**	-0.013 (-0.46)
CG_{dum}	1.921***	35.716	**CS_{dum}**	-0.002 (-0.06)
HC_{dum}	4.376***	71.560	**CG_{dum}**	0.117 (3.99)***
UTL_{dum}	2.915***	73.754	**HC_{dum}**	0.031 (0.66)
BM_{dum}	2.188***	36.935	**UTL_{dum}**	0.020 (0.62)
OG_{dum}	3.230***	49.952	**BM_{dum}**	0.013 (0.41)
			OG_{dum}	0.068 (1.72)*
Pseudo R-Square			**Adj R^2**	.279
Cox and Snell	.458		**F**	23.571
Nagelkerke	.492		***Sig***	.000
-2 Log Likelihood			**N**	874
Intercept Only	2312.20			
Final Model	1784.78			
N	874			

*Notes: This table reports the regression results of the two-stage least estimation. Panel A reports the results of the first stage while panel B report the results for the second stage. ***, ** and * denotes p-values significant at the 1%, 5% and 10% levels, respectively. Variables are defined as Taffler's z-score (TZS), interest coverage ratio (ICR), predicted values of credit ratings (PCR), predicted values of credit rating squares (PCR^2), log of sales (LOS) refers to natural logarithm of sales, profitability (PROF) is the ratio of earnings before interest, taxes and depreciation to total assets, fixed assets ratio (FAR) is the ratio of fixed assets to total assets, market to book ratio (MBR) is the book value of the assets minus the book value of the equity minus market value of equity divided by book value of assets and liquidity ratio (LIQD)is the ratio of current assets to total assets, technology dummy ($TECH_{dum}$), industrial dummy (IND_{dum}), consumer services dummy (CS_{dum}), consumer goods dummy (CG_{dum}), heath care dummy (HC_{dum}), utility dummy (UTL_{dum}), basic material dummy (BM_{dum}) and oil and gas dummy (OG_{dum}).PCR and PCR^2 are predicted CR and CR^2 from the first stage.*

For correct interpretation of the results, it is necessary to investigate that the instruments used for the endogenous variables are valid and are independent of the error terms. To testify the instrument validity (Gujarati, 2004), a Sargan test is used, where the Sargan statistics (SARG) is defined as:

$$SARG= R^2 \,(n\text{-}k)$$
$$= 0.000\ (874 - 15)$$
$$=0.000$$

Here, R^2 is obtained from an auxiliary regression of residuals from the second stage of 2SLS, which are regressed on the predicted values of CR and CR^2 and control variables. *n* is the number of observations and *k* is the number of coefficients in the original model. The calculated SARG statistics is equal to 0.00. If the test statistics is greater than the critical chi-square value with *r* degree of freedom, the null hypothesis for instrument validity will be rejected (Gujarati, 2004). *r* degree of freedom is *s*-*q*, where *s* is the number of instruments in the model and *q* is the number of endogenous variables in the model. The critical chi-square value χ^2 is 3.56 and the calculated SARG statistics is less than the χ^2 i.e., 0.00<3.56. Therefore, the null hypothesis of instrument validity cannot be rejected suggesting that the instruments selected for the endogenous variables are not correlated with the error term in the second stage.

It should be noted that the instruments used for credit ratings might be problematic because they may not be completely uncorrelated with the disturbance term in the dependent variable, the debt ratio. For example, interest coverage ratio may be influenced by the proportion of debt firms have although it not directly cause change in the debt ratio. Similarly, Taffler's z-score, a measure of creditworthiness, may influence the leverage behaviour of the firms and also is influenced by the capital structure and its components due to the score being composed of several elements of the capital structure. It is acknowledged that these two instruments are not the perfect instrumental variables for credit ratings as they cannot be completely independent of the error term. The results of 2SLS should thus be interpreted with caution.

ii. Results Based on Lagged Explanatory and Control Variables

A less formal technique to address reverse causality may be through estimating the relationships using lagged explanatory and control variables. Although a lagged structure in regression may not practically remove endogeneity in the model, it could theoretically help in establishing a relationship between dependent and independent variables. For example, it is not even theoretically possible that the capital structure of a subsequent period influences the credit ratings of the previous period. It is also not likely that rating agencies will downgrade or upgrade a firm before it has actually issued or reduced debt. Model (1) can be rewritten as:

$$TDTA_{i,t} = \beta_0 + \beta_1 CR_{i,t-1} + \beta_2 CR_{i,t-1}^2 + \sum_{i=1}^{n} \beta_i X_{i,t-1} + \varepsilon_{i,t-1} \textbf{... (1d)}$$

Table 6.16 presents the results only for the rated firms' sample by using lagged independent and control variables and further confirms the earlier conclusion. Column 1 reports the results for the broad rating coding and Column 2 for the individual rating coding. Consistent with Column 2 of Tables 6.9 and 6.11, the coefficients of CR and CR^2 in Table 6.16 are significantly positive and negative, respectively, providing strong support to the hypotheses suggesting that previous years' credit ratings are also non-linearly associated with the capital structures of firms.

Table 6.16
Pooled Time-series Cross-sectional Regression of Book Debt Ratio on Lagged Explanatory and Control Variables (Model 1d)

Variables	1	2
(Constant)	0.621 (5.65)***	0.585 (5.26)***
CR	0.193 (6.94)***	0.065 (7.86)***
CR^2	-0.024 (-4.94)***	-0.003 (-5.61)***
LOS	-0.044 (-7.86)***	-0.039 (-6.79)***
PROF	0.002 (0.04)	0.020 (0.41)
FAR	0.115 (4.26)***	0.108 (4.09)***
MBR	0.018 (3.46)***	0.016 (3.18)***
LIQD	-0.050 (-6.58)***	-0.051 (-6.75)***
$TECH_{dum}$	0.025 (0.56)	0.029 (0.66)
IND_{dum}	-0.004 (-0.17)	-0.010 (-0.38)
CS_{dum}	0.011 (0.48)	0.013 (0.55)
CG_{dum}	0.114 (4.27)***	0.125 (4.60)***
HC_{dum}	0.057 (1.52)	0.078 (2.03)**
UTL_{dum}	0.035 (1.26)	0.043 (1.54)
BM_{dum}	0.028 (0.97)	0.030 (1.04)
OG_{dum}	0.078 (2.27)**	0.085 (2.48)**
Adj R^2	.323	.328
F	25.453	26.061
Sig	.000	.000
N	874	874

*Notes: The table reports the regression results of model 1d (lagged explanatory and control variables) using broad rating (Column 1) and individual rating coding (Column 2). ***, ** and * denotes p-values significant at the 1%, 5% and 10% levels, respectively.*

In sum, the results of the main analysis as well as the robustness checks provide strong support to accept the alternative hypotheses H_{1a}, H_{1b} and H_{1c} that credit ratings have a non-linear inverted U-shaped relationship with capital structure of UK firms. It is found that although rated firms have higher leverage than non-rated firms, there are systematic differences in leverage across rating scale. High rated firms are found to have low debt ratios, which appears to be due to the concerns for maintaining their high credit ratings. For high rated firms, it appears that the benefits of high credit rating outweigh the benefits of high debt ratios. Similarly, low rated firms, although having better access to debt markets due to being rated, are found to have low debt ratios. In contrast to high rated firms, which are expected to enjoy several financial and non-financial benefits of high ratings, low leverage of low rated firms indicate the possibility that they are concerned about the potential costs imposed on them by their low ratings. Mid rated firms, however, are found to have higher debt ratios than high and low rated firms which may suggest that such firms take advantage of possessing good credit ratings and are also hopeful that having high leverage will not significantly affect their credit ratings.

6.4. Conclusion

This chapter presented empirical results to investigate the relationship between credit ratings and capital structures of UK firms. A non-linear relationship between credit ratings and capital structures was hypothesised where high rated and low rated firms were expected to have low levels of leverage and mid rated firms have high levels of leverage in their capital structures. The results are presented using different measures of credit ratings and various estimation techniques. The results of the present chapter finds strong support for the hypothesised relationship indicating that credit ratings have a non-linear relationship with capitals structure of firms. Besides addressing the violations of OLS with a specific focus on endogeneity, the chapter has presented several sensitivity checks. The results remain robust to alternative estimation techniques and coding procedures.

Consistent with Faulkender and Petersen (2006), Judge and Mateus (2009) and Mittoo and Zhang (2010), the findings of the present chapter support the *credit rating – market access hypothesis* (CR-MA) which implies that rated firms have higher leverage than non-rated firms. However, unlike prior studies, which have failed to capture the differences in leverage structures across rating levels and assumed that all rated firms have high leverage, the results of the present chapter indicate that there are systematic differences in the level of leverage across different rating levels. The results, therefore, extend the prior literature, which underestimate the differences in leverage across rating levels. These results support the underlying *credit rating – capital structure hypothesis* (CR-CS) that concerns for costs and benefits of credit ratings would alter firms' behaviour towards their capital structures. Strong empirical evidence shows that there is non-linear relationship between credit ratings and capital structures where high and low rated firms have lower levels of gearing than mid rated firms. The behaviour of high and low rated firms towards their capital structure appears to be consistent with the assumption that these firms may have high concerns for credit ratings, which translate into low leverage ratios.

Chapter 7
Credit Rating Changes and Capital Structure

7. Introduction

In the previous chapter, it was established that credit ratings help UK firms in accessing the debt markets and the firms at different level of ratings have different level of gearing in their capital structures. These differences might be attributable to the implications of the *credit rating – capital structure hypothesis* (CR-CS) which suggests that firms take into account the discrete costs and benefits of different rating levels when making their capital structure decisions. In the present chapter, the discussion is carried forward to more specific capital structure decisions by examining the responses of the firms with respect to their capital structures when they are faced with credit rating changes. Such changes can be potential or actual ratings changes, and if the concerns suggested by the CR-CS hypothesis are material for those firms, such changes are likely to affect capital structure activities. The chapter, therefore, has two main objectives. First, to examine the impact of potential credit rating changes on capital structure decisions and second, to investigate the significance of actual credit rating changes for those decisions.

The present chapter is divided into four main sections. Section 7.1 discusses the descriptive statistics of the variables used in the analysis. It presents the outlier treatment procedures and their effects on the sample along with the distribution of the dependent variables used in the analyses. Section 7.2 presents the multivariate analysis to examine the impact of potential credit rating changes on capital structure and Section 7.3 presents the regression results for analyses of the relationship between actual credit rating changes and capital structure decisions. Finally, Section 7.4 concludes the chapter.

7.1. Descriptive Statistics of Variables

This section presents the descriptive statistics of the variables used in the models to examine the relationship of potential and actual credit rating changes and capital structure activities. Specifically, it discusses the descriptive statistics of the sample before and after the outlier treatments (Subsection 7.1.1), distribution of net debt issuance (Subsection 7.1.2) and capital structure activities (Subsection 7.1.3) across rating levels. Moreover, the section also presents the distribution of credit rating changes in the sample (Subsection 7.1.4).

7.1.1. Descriptive Statistics of Dependent, Explanatory and Control Variables

In Chapter 3, it was discussed that if firms have higher chances of being upgraded or downgraded, they are more likely to have leverage reducing behaviour following the implications of the *credit rating – capital structure hypothesis.* These potential credit ratings changes are measured as firms having either a '+' or a '-' sign with their credit ratings. Firms are also expected to continue with leverage reducing behaviour once they have actually been downgraded. To analyse empirically the conjectured behaviour of firms, a sample of 104 rated UK firms over a period of 22 years starting from 1988 to 2009 (874 firm-years observations) is analysed. The definitions and justifications of the dependent, explanatory and control variables are given in Chapter 5.

Table 7.1 shows the descriptive statistics of the dependent and control variables before and after the outlier treatments. Panel A (B) presents the descriptive statistics before (after) the outlier treatment. Scattered plots, box plots and visual inspections have been conducted and they show that the data are fairly well distributed, with few outlying observations. Some of the outlying observations theoretically and economically do not make sense, while other observations are too far away from other observations for the regressions to give precise estimations. Dependent variables, including change in debt ratio (CDR) and Kisgen's debt Ratio (KDR), had 3-5 observations above and below one, which have been truncated to ±1. Debt issuance by total assets (DITA) and debt reduction by total assets (DRTA) had also a few values greater than one, which do not theoretically make since. For example, theoretically it is not possible for the firm to issue or reduce more debt than its assets in any given year. Such values therefore, are truncated to one.

The control variables are also fairly well distributed, with few numbers of outliers. Although minimal, these outlying observations appear to be very distant from the rest of the data. Unlike data used in the previous chapter, the small size of data do not allow to discard such values. Therefore, variables are winsorised at a low percentage of 0.5% where required. The lag change in the fixed assets ratio (ΔFAR_{t-1}) and the market to book ratio (ΔMBR_{t-1}) do not seem to have any outlying observation whereas lag change in the log of sales (ΔLOS_{t-1}), profitability ($\Delta PROF_{t-1}$) and liquidity ($\Delta LIQD_{t-1}$) had a few extreme observations. Therefore, these three variables are winsorised at 0.5% levels on both sides. It is to be noted however, that the winsorising process has had no material impact on the mean values of the variables while standard deviations have been reduced considerably.

Table 7.1
Descriptive Statistics of Variables before and after Outlier Treatment

	N	Range	Minimum	Maximum	Mean	Median	S.D
Panel A: Before Outlier Treatment							
CDR	770	13.15	-1.00	12.15	0.14	0.00	0.74
KDR	770	1.78	-0.65	1.13	0.02	0.02	0.13
DITA	770	1.54	0.00	1.54	0.08	0.03	0.14
DRTA	770	1.17	-0.09	1.08	0.06	0.02	0.11
EITA	770	0.65	0.00	0.65	0.01	0.00	0.05
ERTA	770	0.33	0.00	0.33	0.01	0.00	0.04
ΔLOS_{t-1}	668	16.12	-14.29	1.83	0.03	0.04	0.60
$\Delta PROF_{t-1}$	668	3.76	-1.80	1.95	0.00	0.00	0.14
ΔFAR_{t-1}	668	0.76	-0.46	0.30	-0.01	0.00	0.06
ΔMBR_{t-1}	668	8.94	-5.59	3.35	-0.02	0.04	0.59
$\Delta LIQD_{t-1}$	668	96.72	-50.00	46.72	-0.02	0.00	2.69
Panel B: After Outlier Treatment							
	N	**Range**	**Minimum**	**Maximum**	**Mean**	**Median**	**S.D**
CDR	668	2.00	-1.00	1.00	0.08	0.01	0.33
KDR	668	1.65	-0.65	1.00	0.02	0.00	0.12
DITA	668	1.00	0.00	1.00	0.07	0.02	0.14
DRTA	668	1.00	0.00	1.00	0.06	0.02	0.11
EITA	668	0.65	0.00	0.65	0.01	0.00	0.05
ERTA	668	0.33	0.00	0.33	0.02	0.00	0.04
ΔLOS_{t-1}	668	4.31	-2.48	1.83	0.05	0.04	0.24
$\Delta PROF_{t-1}$	668	2.10	-0.97	1.13	0.00	0.00	0.11
ΔFAR_{t-1}	668	0.76	-0.46	0.30	-0.01	0.00	0.06
ΔMBR_{t-1}	668	8.94	-5.59	3.35	-0.02	0.04	0.59
$\Delta LIQD_{t-1}$	668	15.79	-9.40	6.40	-0.02	0.00	0.64

Notes: The variables are defined as change in debt ratio (CDR), Kisgen's debt ratio (KDR), debt issuance by total assets (DITA), debt reduction by total assets (DRTA),equity issuance by total assets (EITA), equity reduction by total assets (ERTA), lag change in log of sales (ΔLOS_{t-1}), lag change in profitability ratio ($\Delta PROF_{t-1}$), lag change in fixed assets ratio (ΔFAR_{t-1}), lag change in market to book value (ΔMBR_{t-1}), lag change in liquidity ratio($\Delta LIQD_{t-1}$)

The descriptive statistics of the variables after outlier treatment is given in Panel B of Table 7.1. The dependent variable, change in debt ratio (CDR), although winsorised, shows a mean value of 8% suggesting that firms are more active in debt issuance than debt reduction. The mean value of 8% indicates that firms issue on average 8% debt of the previous years' total assets. Net debt issuance or Kisgen's debt ratio (KDR), a cash flow measure of change in debt ratio, shows a different mean value but similar trend as the CDR. The average value of KDR is 2%, indicating that on average rated firms issue 2% more debt than equity of the previous year's total assets. The averages of the change in debt ratios (CDR and KDR) are lying close towards the lower end that indicates that there are not many firms, which issue large amounts of debt. However, the standard deviation suggests that firms have a lot of variability in their debt issuance and reduction patterns.

A comparison of mean values of debt issuance by total assets (DITA) and debt reduction by total assets (DRTA) also show that UK rated firms are slightly more active in debt issuance compared to debt reduction. The mean value of DITA indicates that firms on average issue debt by amounting to 7% of previous year's total assets, which is slightly more than the debt reduction. The equity issuance and reduction ratios, conversely, do not indicate that UK firms are very active in the equity market compared to the debt market. Nevertheless, some firms have issued up to 65% of equity of their previous years' total assets. Moreover, rated firms, on average, tend to reduce more equity than the amount they issue. The debt issuance and equity reduction activity by rated firms provides an additional support to the *credit rating – market access hypothesis* (CR-MA) and to the empirical evidence of the previous chapter. The possession of credit ratings offers an alternative source of funding to such firms and one can expect that their reliance on equity will be relatively less than that of non-rated firms.

7.1.2. Credit Ratings and Net Debt Issuance

Figure 7.1 shows the incremental leverage decisions of UK firms with respect to their credit ratings. The figure indicates that firms with high credit ratings issue relatively more debt than equity compared to low rated firms. Contrary to US firms, which have been reported by Kisgen (2006) to show very clear declining trend in the net debt issuance behaviour with respect to credit ratings, the decline in the net debt issuance is obvious but not very sharp for UK firms. UK firms, having broad credit rating 'BBB', continue to issue net debt whereas the BBB rated US firms on average issue relatively higher level of equity than debt. This might be due to the regulatory use of credit ratings in the US market, where a few regulations do not permit institutional investors to invest in speculative grade bonds. In such cases, firms near the speculative grade (i.e., BBB- and BB+) in the US market can be expected to be more cautious regarding their credit ratings than their counterparts UK firms. Kisgen (2006) also empirically finds that firms near the speculative grade tend to have leverage reducing behaviour. However, for UK rated firms, this trend is more obvious in firms at speculative grade and below; they show a sharp decline in net debt issuance where most of the firms seem to issue relatively more equity than debt.

The rated firms in the UK issue more debt relative to equity compared to their counterpart in the US. For example, AA+ rated UK firms issue on average 8% more debt than equity, while AA+ rated US firms issue on average 1.4% more debt than equity (Kisgen, 2006).

This trend continues at almost all ratings levels, from the investment grade to speculative grade firms, which to some extent confirms the findings of Judge and Mateus (2009) who find that the effects of possessing credit ratings for UK firms has more pronounced impact on levels of leverage with rated UK firms have higher leverage than counterpart rated US firms.

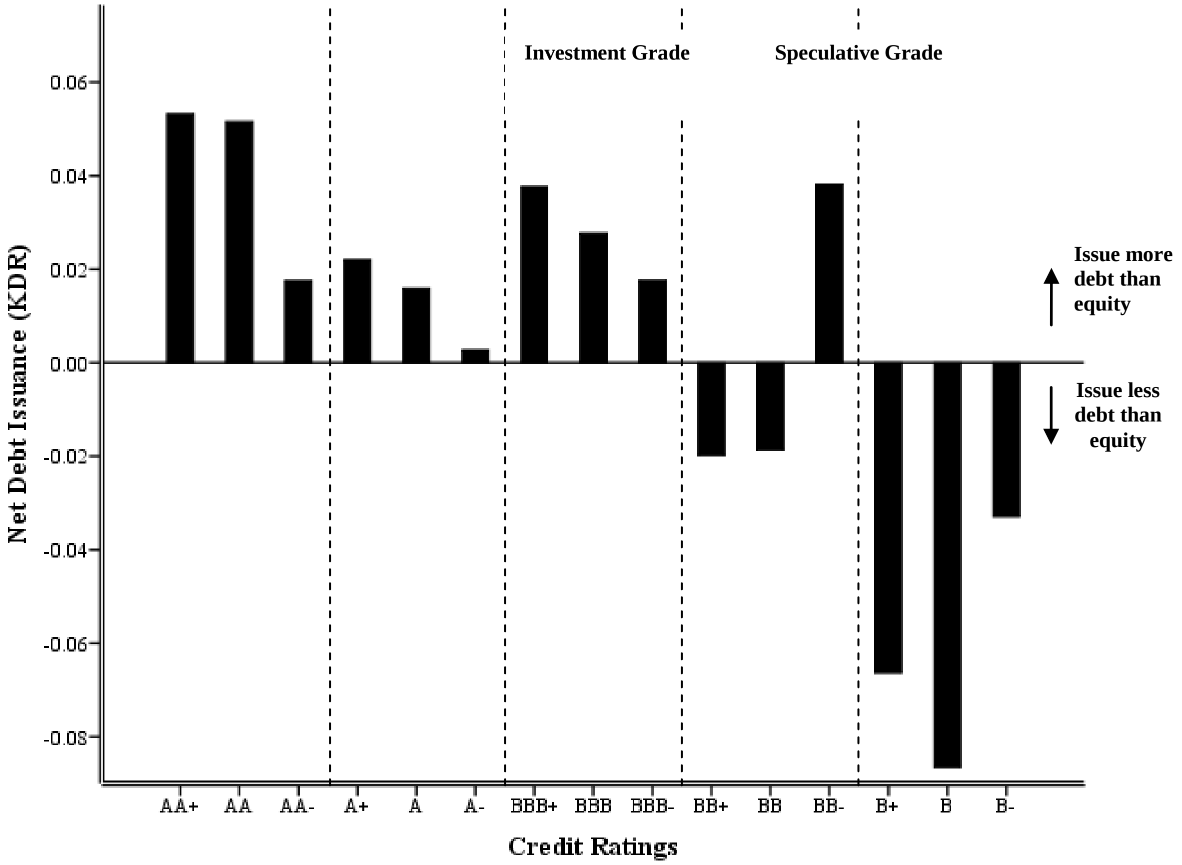


Figure 7.1: Net Debt Issuance (KDR) of UK Firms by Credit Ratings

The preliminary evidence suggests that '+' and '-' signs with credit ratings do not have any clear link with the leverage related behaviour, except for the low rated firms. The figure displaying UK firms' net debt issuances show that '-' sign with credit ratings, in general, have more of a powerful effect in explaining the lower level of leverage. However, this effect is limited to only the investment grade firms. For the speculative grade firms, it seems that firms with '+' sign with their credit ratings tend to keep leverage at a low level to possibly have an upgrade to the next broad category. The figure overall suggests that within the rating categories, there are sharp differences in the leverage behaviour of UK firms, requiring some control effects in the models to capture these differences.

7.1.3. Credit Ratings and Capital Structure Activities

Figure 7.2 (A and B) show the average debt and equity issuance/ reduction by rating across firm-years from 1988-2009. Figure 7.2 (A) shows that the low rated firms, compared to the high rated firms, are more active in both issuing and redeeming debt. It also shows that rated firms are likely to issue relatively more debt and reduce less debt except for the low rated firms that show a tendency to retire higher amounts of debt. Most of the speculative grade firms seem to reduce more debt than they issue. On the other hand, high rated firms seem to issue more debt and reduce less debt but the average size of debt issuance is considerably less than the low rated firms.

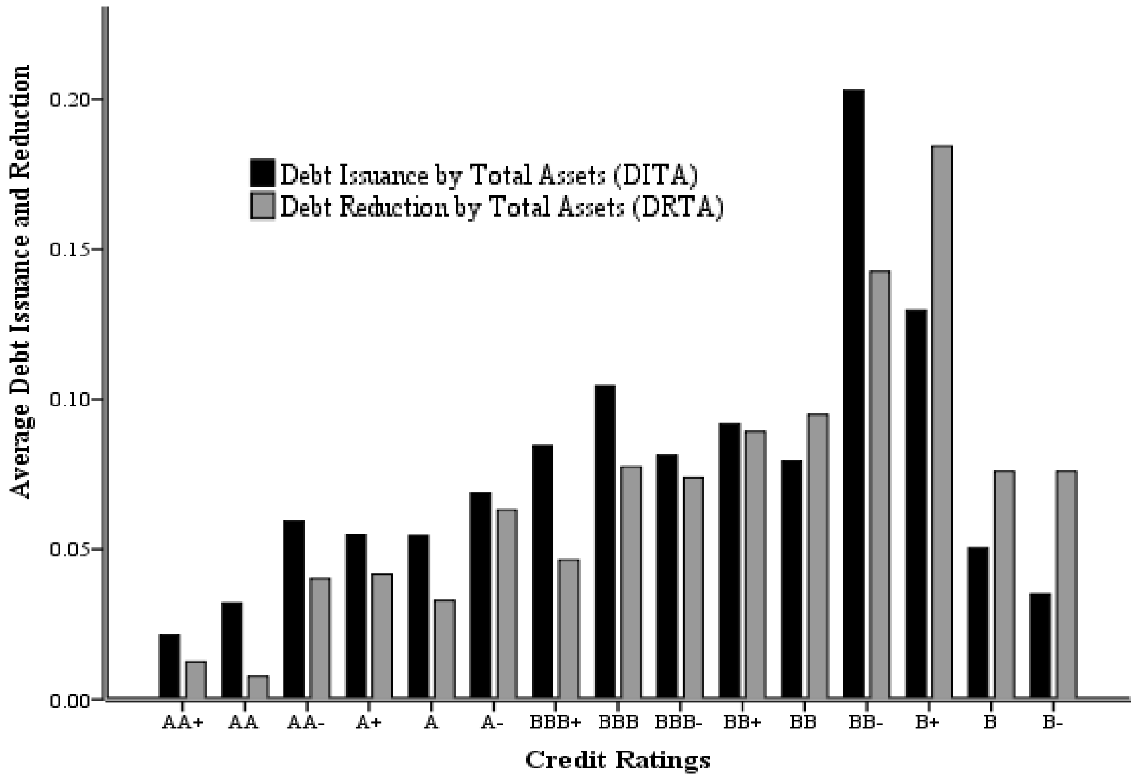


Figure 7.2 (A): Debt Issuance/Reduction by Credit Ratings

Figure 7.2 (B) indicates that high rated firms are more geared towards equity reduction behaviour. Such behaviour may be an indication of confidence such firms have towards their credit quality and superior access to debt markets. Contrary to the high rated firms, low rated firms are more inclined towards equity issuance behaviour, supporting the findings of the prior chapter. Low rated firms either have constrained access to the debt markets or they purposely maintain a lower level of leverage in a hope to be upgraded. However, neither of the figures indicate any definitive patterns of debt or equity activities with respect to potential changes in credit ratings as measured by a '+' or a '-' sign with firms' credit ratings. Nevertheless, preliminary evidence suggests some apparent differences in the behaviour of firms across the ratings level and such differences may have implication for the overall results. A formal analysis will explore further, the behaviour of rated firms with respect to such changes.

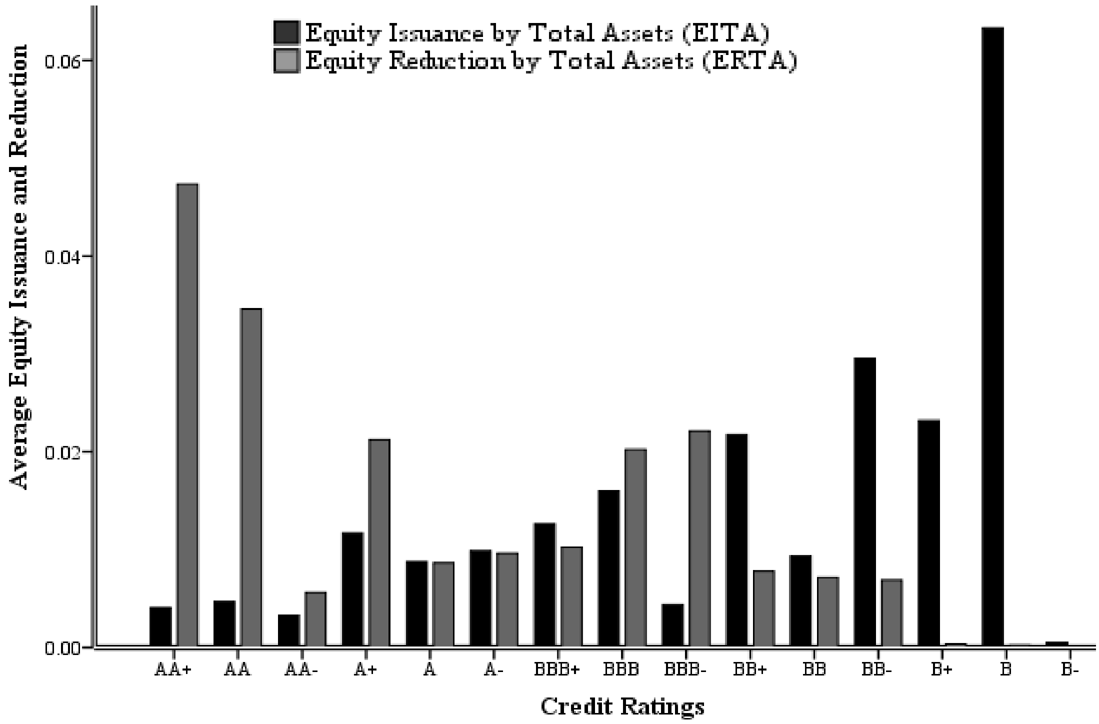


Figure 7.2 (B): Equity Issuance/ Reduction by Credit Ratings

7.1.4. Distribution of Credit Rating Changes in the Sample

As discussed in Chapter 5, following Kisgen (2006), potential upgrades and downgrades are measured by dummy variables. To measure the proximity of an upgrade, the PLUS dummy takes the value of 1 if a firm has a '+' sign with its credit rating, while the MINUS dummy representing the proximity of a downgrade takes the value of 1 if a firm has a '-' sign with its credit rating. POM is a dummy variable when credit ratings have either a '+' or a '-' sign. These variables are lagged by one year with respect to the dependent variable, to reduce any potential simultaneity bias in the model. The frequency distribution of these variables is presented in Table 7.2.

The table shows that 64% of the firms have a '+' or a '-' sign with their credit ratings and can be hypothesised to have a higher chance of an upgrade or a downgrade in the following year. The statistics also show that firms with a PLUS are a slightly higher proportion of the sample firms than firms with a MINUS, yet the overall frequency is fairly well distributed, with PLUS being approximately 34%, MINUS being 30% and firms that are not near rating changes, i.e., without a modifier, being 36% of the sample.

Table 7.2
Frequency Distribution of the POM, PLUS and MINUS

	POM		PLUS		MINUS	
Value	**Frequency**	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**
0	276	35.8	503	65.3	543	70.5
1	494	64.2	267	34.7	227	29.5
Total	770	100	770	100.0	770	100.0

Notes: Variables are defined as 'POM' when firm has either a'+' or '-' with its credit rating in the previous year, 'PLUS' when it has '+' and 'MINUS' when firm-year has a '-' sign in the previous year.

Table 7.3 displays the frequency distribution of the downgrades and upgrades and in contrast to potential rating changes shows that the downgrades and upgrades are not proportionally well distributed. Downgraded firms constitute 18.4% of the total firm-years while the firms upgraded make up 5.6% of all firm-years. A large proportion of firm-years (76% of all firm years) do not indicate any change in credit ratings. Prior studies (e.g., Gonis and Taylor, 2009) have also found that the rate of downgrades for UK rated firms exceeds the upgrades. They argue that this is attributable primarily to stringent standards of the rating agencies and partially to the declining quality of rated firms (Gonis and Taylor, 2009; Blume *et al.,* 2002). Blume *et al.* (2002) also find that US firms have been downgraded more often than they are upgraded. The next section formally investigates the relationship between potential and actual credit rating changes and firms' financial decisions.

Table 7.3
Frequency Distribution of the Downgrades and Upgrades in the Sample

	Stable		Downgraded		Upgraded	
Value	**Frequency**	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**
0	185	24.0	628	81.6	727	94.4
1	585	76.0	142	18.4	43	5.6
Total	770	100.0	770	100.0	770	100.0

Notes: Variables are defined as 'stable' when firm has either has not upgraded or downgraded in the previous year, 'downgraded' when a firm has been downgraded in previous year and 'upgrade' when a firm has been upgraded in previous year.

7.2. Analysis of Potential Credit Rating changes and Debt Ratios

This section investigates the impact of potential credit rating changes on firms' financial decisions. It was hypothesised that concerns for credit ratings, as suggested by the *credit* *rating – capital structure hypothesis* (CR-CS), will lead firms to reduce leverage when they are near to upgrades or downgrades. Models 2a and 2b are set out to test hypotheses H_{2a}, H_{2b} and H_{2c}. Taken from Chapter 3, these hypotheses are restated as follows:

H_{2a}= Firms with MINUS or PLUS sign with their credit rating are more likely to reduce the amount of leverage.

H_{2b}= Firms with MINUS sign with their credit rating are more likely to reduce the amount of leverage.

H_{2c}= Firms with PLUS sign with their credit rating are more likely to reduce the leverage.

Models 2 and 3 explore the relationship of potential credit rating changes on the leverage related behaviour of UK firms. Models restated from Chapter 5 as:

$$\Delta DR = \beta_0 + \beta_1 POM_{i,t-1} + \sum_{i=1}^{n} \beta_i \Delta X_{i,t-1} + \varepsilon_{i,t-1} \textbf{... (2a)}$$

$$\Delta DR = \beta_0 + \beta_1 PLUS_{i,t-1} + \beta_2 MINUS_{i,t-1} + \sum_{i=1}^{n} \beta_i \Delta X_{i,t-1} + \varepsilon_{i,t-1} \textbf{... (2b)}$$

Where β_1 in Model 2a and β_1 and β_2 in Model 2b are hypothesised to be less than zero. As discussed in Chapter 5, two measures are used to estimate ΔD. All control variables are firm-level factors from Model 1, measured as change variables. As a measure of robustness, models are also estimated using control variables from Kisgen (2006). Two dependent variables are used to test the relationship: the first, measuring the change in debt ratio (CDR), is the first difference of the total debt by the total assets of the previous year and the second measure is the net debt issuance, or Kisgen's debt ratio (KDR). KDR is defined as the net debt issuance minus net equity issuance by the total assets of the previous year (for definitions and a more detailed discussion of the variables, see Section 5.2.2). The following subsections reports the empirical results.

7.2.1. Testing the Impact of Potential Rating Changes with Models 2a and 2b

Table 7.4 contains the results of pooled OLS regressions for the sample of 104 rated firms over the period of 22 years. Columns 1 to 4 report the results for the change in the simple debt ratio (CDR), while Columns 5 to 8 present the results for net debt issuance, KDR. Columns 1, 3, 5 and 7 show the results for partial models without control variables and Columns 2, 4, 6 and 8 present the results for the full model.

Columns 1 and 2 report the results for the POM and show that neither partial nor the full model sufficiently explains the variation in the dependent variable with the F-values of both models insignificant. Column 1 shows that the coefficient of POM is negative but the coefficient is statistically insignificant. After adding control variables to the model, the adjusted-R^2 has slightly improved, but the model remains statistically insignificant and so is the coefficient of POM. This suggests that for UK firms, having a PLUS or a MINUS sign with their credit ratings is irrelevant and does not have a significant impact on any changes in their debt ratio in the subsequent year. Columns 3 and 4 reports results for partial and full models for individual PLUS and MINUS dummies and show similar results. The coefficients on both dummies are statistically insignificant and do not support the rejection of the null hypothesis. However, only the size of the firm is found to be significant in the model and has a positive effect on the leverage decisions. The coefficient of ΔLOS indicates that firms are more likely to issue debt when there is a positive change in the total sales of firms.

Results for the models in Columns 5-8, with net debt issuance or Kisgen's debt ratio (KDR) a cash flow measure of dependent variable, are qualitatively similar to the results in Columns 1 to 4, with the exception for PLUS, which now has a positive but insignificant relation with KDR. All the other dummies for potential credit rating changes remain insignificant. The results indicate that firms possessing a PLUS or a MINUS sign with their credit ratings do not have any particular leverage related behaviour. This supports the rejection of the alternative hypothesis in favour of the null hypothesis of the coefficients of variables being jointly equal to zero. The results suggest that any behaviour of UK rated firms towards their capital structures is not as though they are very concerned about the potential credit ratings changes.

Table 7.4

Pooled Time-series Cross-sectional Regression of CDR and KDR on Potential Credit Rating Changes

	1	2	3	4	5	6	7	8
Variables	**CDR**	**CDR**	**CDR**	**CDR**	**KDR**	**KDR**	**KDR**	**KDR**
(Constant)	0.038 (3.92)***	0.030 (3.46)***	0.038 (3.91)***	0.030 (3.45)***	0.022 (2.93)***	0.021 (2.66)***	0.022 (2.94)***	0.021 (2.67)***
POM $_{t-1}$	-0.009 (-0.75)	-0.008 (-0.75)			-0.008 (-0.85)	-0.006 (-0.66)		
PLUS $_{t-1}$			-0.007 (-0.48)	-0.009 (-0.68)			0.004 (0.36)	0.001 (0.09)
MINUS $_{t-1}$			-0.012 (-0.83)	-0.008 (-0.60)			-0.022 (-1.95)*	-0.015 (-1.30)
ΔLOS $_{t-1}$		0.063 (2.79)***		0.064 (2.79)***		0.030 (1.45)		0.028 (1.36)
ΔPROF $_{t-1}$		-0.035 (-0.73)		-0.035 (-0.73)		0.034 (0.80)		0.032 (0.76)
ΔFAR $_{t-1}$		0.144 (1.53)		0.144 (1.53)		0.099 (1.18)		0.104 (1.23)
ΔMBR $_{t-1}$		0.003 (0.31)		0.003 (0.31)		-0.005 (-0.58)		-0.005 (-0.57)
ΔLIQD $_{t-1}$		0.004 (0.51)		0.004 (0.51)		0.004 (0.54)		0.003 (0.46)
Adj R^2	-.001	.007	-.002	.005	.000	-.001	.005	.000
F	.560	1.740	.348	1.489	.715	.848	2.956	.994
Sig	.454	.109	.706	.168	.398	.533	.053	.434
N	668	668	668	668	668	668	668	668

Notes: This table displays the OLS regression results for estimating the impact of potential change in credit rating on the change in the debt ratio. Columns 1-4 report the results for change in debt ratio (CDR) and Columns 5-8 report the results for net debt issuance (KDR). Variables are defined as fist difference in total debt by total assets of previous year (CDR), net debt issuance measured as (debt issuance - debt reduction +any change in short term debt) - (equity issuance - equity reduction) by total assets of the previous year (KDR), dummy variable taking value of 1 if a firm as a '+' or a '– 'sign with its credit rating in the previous year or zero otherwise (POM $_{t-1}$*), dummy variable taking value of 1 if a firm has a '+' sign with its credit rating in the previous year (PLUS* $_{t-1}$*), dummy variable taking value of 1 if a firm has a '–' sign with its credit rating in the previous year (MINUS* $_{t-1}$*), lag change in log of sales (ΔLOS* $_{t-1}$*), lag change in profitability ratio (ΔPROF* $_{t-1}$*), lag change in fixed assets ratio (ΔFAR* $_{t-1}$*), lag change in market to book value (ΔMBR* $_{t-1}$*) and lag change in liquidity ratio(ΔLIQD* $_{t-1}$*). ***, ** and * denotes p-values significant at the 1%, 5% and 10% levels, respectively.*

The models in Table 7.4 have limited power as measured by the adjusted-R^2, in explaining any variation in the dependent variables, whether dependent variable is measured as change in the simple debt ratio (CDR) or net debt issuance (KDR). The limited power of the adjusted-R^2 can, however, be attributed to the nature of dependent and control variables. It may be possible that the factors affecting the capital structures of the firms will not respond very well in the short-run, possibly because the leverage decisions are implicitly long-term decisions. Low adjusted-R^2 is common among the studies using explanatory and control variables measured as change variables. For example, Graham (1996) also reports lower adjusted-R^2 in all the specification with control variables and dependent variable measured as change variables. Kisgen's 2006 and 2009 studies, both report very low adjusted-R^2. Also it should be noted that the Models 2a and 2b also differ from Kisgen (2006) as the control variables are those which are empirically tested by the present study as well as by prior studies to determine UK firms' capital structures. This can also influence the results. To be consistent with Kisgen (2006), the next section reports the results of model with specifications similar to Kisgen (2006).

7.2.2. Testing the Impact of Potential Rating Changes with Kisgen's (2006) Model

Table 7.5 reports the results for models with specifications similar to Kisgen (2006). Columns 1 and 3 present the results for POM, while Columns 2 and 4 presents the results for individual dummy variables for PLUS and MINUS. In Columns 1 and 2, the dependent variable is defined as net debt issuance (KDR) without any large debt offerings. Large debt offerings is defined as a firm-year in which the debt issuance is >= 10% of the total assets of the previous year. In Columns 3 and 4, the reported results are for the net debt issuance (KDR), excluding large debt offerings and equity offerings, where large debt and equity offerings are defined as debt or equity offerings >= 10% of the previous year total assets.

It can be argued that the implications of the *credit rating – capital structure hypothesis* (CR-CS), which suggests that potential credit rating changes are important for the firms' capital structure, should be more relevant for the small size and medium sized offerings only. The rationale is that the small and medium sized offerings can lead in rating change when the firm is near an upgrade or a downgrade. Conversely, large offerings will eventually lead to a rating change, whether the firm is near or not a rating change. Moreover, in some cases, the credit rating changes may not be relevant and the firm might have large debt or equity offerings without considering the impact on the credit ratings. For example, in the acquisition of another firm or reorganisation, the benefit of large offerings may outweigh the costs and benefits associated with rating changes. This implies that concerns over rating change would not be material when firms intend to issue large amounts of debt and equity. To be consistent with Kisgen (2006), large debt and equity offerings (using a 10% cut-off) are excluded from the sample.

Table 7.5
Pooled Time-series Cross-sectional Regression of CDR and KDR on Potential Credit Rating Changes (Kisgen's 2006 Model)

	1	2	3	4
Variables	**Excluding large Debt Issuance UK**	**Excluding large Debt Issuance UK**	**Excluding Large Debt and Equity Issuance UK**	**Excluding Large Debt and Equity Issuance UK**
(Constant)	-0.146 (-3.06)***	-0.134 (-2.74)***	-0.083 (-2.00)**	-0.071 (-1.69)*
POM_{t-1}	-0.008 (-1.10)		-0.004 (-0.71)	
$PLUS_{t-1}$		-0.003 (-0.32)		0.000 (0.06)
$MINUS_{t-1}$		-0.014 (-1.62)		-0.010 (-1.33)
D/D+E	-0.007 (-1.21)	-0.008 (-1.28)	-0.007 (-1.34)	-0.007 (-1.41)
LOS_{t-1}	0.009 (3.05)***	0.009 (2.75)***	0.006 (2.09)**	0.005 (1.80)*
$PROF_{t-1}$	0.047 (1.54)	0.043 (1.39)	0.038 (1.45)	0.034 (1.29)
Adj R^2	.017	.018	.008	.010
F	3.981	3.514	2.453	2.334
Sig	.003	.004	.045	.041
N	705	705	689	689

Notes: This table displays the OLS regression results for estimating the impact of potential change in credit rating on the change in the debt ratio using similar models as Kisgen (2006). Variables are defined as: net debt issuance measured as (debt issuance - debt reduction + any change in short term debt) - (equity issuance - equity reduction) by total assets of the previous year (KDR),dummy variable taking value of 1 if a firm as a '+' or a '– 'sign with its credit rating in the previous year or zero otherwise (POM_{t-1}), dummy variable taking value of 1 if a firm has a '+' sign with its credit rating in the previous year ($PLUS_{t-1}$), dummy variable taking value of 1 if a firm has a '–' sign with its credit rating in the previous year ($MINUS_{t-1}$), lag total debt by total debt plus equity (D/(D+E), lag log of sales (LOS_{t-1}), lag profitability ratio ($PROF_{t-1}$). Large debt or equity offerings is any debt or equity offering greater than 10% of the total assets of previous year.
****, ** and * denotes p-values significant at the 1%, 5% and 10% levels, respectively.*

Columns 1 and 2 of Table 7.5 indicate that there are 8.4% cases (65 firm-years) where the firms have issued 10% or more debt of the previous years' total assets, while Columns 3 and 4 show that in 10.5% cases, firms have both large debt and equity issuances. These figures are smaller than what Kisgen (2006) report for the US, with 14% of the firms having had large debt issuances. This can indicate that although UK rated firms have higher leverage compared to the US rated firms, offerings of large size by UK firms are still limited to few firms. From Figure 7.1, it can be noted that the debt issuance in the UK is more common in the high rated firms, but on average their issues are smaller compared to low rated firms that tend to issue less debt than equity.

Column 1 indicates that, similar to Column 2 of Table 7.4, the coefficient of POM is negative but the coefficient remains insignificant. In Column 2, the individual proxies for potential rating change, PLUS and MINUS, show similar results. The coefficients of both proxies are negative but insignificant, suggesting irrelevance of the potential rating changes for capital structure decisions, even after taking out the large debt offerings. This indicates that whether the offering size of debt is small, medium or large, the UK firms do not on average take into considerations the sign of their credit ratings when they make any adjustments to their capital structures.

Columns 3 and 4 present regression output for net debt issuance excluding large debt and equity and offer qualitatively similar results to Columns 1 and 2. Despite excluding large debt and equity offerings, the coefficients of POM remain insignificant. Individual proxies in Column 4 also show a similar trend. The coefficient of MINUS remains negative but PLUS has become positive with this specification. Nevertheless, both coefficients remain insignificant. These results are unlike the US firms reported by Kisgen (2006), which consistently indicate a negative relationship of potential rating changes with the net debt issuance without the large debt or large debt and equity offerings.

A comparison of Table 7.4 and 7.5 indicates that the results are not dependent on the definitions of control variables. The results of Table 7.5 and 7.4 are qualitatively similar where the coefficients of potential rating changes are mostly of expected sign but remain insignificant despite of the specification. Nevertheless, the specifications in Table 7.5 have certainly improved the overall fit of the models.

The results in Sections 7.2.1 and 7.2.2 do not provide enough support to accept H_{2a}, H_{2b}, and H_{2c} in favour of null hypotheses that there is no relationship between potential rating changes and firms' leverage decisions. The behaviour of UK firms towards their leverage suggests that, unlike US firms, the costs of being downgraded and the benefits of being upgraded do not seem to be material for UK firms. These insignificant results may have various reasons. They may indicate that UK firms are generally already at their target credit ratings. For example, Hovakimian *et al.* (2009) find that firms above their target credit ratings have leverage issuance behaviour, while firms below their targets have leverage reduction behaviour. If most UK firms are at their target credit ratings, then they may not make any adjustments to their leverage structures.

As already discussed in Chapters 2 and 3, the sensitivities of firms towards rating changes can be expected to vary across different markets depending upon the level of development of the bond markets they use, and their local credit rating industry, and so the perceived benefits and costs of rating changes will also vary. A market with a developed credit rating industry (e.g., the US market), is likely to have a different distribution of credit ratings from a market with a relatively less developed rating industry. For example, US firms are characterised by a developed bond market and their credit rating industry has 30% speculative firms (Kisgen, 2006) while the sample of UK rated firms shows that 13% of rated firms are at a speculative grade. A market characterised by highly rated firms, which are already highly creditworthy and financially too sound to be downgraded any time soon, may not have similar sensitivities for credit ratings changes as a market with a significant proportion of low rated firms.

The differences in results between the present study and prior US studies could be attributable to the difference in regulatory dependence on credit ratings in the markets. As discussed in Chapter 2, the development of the credit ratings industry in the US market can be attributable to the regulatory use of credit ratings. These regulations include the prohibition of institutional investors from investing in speculative grade issues, less strict disclosure requirements for investment grade bonds, and restrictions on market mutual funds' investment in low-grade bonds etc. Such dependencies of regulatory bodies on credit ratings can affect capital structures in two ways. First, regulatory reliance will create an environment of high acceptance for credit ratings in the market, such that credit ratings become an essential part of investors and managements' decision-making processes. This may increase the use of credit ratings in general. Second, the widespread use of credit ratings in regulations can result in firms being more careful about their credit ratings, and their capital structure decisions will be more inclined towards achieving ratings that meet the threshold of the regulatory clauses. Moreover, explicitly defined regulatory thresholds lead to forced selling, resulting in a predictable market reaction on rating changes. The underlying risk of the upgraded or downgraded firms may not have changed significantly, but due to the regulatory dependence, the cost of borrowing may increase. In a market where laws and regulations are not tied up with credit ratings (e.g., the UK), firms can be less sensitive towards potential rating changes.

It should also be acknowledged that the proxies for potential rating changes can be noisy, and they might not capture what they are intended to measure. For example, a strong BBB-may have a higher chance of upgrade than a weak BBB+. Moreover, the proxies are only able to measure potential rating changes from one broad rating category to another, but they do not represent the potential rating changes within the broad rating category. This may underestimate the predictive ability of the model and bias the results towards only the broad rating category. The results have therefore to be interpreted with caution.

7.2.3. Potential Rating Changes and Individual Capital Structure Activities

To provide an in-depth examination of the capital structure choices firms make, logistic regression analysis is also carried out for the components of net debt issuance (KDR). Binary variables are constructed by using a cut-off level at 5% (and a robustness check at 2.5%), where the dummy variable takes a value of 1 if the total debt issuance, debt reduction, equity issuance and equity reduction are greater than or equal to 5% of the total assets. Here, debt issuance, debt reduction, equity issuance and equity reduction are tested separately to explore whether PLUS and MINUS have some predictive ability with regard to each one of them. The general model from Chapter 5 is restated below:

$$Log\left(\frac{\rho}{1-\rho}\right) = Logit\ (\rho) = \beta_0 + \beta_1 PLUS_{i,t-1} + \beta_2 MINUS_{i,t-1} + \sum_{i=1}^{n} \beta_i X_{i,t-1} \quad \textbf{...(3)}$$

Here, β shows the direction of the relationship and a Wald test shows the significance of each predictor (Pallant, 2005). e^{β} shows the odd ratio for each variable in the model, where the odds ratio is *'the increase (or decrease if the ratio is less than one) in odds of being in one outcome category when the value of the predictor increases by one unit'* (Tabachnick and Fidell, 2001, p. 548). If firms were concerned about the costs and benefits offered by credit ratings, the *credit rating – capital structure hypothesis* would imply that firms would be reluctant to issue debt and reduce equity when they are near to credit ratings changes. Moreover, it can also be expected that firms are more reluctant to reduce debt and issue more equity instead. The results are reported in Table 7.6.

Table 7.6
Binary Logistic Regression Analysis of the Components of Net Debt Issuance (KDR) on Potential Credit Rating Change

	>=2.5%			>=5%			>=2.5%			>=5%		
	Panel A: Debt Issuance						**Panel B: Debt Reduction**					
	1			**2**			**3**			**4**		
Variables	**β**	**Wald**	**e^{β}**	**β**	**Wald**	**e^{β}**	**β**	**Wald**	**e^{β}**	**β**	**Wald**	**e^{β}**
(Constant)	-0.10	0.18	0.90	-0.56	5.37**	0.57	0.05	0.04	1.05	-0.74	8.52***	0.48
$PLUS_{t-1}$	-0.01	0.00	0.99	0.11	0.31	1.11	-0.29	2.38	0.75	-0.09	0.22	0.91
$MINUS_{t-1}$	0.06	0.11	1.07	-0.02	0.01	0.98	-0.06	0.10	0.94	0.03	0.02	1.03
ΔLOS_{t-1}	0.26	0.56	1.30	0.10	0.07	1.10	-0.50	2.01	0.60	-0.31	0.72	0.73
$\Delta PROF_{t-1}$	-0.46	0.41	0.63	0.31	0.18	1.36	-0.20	0.07	0.82	-1.05	1.66	0.35
ΔFAR_{t-1}	-1.17	0.67	0.31	-0.87	0.37	0.42	-3.39	5.03**	0.03	-2.30	2.31	0.10
ΔMBR_{t-1}	-0.06	0.17	0.94	-0.15	1.09	0.86	0.22	2.39	1.25	0.03	0.05	1.03
$\Delta LIQD_{t-1}$	-0.04	0.10	0.96	-0.07	0.30	0.93	-0.28	2.97*	0.76	-0.25	2.49	0.78
Cox & Snell R Square	.004			.012			.020			.012		
Nagelkerke R Square	.006			.017			.027			.017		
N	668			668			668			668		
	Panel C: Equity Issuance						**Panel D: Equity Reduction**					
	5			**6**			**7**			**8**		
Variables	**β**	**Wald**	**e^{β}**	**β**	**Wald**	**e^{β}**	**β**	**Wald**	**e^{β}**	**β**	**Wald**	**e^{β}**
(Constant)	-2.77	33.22***	0.06	-3.45	36.35***	0.03	-1.66	21.96***	0.19	-1.91	23.64***	0.15
$PLUS_{t-1}$	0.17	0.20	1.19	0.33	0.55	1.40	-0.71	8.55***	0.49	-0.53	3.40*	0.59
$MINUS_{t-1}$	-0.13	0.13	0.87	0.16	0.13	1.18	0.57	3.27*	1.77	0.20	0.33	1.22
ΔLOS_{t-1}	0.98	2.33	2.67	0.78	1.13	2.18	-0.86	3.18*	0.42	-0.98	3.24*	0.38
$\Delta PROF_{t-1}$	-1.72	1.85	0.18	-1.65	1.38	0.19	1.95	4.00**	7.01	2.11	4.14**	8.28
ΔFAR_{t-1}	0.57	0.05	1.78	1.44	0.22	4.21	-1.22	0.36	0.30	-1.74	0.58	0.17
ΔMBR_{t-1}	0.35	1.72	1.42	0.35	1.27	1.42	0.08	0.14	1.08	0.15	0.40	1.17
$\Delta LIQD_{t-1}$	-0.10	0.21	0.91	-0.40	4.00**	0.67	-0.09	0.23	0.92	-0.09	0.23	0.91
Cox & Snell R Square	.009			.013			.043			.022		
Nagelkerke R Square	.025			.040			.074			.044		
N	668			668			668			668		

*Notes: ***, ** and * denotes the significance at the 1%, 5% and 10% levels, respectively.*
The table displays the results of logistic regression for analysing the impact of potential credit rating changes on the components of KDR, i.e., debt issuance, debt reduction, equity issuance and equity reduction. Cut-off of 2.5% and 5% is used where the binary variable for debt issuance, debt reduction, equity issuance and equity reduction takes the value of 1 if there the components are 2.5% or 5% of the previous year's total assets and zero otherwise.

Similar to the earlier results of the chapter, capital structure decisions do not seem to be influenced by potential ratings changes. The dummies for potential rating changes are mostly insignificant for debt issuance and reduction and equity issuances, irrespective of the cut-off level. The insignificance of the dummies does not suggest any particular behaviour related to debt and equity issuances. However, Column 7 of Panel D indicates that when firms have a PLUS sign they are more likely not to reduce equity (marginally significant at the 10% level) while firms having MINUS sign show that they reduce equity. The coefficients indicate that firms with a PLUS sign have 51% less odds of not reducing equity compared with firms which do not have a PLUS sign. Conversely, firms with a MINUS sign have 1.77 higher odds of reducing equity compared with firms which do not have a MINUS sign (Column 7 of Panel D).

The above results have to be interpreted with caution as the components are analysed independently. They may not provide a meaningful picture individually but does show the channels which firms choose to adjust their capital structures. For example, a firm that issues debt and equity of equal amounts may not have any real capital structure change (i.e., would show zero net debt issuance). However, a separate analysis of the components may indicate the alternatives firms choose to adjust their overall capital structures. Overall results from Tables 7.4, 7.5 and Table 7.6 do not indicate any specific patterns of the UK firms' decisions about their capital structures when they are near to possible rating changes.

7.2.4. Testing the impact of Potential Rating Changes across Rating Levels

Referring to Kisgen's (2006) study, there are minor differences in high rated US firms and low rated firms in terms of their leverage related behaviour (pp. 1051-1053). For most of the broad rating categories in Kisgen's results, the dummies for potential rating change show a negative and significant relationship while a few coefficients of some rating categories are insignificant and are of opposite sign.[30] This suggests that US firms, despite their levels of rating, tend to decrease their amounts of leverage, suggesting that concerns about rating levels are shared almost equally among different rating levels.

Although the implications of the *credit rating – capital structure hypothesis* suggest that concerns for the costs and benefits offered by credit ratings are likely to be present at every

[30] For the individual broad rating regression, POM, PLUS and MINUS are occasionally insignificant which Kisgen (2006) attributes to the small sample size for that particular broad rating category.

rating level, it can be argued that firms at different rating levels may have different sensitivities towards potential rating changes, which may influence their capital structures differently. For example, high rated firms, which have limited amounts of debt and lower risks of bankruptcy, may behave differently from low rated firms. Shivdasani and Zenner (2005) also argue that debt issuance by high rated firms with limited debt on their balance sheets may not have as significant an economic impact on their ratings and cost of debt as it would have for low rated firms. The level of financial flexibility and the superior market position, therefore, may lessen the sensitivities of high rated firms towards minor changes in their credit ratings.

Moreover, the distribution of credit ratings in the UK market is different from the US market, which may also potentially result in different behaviours of firms across rating levels. As discussed earlier, the present sample indicates that 87% of UK firms are investment grade firms while 13% are speculative grade. This is comparable to Kisgen (2006) reporting 70% investment grade and 30% speculative grade firms. Speculative grade firms should arguably be more concerned about maintaining and improving their current rating levels, as they may be more susceptible to rating downgrades due to their relatively poorer quality. Rating changes can be expected to have relatively more serious repercussions for low rated than for high rated firms. Therefore, it can be expected that when speculative grade firms are faced with potential rating changes, their concerns for downgrades are likely to result in leverage reducing behaviour. Finally, it can also be observed in Figures 7.1 and 7.2 (A & B) that there are wide differences in net debt issuance behaviour among high and low rated UK firms. These expected differences require the inclusion of variables which might capture these differences in the model.

To control for such differences, firms' individual credit rating (CR), and the interaction terms (CR*PLUS and CR*MINUS) are introduced in the model. Interaction terms, CR*PLUS and CR*MINUS, are constructed by multiplying individual credit ratings with the dummy variables, PLUS and MINUS, respectively. Firms' individual credit ratings will capture any differences in the capital market activity at different rating levels while the interactions terms may capture the leverage related behaviour at a particular rating level and when the firms also have a potential to be upgraded or downgraded. Analysis is conducted for changes in subsequent debt ratios and individual capital structure activities.

7.2.4.1. Potential Rating Changes and Changes in Debt Ratios across Rating Levels

Table 7.7 presents the results after the inclusion of the CR and interaction variables in the model. Column 1 displays results for the change in simple debt ratio (CDR) and Columns 2 and 5 report the results for net debt issuance (KDR). Columns 3 and 6 present the results for KDR excluding large debt issuance and Columns 3 and 6 for KDR excluding large debt and equity issuance. Columns 5 to 7 display the results for the models similar to Kisgen (2006).

The table indicates that introducing interaction terms in the model has considerably improved the fit of the model in all the cases. R^2*-change*, which tests the incremental effect of additional variables by comparing the hierarchical F-test, supports the rejection of the null hypothesis that the additional predictors are zero. This suggests that the alternative models are significantly better in explaining the variations in dependent variables. The results for the interaction term CR*PLUS in Column 1 of Table 7.7 indicate that low rated firms that have a PLUS sign with their credit ratings are, as expected, more likely to reduce the amount of leverage in the subsequent period. The results in Column 2 show that the relationship of PLUS is positive while the interaction term CR*PLUS has a negative and significant relationship with KDR. The positive coefficient of PLUS suggests that high rated firms with a PLUS sign with their credit rating, tend to issue annually 5.6% more debt than equity compared to the firms that do not have a PLUS sign. However, when firms are low rated, and have a PLUS sign, they are more likely to reduce the amount of leverage. The coefficient shows that these firms reduce 1% more debt than equity with each level decrease in the credit rating. Overall, the results show that low rated firms are keen towards getting an upgrade, while the behaviour of high rated firms do not show any concern towards rating changes.

When large debt issuances are excluded, low rated firms, irrespective of the sign, reduce the amount of leverage. The coefficient of CR, although marginally significant, shows that as the rating falls, firms have a tendency for reducing than issuing more debt. However, the firms that have a PLUS sign in particular, on average issue less debt than equity. The specifications without large debt and equity also offer similar results. Nevertheless, PLUS is no longer significant, which indicates that high rated firms with PLUS sign generally issued large amounts of debt and equity.

Table 7.7
Pooled Time-series Cross-sectional Regression of CDR and KDR on Potential Credit Rating Changes, CR and Interaction Effects

	1	2	3	4	5	6	7
Variables	**CDR**	**KDR**	**Excluding large Debt**	**Excluding Large Debt and Equity**	**KDR**	**Excluding large Debt**	**Excluding Large Debt and Equity**
(Constant)	0.033 (1.37)	0.043 (2.06)**	0.024 (1.59)	0.030 (2.35)**	0.061 (0.80)	-0.007 (-0.11)	0.012 (0.24)
$PLUS_{t-1}$	0.037 (1.19)	0.056 (2.03)**	0.047 (2.38)**	0.024 (1.42)	0.065 (2.49)**	0.048 (2.38)**	0.037 (2.09)**
$MINUS_{t-1}$	-0.020 (-0.61)	-0.020 (-0.69)	0.000 (0.01)	-0.013 (-0.70)	0.000 (0.01)	0.008 (0.36)	0.008 (0.44)
CR_{t-1}	0.000 (-0.11)	-0.003 (-1.15)	-0.004 (-1.86)*	-0.004 (-2.39)**	0.000 (0.05)	0.000 (-0.20)	0.000 (0.20)
$CR*PLUS_{t-1}$	-0.008 (-1.76)*	-0.010 (-2.53)**	-0.009 (-3.05)***	-0.004 (-1.74)*	-0.011 (-2.76)***	-0.009 (-2.92)***	-0.006 (-2.42)**
$CR*MINUS_{t-1}$	0.002 (0.41)	0.001 (0.19)	-0.002 (-0.60)	0.001 (0.31)	-0.002 (-0.58)	-0.003 (-1.13)	-0.003 (-1.04)
ΔLOS_{t-1}	0.061 (2.69)***	0.023 (1.17)	0.009 (0.61)	0.013 (1.05)			
$\Delta PROF_{t-1}$	-0.031 (-0.65)	0.041 (0.98)	0.065 (2.09)**	0.063 (2.44)**			
ΔFAR_{t-1}	0.147 (1.56)	0.103 (1.25)	-0.022 (-0.36)	-0.015 (-0.29)			
ΔMBR_{t-1}	0.002 (0.25)	-0.006 (-0.74)	-0.007 (-1.18)	-0.002 (-0.35)			
$\Delta LIQD_{t-1}$	0.004 (0.42)	0.002 (0.23)	0.002 (0.46)	0.003 (0.63)			
D/D+E					0.009 (1.61)	-0.011 (-2.15)**	-0.009 (-2.16)**
LOS_{t-1}					-0.005 (-1.24)	0.000 (-0.07)	-0.002 (-0.52)
$PROF_{t-1}$					0.262 (6.42)***	0.145 (4.28)***	0.139 (4.72)***
Adj R^2	.011	.031	.073	.053	.083	.073	.056
F-Value	1.749	3.041	5.860	4.378	9.648	7.882	6.120
Sig	.067	.001	.000	.000	.000	.000	.000
N	668	668	615	605	770	705	689

*Notes: This table reports the OLS regression results of CDR (Column 1), KDR (Columns 2 and 5) and KDR without large debt issuances (Columns 3 and 6) and KDR excluding both large debt and large equity issuance (Columns 4 and 7) on potential rating change variables, CR and interaction variables. ***, ** and * denotes that the p-value is significance at 1%, 5% and 10% respectively.*

For robustness purpose, Columns 5 to 7 present the results on the models similar to Kisgen (2006). It can be observed that results remain similar to Columns 2 to 5 with high rated firms with PLUS sign issue more debt than equity while low rated firms with a PLUS sign are more likely to issue less debt than equity. The coefficients remain significant in all the cases.

Overall, these results are different when compared to the US counterpart firms. Kisgen's (2006) study shows that firms with a PLUS or a MINUS with their credit ratings are more likely to reduce the amount of leverage where almost all rating levels indicate this tendency. Unlike the US firms, the present sample of UK firms suggests that high rated firms possibly take advantage of their PLUS sign and issue more debt relative to equity, while the low rated firms with a PLUS sign are more likely to reduce the amount of debt. The results seem to suggest that UK firms are more confident about their credit ratings yet this confidence is not shared among all levels of ratings. For the low rated firms, the 'sign' matters relatively more than the rest of the sample. Moreover, since high rated firms have lower levels of leverage (concluded from the previous chapter), they have greater flexibility to issue debt, when they require. Such firms might be relatively safer from minor changes to credit ratings or such changes may not have very serious consequences for firms. Nevertheless, they keep the total amount of leverage lower than other rated firms.

Compared to low rated firms with a MINUS sign, low rated firms with a PLUS sign seems to be more hopeful of getting credit ratings upgrade. In all the specifications in Table 7.7, the negative relationship of CR*PLUS indicates that such firms will issue less debt than equity. Following from the previous chapter it is also likely that low rated firms generally have constrained access to debt markets that leads such firms to issue more equity instead. However, the significance of CR*PLUS particularly suggests that the low rated firms, which reduce the amount of leverage when they have a PLUS sign, is most likely due to the concerns for costs of low credit ratings as suggested by the CR-CS hypothesis.

7.2.4.2. Potential Rating Changes and Capital Structure Activities across Rating Levels

An in-depth analysis of the components of KDR with a cut-off at 5% is also presented in Table 7.8. This will facilitate the understanding of the alternatives firms choose when they attempt to bring any change in their capital structures in consideration of potential ratings changes. Although the fits of the models have generally improved, the coefficients of the PLUS, MINUS and interaction terms are insignificant in some cases. Column 2 indicates that low rated firms have higher odds of reducing the amount of leverage. The Wald test is significant at the 1% level. The coefficient indicates that with decrease in each broad rating category, the odds of reducing 5% or more leverage increases by 23% (Column 2). This is in line with the results of the previous chapter that finds the low rated firms have low levels of gearing. It appears that low rated firms not only keep the total amount of leverage low, but also their capital structure activities are diverted towards reducing leverage in the subsequent periods. This can either be attributable to their constrained access to debt markets or their deliberate efforts towards improving their current credit ratings.

It can be noted that the change in net issuance behaviour (KDR) of firms with a PLUS sign, whether they are high or low rated, can be attributed to equity issuance/reduction behaviour. High rated firms with a PLUS sign are more likely not to issue equity where an odd ratio of 0.07 in Column 3 indicates that these firms have 0.07 lesser odds of not reducing equity than other high rated firms without a PLUS sign. On the contrary, low rated firms with a PLUS sign are more likely to issue equity than other low rated firms. The odd ratio of 1.37 in Column 3 indicates that such firms have 37% higher odds of issuing 5% or more equity than the rest of the firms, thus suggesting that to achieve possible higher ratings, low rated firms tend to issue more equity. The equity issuances of low rated firms tend to support the CR-CS hypothesis which suggests that if the concerns for credit ratings are material, firms may not follow the hierarchy in financing as suggested by the pecking-order theory. Firms may issue equity instead of debt to achieve higher ratings. Low rated firms with a MINUS sign are, surprisingly, found to have higher odds of reducing equity.

Table 7.8
Logistic Regression Analysis of the Components of Net Debt Issuance (KDR) on Potential Credit Rating Change, CR and Interaction Effect at 5% Cut-off

	1			2			3			4		
Variables	**Debt Issuance**			**Debt Reduction**			**Equity Issuance**			**Equity Reduction**		
	β	**Wald**	e^{β}	**β**	**Wald**	e^{β}	**β**	**Wald**	e^{β}	**β**	**Wald**	e^{β}
(Constant)	-0.65	3.18*	0.52	-2.26	26.84***	0.10	-3.44	19.14***	0.03	-0.04	0.00	0.96
$PLUS_{t-1}$	-0.62	1.60	0.54	0.20	0.13	1.22	-2.61	3.84**	0.07	0.28	0.14	1.32
$MINUS_{t-1}$	-0.53	1.04	0.59	-0.79	1.48	0.46	-1.33	1.15	0.27	-2.94	10.57***	0.05
CR_{t-1}	0.03	0.27	1.03	0.21	13.11***	1.23	0.07	0.50	1.07	-0.37	12.81***	0.69
$CR*PLUS_{t-1}$	0.09	1.71	1.10	0.02	0.05	1.02	0.32	4.07**	1.37	-0.02	0.030	0.98
$CR*MINUS_{t-1}$	0.08	1.34	1.09	0.10	1.52	1.11	0.15	1.04	1.16	0.44	10.98***	1.56
ΔLOS_{t-1}	0.12	0.11	1.12	-0.24	0.41	0.79	0.66	0.94	1.94	-1.51	6.38**	0.22
$\Delta PROF_{t-1}$	0.21	0.08	1.23	-1.43	3.06*	0.24	-1.42	1.21	0.24	4.01	9.34***	55.42
ΔFAR_{t-1}	-0.81	0.32	0.45	-2.46	2.4	0.09	0.86	0.09	2.37	-2.00	0.62	0.14
ΔMBR_{t-1}	-0.13	0.83	0.88	0.10	0.38	1.10	0.32	1.1	1.38	0.14	0.27	1.15
$\Delta LIQD_{t-1}$	-0.05	0.16	0.95	-0.21	1.84	0.81	-0.38	3.86**	0.68	-0.14	0.56	0.87
Cox & Snell R Square		.020			.102			.037			.075	
Nagelkerke R Square		.027			.143			.115			.149	
N		668			668			668			668	

*Notes: This table show the results of the logistic regression model for the components of KDR with cut-off of 5%. Components are regressed upon dummies of potential rating change, CR and interaction variables. ***, ** and * denotes the significance at the 1%, 5% and 10% levels, respectively.*

7.3. Analysis of Actual Credit Rating changes and Debt Ratio

As argued in Chapter 3, the implications of the *credit rating – capital structure hypothesis* (CR-CS) would imply that concerns for credit ratings would induce firms to reduce their amount of leverage once they have been downgraded. However, given the benefits of rating upgrades, they are more likely not to have any significant change in their capital structures. The hypotheses from Chapter 3 are restated below:

H_{3a} = *Other things being equal, downgraded firms will decrease the amount of leverage in their capital structure.*

H_{3b} = *Other things being equal, upgraded firms are likely to have a significant change in their capital structure.*

The model to test the above hypotheses is:

$$\Delta DR = \beta_0 + \beta_1 UG_{i,t-1} + \beta_2 DG_{i,t-1} + \sum_{i=1}^{n} \beta_i \Delta X_{i,t-1} + \varepsilon_{i,t-1} \ \textbf{... (4)}$$

It is expected that β_2 will be less than 0 while β_1 will not be significantly different from zero, to support the CR-CS hypothesis.

7.3.1. Testing the Impact of Actual Credit Rating Changes on Debt Ratio

Table 7.9 presents the OLS regression results for the change in debt ratio (CDR) and net debt issuance (KDR) regressed upon the dummies for actual downgrade and upgrade of the firms and other control variables. Columns 1 and 2 present the results for CDR based on rating change dummies only and the full model with controls for changes in the firm characteristics, respectively, while Columns 3 and 4 report the results for the KDR. Columns 5 and 6 report the results for UK rated firms based on the model close to Kisgen (2009) using CDR and KDR, respectively, as dependent variables. Kisgen (2009) controlled for firm-level characteristics, both at levels and changes in his models.

As can be noted from Columns 1 and 2, the F-values of the models are statistically significant at the 1% level, suggesting that the joint effect of the coefficients of rating change and control variables are significantly different from zero. UG, the dummy for upgrades, shows a negative relationship significant at the 10% level while DG, the dummy for a downgrade in the previous year shows a positive relationship with the change in simple debt ratio (CDR) (significant at the 1% level). Adding firm-level control variables in the model does not change the signs and significance of upgrade and downgrade dummies. Similar to Column 1, Column 2 shows a negative relationship of UG and a positive relationship of DG with the CDR. Although marginally significant, the coefficient of UG suggests that firms with upgrades in ratings in the previous year are more likely to reduce debt, on average, amounting 4.2% of the total assets of last years. On the other hand, a downgrade in the previous year yields a positive relationship, significant at the 1% level indicating that these firms issue debt amounting to 5.6% of last years' total assets. This may imply that downgrades in the previous years are not as important for the firms as an upgrade and the firms continue to issue debt after they have been downgraded.

Columns 3 and 4 for KDR also show similar results. The results for KDR for the coefficients of upgrade and downgrade are significant and have similar sign as in Columns 1 and 2, respectively. However, the significance is slightly reduced for the DG in Column 3. The results indicate that the UK firms reduce the amount of leverage after an upgrade in the previous year and continue to increase the amount of leverage after they have a downgrade. The coefficient of UG shows that firms issue on average 4% less debt than equity after they have been upgraded, while they increase 3% more debt relative to equity after downgrades. For the purpose of robustness checks, model specifications close to Kisgen (2009) are also tested. The results are reported in Columns 5 and 6. It can be observed that, consistent with the CR-CS hypothesis, upgraded firms show an insignificant relationship with CDR and KDR. However, the downgrade dummy in both the specifications remains positive and significant, indicating that such firms continue to issue debt when they are downgraded. These results indicate the possibility of the model specifications influencing the results.

Table 7.9
Pooled Time-series Cross-sectional Regression of CDR and KDR on Actual Credit Rating Changes

	CDR		KDR		CDR	KDR
Variables	**1**	**2**	**3**	**4**	**5**	**6**
(Constant)	0.019 (3.18)***	0.016 (2.62)***	0.014 (2.60)***	0.013 (2.29)**	0.080 (1.04)	-0.075 (-1.11)
UG_{t-1}	-0.040 (-1.80)*	-0.042 (-1.89)*	-0.038 (-1.89)*	-0.040 (-2.02)**	-0.033 (-1.53)	-0.029 (-1.54)
DG_{t-1}	0.051 (3.91)***	0.056 (4.22)***	0.027 (2.32)**	0.031 (2.61)***	0.065 (5.09)***	0.043 (3.77)***
ΔLOS_{t-1}		0.074 (3.30)***		0.036 (1.77)*	0.068 (3.10)***	0.026 (1.34)
$\Delta PROF_{t-1}$		-0.003 (-0.05)		0.055 (1.28)	-0.117 (-2.16)**	-0.107 (-2.24)**
ΔFAR_{t-1}		0.146 (1.58)		0.101 (1.21)	0.076 (0.84)	0.025 (0.32)
ΔMBR_{t-1}		0.004 (0.49)		-0.004 (-0.47)	0.005 (0.53)	-0.002 (-0.30)
$\Delta LIQD_{t-1}$		0.002 (0.27)		0.003 (0.39)	0.008 (0.88)	0.002 (0.28)
LOS_{t-1}					-0.008 (-1.78)*	0.000 (0.02)
$PROF_{t-1}$					0.236 (4.19)***	0.325 (6.55)***
FAR_{t-1}					0.033 (1.53)	0.037 (1.91)*
MBR_{t-1}					0.017 (3.64)***	0.016 (3.76)***
$LIQD_{t-1}$					-0.015 (-1.75)*	-0.004 (-0.53)
Adj R^2	.027	.038	.012	.015	.105	.126
F	10.265	4.809	5.094	2.420	7.536	9.025
Sig	.000	.000	.006	.019	.000	.000
N	668	668	668	668	668	668

Notes: This table displays the OLS regression results for CDR and KDR regression upon the actual rating change dummies for Model (6). Variables are defined as upgrade dummy (UG), downgrade dummy (DG), lag change in log of sales (ΔLOS_{t-1}), lag change in profitability ratio ($\Delta PROF_{t-1}$), lag change in fixed assets ratio (ΔFAR_{t-1},)lag change in market to book value (ΔMBR_{t-1},)and lag change in liquidity ratio($\Delta LIQD_{t-1}$), lag log of sales (LOS_{t-1}), lag profitability ratio ($PROF_{t-1}$), lag fixed assets ratio (FAR_{t-1},), lag market to book value (MBR_{t-1},) and lag liquidity ratio($LIQD_{t-1}$)
****, ** and * denotes that the p-value is significance at 1%, 5% and 10% respectively.*

These results are inconsistent with the CR-CS hypothesis as well as with previous reported results for US firms by Kisgen (2009). Kisgen find that US firms tend to reduce their amounts of leverage after a downgrade while with some specifications he also documents that, contrary to the CR-CS hypothesis's expectations, upgraded firms reduce their amounts of leverage. The upgrade dummy's significance is reduced either when a fixed-effects model is used or it becomes insignificant when time-varying effects by industries are controlled for.

However, in the case of UK firms, the negative relationship of the upgrade dummy with net debt issuance may be for many reasons. There is a possibility of a simultaneous relationship between the two variables. For example, firms that have reduced their amounts of leverage are more likely to be upgraded, whereas firms that have issuance debt are more likely to be downgraded. However, this possibility could be ruled out due to the variables being measured as first difference while all the explanatory and control variables are lagged by one period. It is not theoretically possible for firms to be upgraded or downgraded before they have actually reduced or issued debt respectively.

These results may also indicate that, in general, the benefits of upgrades perceived by UK firms are higher than the costs of reducing their debt, i.e., losing debt tax shields. The firms may continue to reduce debt to a point where the net benefits of upgrades are higher than the costs of reducing debt. It can be argued that firms might have target credit ratings and therefore they continue to adopt leverage reduction behaviour, even following an upgrade, to achieve those targets. Similarly, it seems that the benefits of issuing debt for downgraded firms are perceived to be higher than the costs of downgrades. Given this, firms may continue to issue debt, irrespective whether the issuance jeopardises their credit rating. The empirical evidence thus provides support to reject H_{3a} and accept H_{3b}; firms do not reduce their amount of debt when they are downgraded and they issue more leverage when they are upgraded.

7.3.2. Actual Rating Changes and Individual Capital Structure Activities

To analyse leverage related behaviour in more detail, analysis of the components of net debt issuance (KDR) is also presented in Table 7.10. The table shows that the upgrade and downgrade dummies are insignificant in most of the specifications, specifically for debt issuance and debt reduction. Alternatively, for equity issuance and reduction, it can be noted that firms bring changes in their levels of equity following upgrades. The odds ratios of UG reported in Column 5 and 6 of Panel C show that upgraded firms have 2.70 and 2.85 times higher odds of reducing 2.5% and 5% or more equity, respectively, than the firms which are not upgraded. These results also indicate that firms tend not to reduce equity when they are upgraded. Similarly, downgraded firms issue equity and are not likely to reduce equity, indicating that UK firms do not make any significant changes to their levels of debt, either by issuing or reducing debt, following rating changes. However, unlike US firms that tend to reduce debt and are not likely to issue debt or reduce equity, UK firms prefer to issue equity following rating changes.

7.3.3. Testing the Impact of Actual Rating Changes across Rating Levels

As is already evident from Chapter 6 and Section 7.2.4, firms at different levels of ratings have a tendency to behave differently towards their capital structures. To test whether there are differences in their leverage related behaviour when faced with actual rating changes, similar procedures to Section 7.2.4.1 are followed, by adding credit ratings and interaction terms to the models. Table 7.11 provides the results when CR and interaction effects are introduced into the model. Columns 1 and 2 report the results for CDR, Columns 3 and 4 report the results for KDR, while Columns 5 and 6 display the results for CDR and KDR, respectively, for specifications close to Kisgen (2009).

The results for CDR indicate that the introduction of the CR and the interaction effects have slightly improved the fit of the model. The adjusted-R^2 in Columns 2 to 4 is comparable to Kisgen (2009) reporting 3.7% adjusted-R^2 for the full model. The adjusted-R^2 of the model close to Kisgen's (2009) specifications, however, yields higher adjusted-R^2 of 11.3% and 13.4% for the CDR and KDR as reported in Columns 5 and 6, respectively. As expected, Columns 1 and 2 show differences in the behaviour of high rated and low rated UK firms, when they are faced with actual rating changes. The coefficient of UG in Column 1 shows that high rated firms tend to issue debt by 9.5% of previous year's total assets, when they are upgraded but when low rated firms are upgraded, they tend to reduce debt. Similarly, downgraded firms tend also to increase the amount of leverage. The coefficient of CR*DG shows an insignificant negative relationship with the CDR and does not give support to establish any relationship between the two variables.

Table 7.10
Logistic Regression Analysis of the Components of Net Debt Issuance on Actual Credit Rating Change

	>=2.5%			>=5%			>=2.5%			>=5%		
	Panel A: Debt Issuance						**Panel B: Debt Reduction**					
	1			**2**			**3**			**4**		
Variables	**β**	**Wald**	**e^{β}**	**β**	**Wald**	**e^{β}**	**β**	**Wald**	**e^{β}**	**β**	**Wald**	**e^{β}**
(Constant)	-0.06	0.46	0.94	-0.50	27.49***	0.61	-0.19	4.01**	0.83	-0.73	54.2***	0.48
UG_{t-1}	-0.43	1.53	0.65	-0.34	0.87	0.71	-0.06	0.03	0.94	-0.17	0.21	0.84
DG_{t-1}	0.12	0.33	1.12	0.08	0.14	1.08	0.02	0.01	1.02	-0.24	1.17	0.79
ΔLOS_{t-1}	0.30	0.74	1.35	0.10	0.08	1.11	-0.45	1.58	0.64	-0.33	0.80	0.72
$\Delta PROF_{t-1}$	-0.34	0.21	0.71	0.39	0.28	1.48	-0.15	0.04	0.86	-1.14	1.88	0.32
ΔFAR_{t-1}	-1.17	0.67	0.31	-0.83	0.33	0.44	-3.48	5.23**	0.03	-2.33	2.35	0.10
ΔMBR_{t-1}	-0.05	0.14	0.95	-0.15	1.04	0.86	0.23	2.48	1.26	0.03	0.04	1.03
$\Delta LIQD_{t-1}$	-0.04	0.11	0.96	-0.08	0.36	0.92	-0.27	2.88*	0.76	-0.24	2.24	0.79
Cox & Snell R Square	.007			.005			.017			.014		
Nagelkerke R Square	.010			.007			.022			.019		
N	668			668			668			668		
	Panel C: Equity Issuance						**Panel D: Equity Reduction**					
	5			**6**			**7**			**8**		
Variables	**β**	**Wald**	**e^{β}**	**β**	**Wald**	**e^{β}**	**β**	**Wald**	**e^{β}**	**β**	**Wald**	**e^{β}**
(Constant)	-3.02	190.5***	0.05	-3.31	176.59***	0.04	-1.50	152.31***	0.22	-1.94	187.59***	0.14
UG_{t-1}	0.99	3.58*	2.70	1.05	3.23*	2.85	-1.16	3.23*	0.31	-1.22	2.40	0.29
DG_{t-1}	0.77	4.49**	2.16	0.52	1.4	1.69	-0.58	3.48*	0.56	-0.63	2.75*	0.53
ΔLOS_{t-1}	1.07	2.78*	2.92	0.78	1.12	2.18	-0.75	2.43	0.47	-0.93	2.84*	0.39
$\Delta PROF_{t-1}$	-1.50	1.40	0.22	-1.54	1.25	0.21	2.03	4.17**	7.59	2.27	4.27**	9.67
ΔFAR_{t-1}	0.32	0.02	1.38	0.97	0.10	2.65	-1.22	0.39	0.29	-1.68	0.56	0.19
ΔMBR_{t-1}	0.39	2.16	1.47	0.36	1.36	1.43	0.08	0.16	1.08	0.16	0.43	1.17
$\Delta LIQD_{t-1}$	-0.14	0.39	0.87	-0.42	4.52**	0.66	-0.01	0.00	0.99	-0.05	0.06	0.96
Cox & Snell R Square	.018			.017			.022			.022		
Nagelkerke R Square	.046			.053			.038			.044		
N	668			668			668			668		

*Notes: This table displays the logistic regression results of for the components of KDR i.e., debt issuance, debt reduction, equity issuance and equity reduction regressed upon the actual credit rating change dummies, upgrade and downgrade for Model (5). ***, ** and * denotes the significance at the 1%, 5% and 10% levels, respectively.*

Table 7.11

Pooled Time-series Cross-sectional Regression of CDR and KDR on Actual Credit Rating Changes, Credit ratings and Interaction Terms

	1	2	3	4	5	6
Variables	**CDR**	**CDR**	**KDR**	**KDR**	**CDR**	**KDR**
(Constant)	0.014 (0.98)	0.008 (0.56)	0.037 (2.85)***	0.035 (2.62)***	0.001 (0.01)	-0.058 (-0.68)
UG_{t-1}	0.095 (1.74)*	0.096 (1.75)*	0.084 (1.72)*	0.093 (1.89)*	0.086 (1.62)	0.083 (1.78)*
DG_{t-1}	0.093 (2.70)***	0.100 (2.90)***	0.067 (2.18)**	0.072 (2.34)**	0.110 (3.30)***	0.086 (2.91)***
CR_{t-1}	0.001 (0.35)	0.001 (0.58)	-0.004 (-1.95)*	-0.004 (-1.83)*	0.005 (1.89)*	0.001 (0.47)
$CR*UG_{t-1}$	-0.017 (-2.65)***	-0.017 (-2.72)***	-0.014 (-2.49)**	-0.015 (-2.74)***	-0.015 (-2.55)**	-0.014 (-2.61)***
$CR*DG_{t-1}$	-0.007 (-1.31)	-0.007 (-1.36)	-0.006 (-1.38)	-0.006 (-1.41)	-0.007 (-1.42)	-0.007 (-1.57)
ΔLOS_{t-1}		0.074 (3.29)***		0.031 (1.57)	0.069 (3.15)***	0.027 (1.38)
$\Delta PROF_{t-1}$		0.016 (0.34)		0.075 (1.77)*	-0.109 (-1.98)**	-0.086 (-1.76)*
ΔFAR_{t-1}		0.142 (1.54)		0.094 (1.14)	0.073 (0.81)	0.025 (0.32)
ΔMBR_{t-1}		0.004 (0.44)		-0.005 (-0.65)	0.005 (0.54)	-0.003 (-0.35)
$\Delta LIQD_{t-1}$		0.001 (0.13)		0.001 (0.08)	0.007 (0.74)	0.001 (0.15)
LOS_{t-1}					-0.006 (-1.03)	-0.001 (-0.26)
$PROF_{t-1}$					0.247 (4.25)***	0.313 (6.13)***
FAR_{t-1}					0.039 (1.73)*	0.033 (1.68)*
MBR_{t-1}					0.018 (3.74)***	0.015 (3.63)***
$LIQD_{t-1}$					-0.013 (-1.53)	-0.003 (-0.45)
Adj R^2	.036	.047	.038	.042	.113	.134
F	5.955	4.305	6.285	3.926	6.640	7.879
sig	.000	.000	.000	.000	.000	.000
N	668	668	668	668	668	668

*Notes: This table displays the OLS regression results for ratings change dummies and interaction effects on the CDR and KDR. Column 1 and 2 reports the results for CDR and Columns 3 and 4 report the results for KDR. Columns 5 and 6 display the results for CDR and KDR, respectively, for model close to Kisgen (2009). Variables are defined as upgrade dummy (UG), downgrade dummy (DG), lag credit ratings(CR_{t-1}), interaction term credit rating*upgrade (CR*UG), interaction term credit rating*downgrade (CR*DG), lag change in log of sales (ΔLOS_{t-1}), lag change in profitability ratio ($\Delta PROF_{t-1}$), lag change in fixed assets ratio (ΔFAR_{t-1},)lag change in market to book value (ΔMBR_{t-1})and lag change in liquidity ratio($\Delta LIQD_{t-1}$), lag log of sales (LOS_{t-1}), lag profitability ratio ($PROF_{t-1}$), lag fixed assets ratio (FAR_{t-1}), lag market to book value (MBR_{t-1}) and lag liquidity ratio($LIQD_{t-1}$)*

****, ** and * denotes the significance at 1%, 5% and 10% respectively*

The results for full model in Columns 2 and 4 are similar except for the CR, which is positive but insignificant when the dependent variable is measured as CDR. The results in Column 4 show significant relationship of the credit ratings with KDR suggesting that the leverage related behaviour of rated firms is not similar across all the rating categories. Marginally significant at the 10% level, the negative relationship of CR indicates that firms issue 0.4% less debt than equity as the ratings decreases from one level to another. Columns 1 to 4 show that the dummies for rating change, i.e., UG and DG as main effects, are both positive and significant in all the models whereas only CR*UG shows a negative relationship with the dependent variable in all the columns.

The positive sign of UG and DG, as main effects, suggests that for high rated firms the impact of a rating change is not material and they continue to issue more leverage. In Column 4, the coefficients of UG and DG suggest that firms will issue 9.3% more debt relative to equity once they have been upgraded and around 7.2%, when they are downgraded, respectively. On the other hand, when low rated firms are upgraded they undertake leverage reducing behaviour. Significant at the 1% level, the results show that low rated firms, when upgraded, will issue 1.5% less debt relative to equity. It seems that the earlier results for upgraded firms, as reported in Table 7.9, were dominated by low rated firms. Once such effects are controlled for in the model, there apparent differences are noted in the behaviour of high and low rated firms. The reported results in Columns 5 and 6 for models close to Kisgen (2009) also show similar predictions.

Similarly to Table 7.8, the results of Table 7.11 indicate that high rated firms in particular are not very concerned about marginal rating changes. High rated firms, whether upgraded or downgraded, continue to issue debt. It seems that rating changes do not impose any material costs on high rated firms. These results are consistent with the argument by Shivdasani and Zenner (2005), that debt issuance by high rated firms may not have serious implications on the cost of borrowing of these firms in the way that it does for low rated firms. It also indicates managements' confidence about the credit quality of their firms. The results suggest that high rated UK firms may be sufficiently financially sound to issue debt and that the benefits of debt issuance outweigh any costs of rating changes. However, low rated firms continue to reduce debt, possibly in the hope of achieving upgrades.

Table 7.12 also reports the results of logistic regression models, showing which channel rated firms choose to bring changes in their capital structures when they are faced with actual change in their credit ratings. The odds ratio of the interaction effect for upgrades UG*CR in Column 4 shows that low rated firms have 2.11 times higher odds of issuing equity compared to other low rated firms that are not upgraded. Unlike the reported results for the US firms in Kisgen (2009), neither the downgrade dummy on its own nor the interaction effect for downgrades show any relevance for debt and equity issuance and reduction behaviour. Nevertheless, similar to results in Chapter 6 and in Table 7.8, low rated firms seem to reduce debt in the subsequent period. The odd ratios for CR in Column 2 indicate that low rated firms have 1.28 times higher odds of reducing debt compared to issuing debt (odd ratio of 1.12 in Column 1). Moreover, low rated firms have also higher odds of issuing equity and not reducing equity implying that low rated firms become more active in equity market with raising concerns for the high costs associated with low credit ratings.

Overall, the results indicate that actual credit rating changes are not material for firms' capital structure decisions in the way suggested by the CR-CS hypothesis. Nevertheless, high and low rated firms tend to have different considerations over the costs and benefits of credit ratings where high rated firms seem to be less concerned about the rating changes than low rated firms. A summary of the findings is presented in Table 7.13.

Table 7.12
Logistic Regression Analysis of the Components of Net Debt Issuance on Actual Credit Rating Change, CR and Interaction Effect at 5% Cut-off

	1			2			3			4		
	Debt Issuance			**Debt Reduction**			**Equity Issuance**			**Equity Reduction**		
	β	Wald	e^{β}	β	Wald	e^{β}	β	Wald	e^{β}	β	Wald	e^{β}
(Constant)	-1.24	26.97***	0.29	-2.34	70.35***	0.10	-4.19	49.13***	0.02	-0.73	4.46**	0.48
UG_{t-1}	-0.18	0.03	0.84	-2.04	2.09	0.13	-7.88	2.00	0.00	-0.84	0.25	0.43
DG_{t-1}	0.83	2.35	2.29	0.03	0.00	1.03	-0.16	0.01	0.85	0.77	0.70	2.17
CR_{t-1}	0.12	11.72***	1.12	0.25	40.82***	1.28	0.13	3.01*	1.14	-0.21	12.71***	0.81
$CR*UG_{t-1}$	-0.05	0.22	0.95	0.14	0.94	1.15	0.75	2.86*	2.11	-0.01	0.00	0.99
$CR*DG_{t-1}$	-0.12	2.24	0.89	-0.04	0.25	0.96	0.09	0.32	1.10	-0.29	2.30	0.75
ΔLOS_{t-1}	0.17	0.24	1.19	-0.15	0.15	0.86	0.83	1.27	2.30	-1.38	5.17**	0.25
$\Delta PROF_{t-1}$	0.33	0.20	1.40	-1.62	3.75*	0.20	-1.77	2.03	0.17	3.43	5.90**	30.84
ΔFAR_{t-1}	-0.71	0.24	0.49	-2.57	2.57	0.08	1.50	0.24	4.47	-2.32	0.84	0.10
ΔMBR_{t-1}	-0.13	0.78	0.88	0.10	0.37	1.10	0.34	0.97	1.40	0.09	0.12	1.09
$\Delta LIQD_{t-1}$	-0.06	0.20	0.94	-0.18	1.39	0.84	-0.37	3.81*	0.69	-0.09	0.22	0.92
Cox & Snell R Square		.024			.103			.042			.057	
Nagelkerke R Square		.032			.144			.132			.114	
N		668			668			668			668	

*Notes: This table displays the logistic regression results of for the components of KDR i.e., debt issuance, debt reduction, equity issuance and equity reduction regressed upon the actual credit rating change dummies, upgrade and downgrade, credit ratings and interaction variables ***, ** and * denotes the significance at the 1%, 5% and 10% levels, respectively.*

Table 7.13 Summary of the Findings
Firms with a ‘+’ or a ‘-’sign, do not show significant variation in their capital structure
Firms with a ‘+’or ‘-’ sign, are more likely to reduce the amount of equity
High rated firms with a ‘+’ sign, increase the amount of leverage in subsequent years
Low rated firms with a ‘+’ sign, tend to reduce the amount of leverage in subsequent years
High rated firms with a ‘+’ sign are more likely not to issue equity but high rated firms with a ‘-’ sign are not likely to reduce equity
Low rated firms with a ‘+’ sign are more likely to issue equity but low rated firms with a ‘-’ sign are more likely to reduce equity
Upgraded firms tend to reduce the amount of leverage in subsequent years
Downgraded firms tend to increase the amount of leverage in subsequent years
Upgraded and downgraded firms are more likely to issue equity and do not reduce equity
High rated firms when upgraded or downgraded tend to issue more debt
Low rated firms, when upgraded, tend to reduce the amount of leverage. They are more likely to issue equity after an upgrade.

7.4. Conclusion

This chapter presented empirical results for analysis of the relationship between potential and actual rating changes and firms’ leverage related decisions. It also presented several robustness checks, including different measures of dependent variables, different model specifications, in-depth analyses of individual capital structure activities, and tests of the variations of results across rating levels.

Unlike prior US study by Kisgen (2006), the results from the main models reported in Table 7.4 do not support the hypotheses that UK firms have leverage reducing behaviour when they are near rating changes. This suggests that the costs and benefits associated with rating changes are not material for firms’ capital structure decisions. However, analysis testing the impact of potential rating changes across rating levels suggests some differences between high rated and low rated firms towards their capital structures. It is noted that high rated UK firms are not very concerned about the modifiers alongside their credit ratings, and they continue to issue more debt when they have a ‘+’ sign. However, the firms which are at the lower end of the rating scale are more likely to reduce their amounts of leverage when they have a ‘+’ sign with their ratings possibly in a hope to achieve upgrades.

Similarly, the results do not also support the hypothesised relationship between actual credit ratings and capital structure decisions. Upgraded firms tend to reduce debt, while downgraded firms tend to issue debt. This behaviour indicates that upgraded firms, in general, may have target credit ratings and they continue to reduce debt once they have been upgraded. However, when analysis is carried out to test the impact of this across the rating scale, only high rated firms tend to issue debt when they are upgraded or downgraded. Firms towards low ratings are inclined to reduce debt following upgrades with each notch decrease in credit rating.

Overall, the results suggest that UK firms are not particularly concerned about the marginal changes in their credit ratings, whether they are potential or actual changes. This indicates that the costs and benefits associated with rating changes, as suggested by the CR-CS hypothesis, are not material for firms' capital structure decisions. It is only the low rated firms, which appear to be concerned about their credit ratings and strive to achieve higher ratings by reducing debt. High rated firms continue to issue debt, irrespective of the potential and actual change in their credit ratings.

Chapter 8
Credit Ratings and Debt Maturity Structure

8. Introduction

This chapter presents the empirical results to analyse the relationship between credit ratings and debt maturity structures of non-financial UK firms. As discussed in Chapter 4, several survey studies highlight that refinancing risk is an important concern for debt maturity structure decisions. However, prior empirical studies, examining the determinants of debt maturity structure of UK firms, tend to underestimate the importance of refinancing risk in their models and therefore may have a limited ability to explain the actual behaviour of firms. This chapter, therefore, examines empirically the significance of refinancing risk for debt maturity structure. Specifically, it tests Diamond's 1991 liquidity theory which theorises that refinancing risk faced by firms induces a non-linear relationship between the between credit ratings and debt maturity structure. Firms exposed to low liquidity risk are expected to have shorter maturity structure, while firms faced with high liquidity risk may prefer longer maturity in their capital structure. However, there may be some firms with high liquidity risk that do not have access to long-term debt markets. Therefore, such firms may rely more on short-term debt. This chapter tests these predictions by providing a detailed empirical analysis.

The remainder of the chapter organised as follows. Section 8.1 provides a detailed description of the data for the analysis. Section 8.2 presents the empirical results and discusses the findings of the multivariate regression analysis for the credit rating – maturity structure hypothesis. Section 8.3 reports the results of some robustness and sensitivity checks and Section 8.4 concludes the chapter.

8.1. Sample Descriptive Statistics

Before formally analysing the relationship between credit ratings and debt maturity structure, a detailed description of the variables is presented in order to summarise the data and describe the trend and distribution of the sample. It reports the statistics of the data without the outliers' treatment and the effects of this treatment on the sample statistics. The subsections also present the comparative statistics of the rated and non-rated UK firms and the trends of the maturity structure over the sample years and industries. Finally, the section also briefly discusses about assumptions of OLS, as they have already been covered in more detail in the Subsection 6.1.4 of Chapter 6.

8.1.1. Descriptive Statistics of the Dependent, Independent and Control Variables

The sample selected for the analysis is composed of a large number of non-rated and rated UK firms. The distribution of the data in the sample is however not suitable to provide reliable and precise estimations as there are several values which are far away from rest of the data. Such values may distort the analysis as their inclusion may influence the data by driving the results towards those values. To obtain more reliable inferences from the data, outlying observations need to be treated carefully such that the impact of these values on results are minimised but the integrity of data is still maintained. Section 5.3 of Chapter 5 discusses the procedures followed to treat such observations. Table 8.1 shows the descriptive statistics of the sample. Panel A displays the descriptive statistics for the whole sample of the rated and non-rated firms before any outlier treatment and Panel B after the treatment. Finally, Panel C displays the descriptive statistics of the final sample for the multivariate analysis.

Panel A indicates several extreme observations. For example, quality of firms (QUAL), defined as the difference between earnings before interest and taxation ($EBIT_{t+1}$) and $EBIT_t$ scaled by SP_t, ranges from -1135.20 to 5971.58, with a mean of 0.02 and standard deviation of 70.54. Asset maturity structure (AMAT), market to book ratio (MBR) and effective tax rate (ETR) also show the presence of extreme observations either at one end or at both ends. However, debt maturity structure (DMR), the dependent variable, and log of sales (LOS), seem fairly well distributed, with mean values appearing to be close to the median values. Visual inspection and graphical presentations such as box plots show that the outlying observations of the rest of the variables are likely to be an error in recording, as they are extremely distant from the rest of the observations.

Notice that, not all of the variables require outlier treatment. Therefore, only the ones that show extreme observations are trimmed or winsorised depending on the nature of the extreme observations. For example, debt maturity ratios (DMR) do not have any value above 1 or below 0; therefore the variables do not require any treatment. Quality of firm (QUAL) and market to book ratio (MBR) have several outliers at both ends while assets maturity structure (AMAT) displays extreme observations only at one end. To be consistent with the outlier treatment followed in Chapter 6 and to maintain the integrity of the data, the variables are trimmed at 0.5% at one or both ends where required. Following this, quality of firm (QUAL) and market to book ratio (MBR) values are trimmed at 0.5% at both ends, while assets maturity structure (AMAT) is trimmed only at the top end. Effective tax rate (ETR) had almost 4% of the values that lay above one or below zero, which, although might be valid cases, they may not be a suitable indicator for measuring the effective tax rate of firms. The 0.5% threshold used earlier would not deal effectively with these observations. Therefore, contrary to the procedure followed for the rest of the control variables, the effective tax rate (ETR) is winsorised at zero and one with any value that lies above (below) one (zero) is set equal to one (zero).

Table 8.1
Descriptive Statistics Before and After Outlier Treatment

Variables	N	Range	Minimum	Maximum	Mean	Median	S.D
Panel A: Descriptive Statistics before outlier treatment							
DMR	37,405	1.00	0.00	1.00	0.56	0.62	0.34
LOS	40,989	25.23	0.00	25.23	12.06	11.61	3.41
QUAL	38,024	17107.08	-11135.50	5971.58	0.02	0.19	70.54
AMAT	30,244	18912.00	0.00	18912.00	26.58	6.85	249.79
MBR	42,872	13937.00	-960.47	12976.53	2.48	1.37	65.73
ETR	42,345	3142.42	-3072.67	69.75	0.10	0.26	15.23
Panel B: Descriptive statistics after outlier treatment							
DMS	37,405	1.00	0.00	1.00	0.56	0.62	0.34
LOS	40,989	25.23	0.00	25.23	12.06	11.61	3.41
QUAL	37,644	51.40	-25.31	26.09	0.22	0.17	2.54
AMAT	30,093	804.58	0.00	804.58	14.03	6.88	40.37
MBR	42,444	22.22	0.09	22.32	1.92	1.37	1.88
ETR	42,345	1.00	0.00	1.00	0.23	0.26	0.20
Panel C: Descriptive statistics for the final sample							
DMS	23,974	1.00	0.00	1.00	0.56	0.64	0.34
LOS	23,974	25.23	0.00	25.23	12.13	11.81	2.95
QUAL	23,974	51.22	-25.21	26.01	0.27	0.18	2.59
AMAT	23,974	798.17	0.00	798.17	12.42	7.17	30.24
MBR	23,974	22.22	0.09	22.32	1.84	1.37	1.65
ETR	23,974	1.00	0.00	1.00	0.24	0.26	0.20

Notes: This table displays the descriptive statistics of the variables before and after outlier treatment and of the final sample for the multivariate analyses. N refers to number of observations (firm-years) and S.D refers to standard deviation. Variables are defined as total long-term debt (payable in more than one year) to total debt (DMR) as dependent variable, log of sales (LOS) refers to natural logarithm of sales, quality of the firm (QUAL) is the difference between earnings before interest and taxation EBITt+1 and EBITt scaled by share price at time t, assets maturity ratio (AMAT) is the ratio of total property, plant and equipment to total annual depreciation, market to book ratio (MBR) is the book value of the assets minus the book value of the equity plus market value of equity divided by book value of assets while and effective tax rate (ETR) is the ratio of total amount of tax charged by total taxable income.

Panel B of Table 8.1 shows that after the trimming procedures, the treated variables have improved in term of their distribution with the standard deviations reduced considerably and with noticeable shifts in the mean values. However, it can be observed from the table that the outlier treatment has not resulted in a complete removal of extreme observations for some cases. For example, QUAL, after trimming at both ends of the distributions by 0.5%, still shows minimum and maximum values of -25.31 and 26.09, respectively, which suggests that firms' abnormal earnings decreased by a maximum of 2,531% and increased by a maximum of 2,609% during the sample period. The first quartile and the third quartile for QUAL indicate that 50% of the observations lie above -0.05 and below 0.57 thus indicating the presence of extreme observations at both ends. Similar results are observed for other variables such as assets maturity structure (AMAT) and market to book ratio (AMAT). Although the standard deviations of these variables have been reduced in comparison with before, it still shows that the distribution has several observations lying distant from the mean. For example, the third quartile for AMAT suggests that 75% of the firm-years have an assets maturity of 11.25 years or below, while 25% have maturity above 11.25 years.[31] It should be noted that the trimming and the winsorising criterion followed is purely arbitrary and the mean and standard deviations are not seriously affected if other thresholds (such as 1% for control variables and ±1 criteria for ETR) are used instead.

Panel C of Table 8.1 displays the final sample for the multivariate analyses and shows that the average debt maturity in the UK firms' capital structure is 0.56 (median of 0.64). This indicates that, on average, the firms have a slightly higher proportion of long-term debt in comparison to their short-term debt. However, the standard deviation of 0.34 suggests considerable variation within the sample. The first and the third quartile show that 50% of the firms have a debt maturity ratio between 0.28 and 0.85 and only 25% of the firms have long-term debt ratio higher than 0.85 in their capital structure. This ratio is comparable to that of Fan *et al.* (2011) reporting 0.62 (median) for the long-term debt ratio of the UK firms using 21,785 firm-years over a sample period of 16 years (1991-2006). However, Antoniou *et al.* (2006) report a slightly

[31] The asset maturity ratio (AMAT) has several large observations for example, the maximum value is 798 years. A plausible explanation could be that the Datastream's definition for Property, plant and equipment (W02301) includes land, which is not a depreciable asset. A firm which held a large amount of non-depreciable assets compared to depreciable assets such as plant and machinery, would have a higher assets maturity ratio.

lower debt maturity ratio of 0.46 for the UK firms. Although this difference is not large, it may arise due to the sample period and/or the number of observations. Antoniou *et al.* (2006) use 35,266 firm-years over a sample period of 38 year (1969-2006). When compared with earlier studies (Antoniou *et al.* 2006; Ozkan, 2000 and 2002), the average value of the DMR in the present study is higher, which may indicate that the UK firms have switched to longer maturity ratios than they had previously chosen. This can also be observed in Figure 8.2. This gradual increase in the debt maturity ratio in recent years could be due to the major changes experienced by British capital markets after the Financial Services Act 1986 which was followed by increased transparency and low issuance costs (Antoniou *et al.*, 2006). The average debt maturity ratio of the present sample is much higher than the reported maturity ratios of approximately 0.10 in Ozkan (2000 and 2002).[32]

In terms of the maturity structure, UK firms lie in the middle of two extremes as reported by Fan *et al.* (2011). For example, Chinese and Greek firms have the lowest maturity of approximately 0.08 and 0.22 respectively, while New Zealand and Norwegian firms have the highest maturity proportion of 0.88 and 0.87 respectively.[33] However, this is notably lower than US firms' average long-term debt ratio of 0.79. This could possibly be due to the developed domestic bond market in the US when compared to the UK market where the reliance of firms, specifically mid and small size firms, is mostly on bank loans (Blake, 2000), which arguably have shorter maturity.

The control variables, when compared to previous studies on the maturity structure of the UK firms, also show some differences. Log of sales (LOS) shows a minimum value of 0.00 and a maximum value of 25.23 with an average size of 12.13. This is much higher than that reported by Ozkan (2000 and 2002) at 10.79 and 10.87, respectively, and Antoniou *et al.* (2006) at 9.03 as log of sales for the UK firms. Quality of firms (QUAL), after trimming, ranges from -25.21 to 26.01 with a mean of 0.30, which indicates that several firms had abnormal losses in the subsequent years. This is likely

[32] Ozkan classified debt maturing in more than 5 years as long-term debt. This means that his sample is limited to only those firms, which provide details on classification of long-term debt, thus resulting in a small sample. Ozkan (2000) used dataset of 429 firms with 4,624 observations during 1984-1996 while Ozkan (2002) employed data for 321 firms for the same period. It also seems that Ozkan (2000 and 2002) have used a sample of small firms which are likely to have had lower debt ratios. Moreover, low average debt maturity ratio reported by Ozkan (2000 and 2002) can be also attributable to the definition used for classifying long-term debt.

[33] Average debt maturity ratios are approximately determined from the figure of the debt maturity structures across the different countries reported by Fan *et al.* (2011).

because of the inclusion of dead firms in the sample, some of which presumably would have negative profitability in many years within the sample period.

A mean of asset maturity ratio (AMAT) of 12.42 indicates that the average maturity of the assets for UK firms is just over 12 years. However, as already stated above, the considerable variation within the sample, which ranges from 0 to 798 years with a standard deviation of 30 years, could be due to the assets structures being largely composed of non-depreciable assets. Nevertheless, the mean AMAT is generally consistent with prior UK studies such as Antoniou *et al.* (2006) reporting 13.58 and Ozkan (2000 and 2002) with 10.24 and 9.732 respectively. The market to book ratio (MBR), with a mean of 1.85 and a standard deviation of 1.66 and the effective tax rate (ETR), with mean value of 0.24 and standard deviation of 0.21, also indicates substantial variation within the sample. Nevertheless, both ratios are consistent with the prior reported results of Ozkan (2000 and 2002) and Antoniou *et al.* (2006).

8.1.2. Average Debt Maturity Ratio over the Sample Period and Industries

Figure 8.1 displays the average debt ratios and debt maturity structure ratios of the whole sample over the sample period. Contrary to Figure 6.1 in Chapter 6, and as depicted in Figure 8.1, which shows that the average debt of the UK firms remains the same over the sample period, this figure indicates that UK firms have been are gradually shifting the type of debt held, from short-term debt towards long-term debt. After an initial decrease in the debt maturity ratio[34], the average maturity ratio is consistently increasing, from approximately 0.50 in 1992 to 0.62 in 2009. The wide range of available sources of debt financing, such as domestic and international bond markets for the large and medium sized firms in particular, may be one of the reasons for the increase in the relative proportion of long-term debt. Moreover, the shift to long-term debt may indicate firms' preferences in lenghtening the payback period of their debt.

[34] The sample firms in the first three years, i.e., 1989-1991 are 11, 24 and 56 respectively, which is likely to be the reason for the inflated debt and debt maturity ratios.

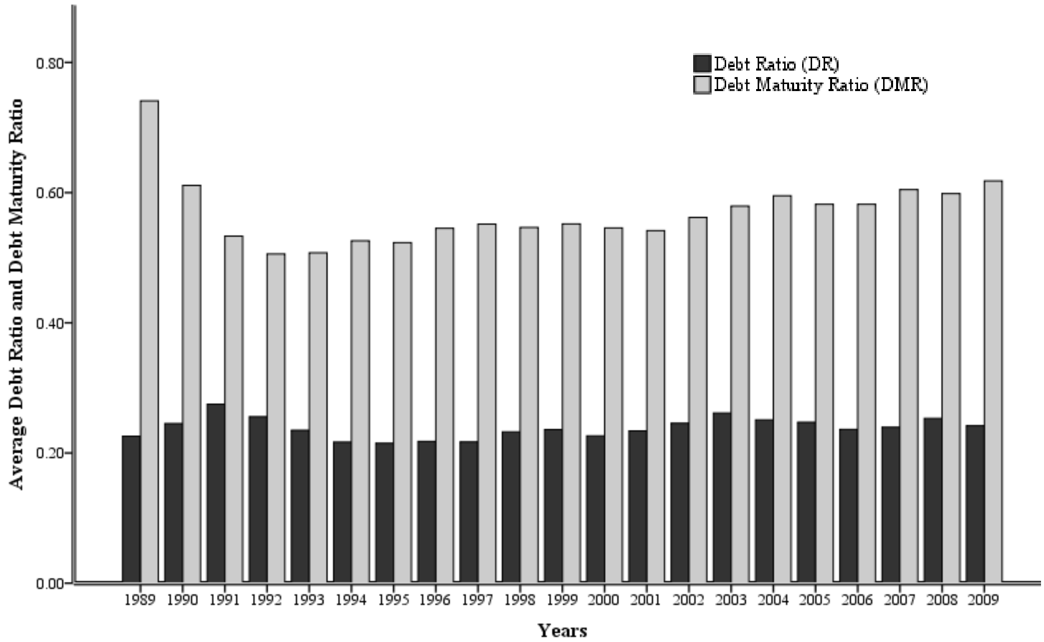


Figure 8.1: Average Book Debt Ratio and Debt Maturity Structure of the UK Firms over the Sample period

Table 8.2 reports the descriptive statistics of the variables with respect to the industry classification. Notable differences exist between the characteristics of the firms across the industries. The debt maturity ratio (DMR) ranges from the utility sector having the highest maturity ratio of 0.76, to firms in the consumer goods sector having the lowest maturity of 0.49. The standard deviation of DMR of the utility sector is low, indicating that within the sector, firms do not vary greatly which in turn suggests the possibility that regulations have influenced the debt maturity structure of such firms. As some prior studies on debt maturity structure exclude utility firms, to be consistent with these studies, analysis will also be conducted excluding utility sector firms from the sample.

Other control variables also show significant differences between the industries. The standard deviation of the variables suggests that within industries, firms vary considerably in term of their size, profitability, maturity of assets, potential growth opportunities and effective taxation. To reiterate here, industry dummies are included in the model to capture the variation across the industries.

Table 8.2
Descriptive Statistics of Dependent and Control Variables Based on Industries

	Variable	N	Minimum	Maximum	Mean	S.D
Basic Materials	DMR	1,644	0.00	1.00	0.61	0.30
	LOS	1,644	1.61	18.51	12.88	3.12
	QUAL	1,644	-24.30	25.62	0.22	2.69
	AMR	1,644	0.00	508.58	15.41	28.61
	MBR	1,644	0.19	21.88	1.58	1.26
	ETR	1644	0.00	1.00	0.25	0.21
Consumer Goods	DMR	3,352	0.00	1.00	0.49	0.33
	LOS	3,352	0.00	22.93	12.57	2.76
	QUAL	3,352	-23.21	24.60	0.26	2.24
	AMR	3,352	0.00	798.17	11.62	25.31
	MBR	3,352	0.13	15.55	1.49	0.96
	ETR	3,352	0.00	1.00	0.26	0.18
Consumer Services	DMR	5,173	0.00	1.00	0.59	0.35
	LOS	5,173	0.00	21.01	11.81	2.63
	QUAL	5,173	-25.00	25.52	0.27	2.63
	AMR	5,173	0.00	797.00	18.56	42.56
	MBR	5,173	0.13	22.32	1.83	1.61
	ETR	5,173	0.00	1.00	0.23	0.20
Health Care	DMR	1,579	0.00	1.00	0.58	0.33
	LOS	1,579	0.69	17.97	11.11	3.55
	QUAL	1,579	-23.56	23.69	0.26	2.52
	AMR	1,579	0.00	758.75	9.80	30.64
	MBR	1,579	0.14	22.17	2.84	2.56
	ETR	1,579	0.00	1.00	0.18	0.20
Industrials	DMR	7,525	0.00	1.00	0.54	0.33
	LOS	7,525	1.10	25.23	12.09	2.72
	QUAL	7,525	-25.17	26.01	0.30	2.62
	AMR	7,525	0.00	459.75	9.62	17.68
	MBR	7,525	0.12	19.96	1.63	1.24
	ETR	7,525	0.00	1.00	0.26	0.20
Oil & Gas	DMR	776	0.00	1.00	0.64	0.33
	LOS	776	3.26	21.80	12.11	3.66
	QUAL	776	-25.21	21.62	0.23	2.30
	AMR	776	0.00	764.14	23.18	74.02
	MBR	776	0.09	14.22	1.71	1.35
	ETR	776	0.00	1.00	0.25	0.24
Technology	DMR	2,621	0.00	1.00	0.51	0.36
	LOS	2,621	2.20	22.41	11.49	3.00
	QUAL	2,621	-23.17	25.54	0.35	3.12
	AMR	2,621	0.00	145.25	4.80	6.56
	MBR	2,621	0.12	20.74	2.57	2.49
	ETR	2,621	0.00	1.00	0.20	0.21
Tele-communications	DMR	614	0.00	1.00	0.71	0.28
	LOS	614	2.89	19.95	14.03	3.23
	QUAL	614	-19.74	23.00	0.20	2.80
	AMR	614	0.00	74.00	6.41	5.59
	MBR	614	0.17	20.15	2.06	1.90
	ETR	614	0.00	1.00	0.23	0.23
Utilities	DMR	690	0.00	1.00	0.76	0.22
	LOS	690	3.22	22.28	14.23	2.64
	QUAL	690	-10.26	15.99	0.08	1.13
	AMR	690	2.52	328.17	22.01	18.61
	MBR	690	0.23	8.15	1.31	0.52
	ETR	690	0.00	1.00	0.25	0.18

This table displays the descriptive statistics of the dependent and control variables based on the industries. Variables are debt maturity ratio (DMR), log of sales (LOS), quality of the firm (QUAL), assets maturity ratio (AMAT), market to book ratio (MBR) and effective tax rate (ETR).

8.1.3. Comparative Statistics of the Rated and Non-Rated Firms

The descriptive statistics presented in Table 8.1 are for the sample composed of rated and non-rated firms. After the outlier treatment, the final sample includes 564 rated firm-years and 23,410 non-rated firm-years. It was argued in Subsection 5.1.4 of Chapter 5 that non-rated firms are likely to have less access to public debt markets as they have relatively inferior credit quality compared with the rated firms. To empirically analyse whether non-rated firms possibly experience restricted access to debt markets and specifically to long-term debt, it should be determined whether the groups have different firm-level characteristics which may explain the differences in the levels of long-term debt in their capital structures. Table 8.3, therefore, displays the mean values of the dependent and control variables for rated and non-rated firms as well as the differences between the two groups.

Table 8.3
Test for the Difference of Means in Rated and Non-rated Samples

		N	Mean	Mean Difference
DMR	Rated	564	0.77	0.22***
	Non-rated	23410	0.56	
LOS	Rated	564	15.24	3.19***
	Non-rated	23410	12.06	
QUAL	Rated	564	0.15	-0.13
	Non-rated	23410	0.28	
AMAT	Rated	564	13.17	0.76
	Non-rated	23410	12.41	
MBR	Rated	564	1.87	0.04
	Non-rated	23410	1.84	
ETR	Rated	564	0.30	0.06***
	Non-rated	23410	0.24	

*This table displays the independent sample t-test for the differences in mean values of the dependent and control variables of rated and non-rated UK firms. *** denotes significance at the 1% level of confidence. Variables are defined debt maturity ratio (DMR), log of sales (LOS), quality of the firm (QUAL), assets maturity ratio (AMAT), market to book ratio (MBR) and effective tax rate (ETR).*

Consistent with Faulkender and Petersen (2006), there are significant differences in the maturity structure of the rated and non-rated firms. Rated firms have on average a proportion of approximately 0.77 of long-term debt in their capital structure, while non-rated firms have a proportion of 0.56 of long-term debt. The difference of 0.22 percentage points is statistically significant at the 1% level, which provides some preliminary evidence suggesting that rated firms have better access to the long-term debt markets than non-rated firms.

Such differences in the proportion of long-term debt can be attributed not only to the rated firms' ability to access domestic debt markets but also to the international debt markets, as firms with better access to international debt markets are argued to have a higher proportion of long-term debt (Schmukler and Vesperoni, 2006). Moreover, it is also argued that maturities in the debt markets or bond markets are greater than private placements such as bank loans (Faulkender and Petersen, 2006; Barclay and Smith, 1995). Therefore, firms with better access to the debt markets are expected to have longer maturities in their debt structure.

The results in Table 8.3 also show that rated firms are significantly different from non-rated firms in other characteristics e.g., they have larger sizes and higher effective tax rates compared with non-rated firms. The differences in the size of the non-rated and rated firms indicate that rated firms are significantly larger than their non-rated counterparts. Moreover, the high effective tax rate indicates that rated firms have higher before tax profits, resulting in high corporate taxes. These results are consistent with the prior US study by Faulkender and Petersen (2006), which reported significant differences in the relative sizes of rated and non-rated firms, while reporting higher marginal tax rates for the rated firms' sample. Interestingly, the quality of the rated firms, as measured by abnormal earnings, is unexpectedly lower than the quality of the non-rated firms. This difference, however, is statistically insignificant. It may be due to a high variation within the sample of the non-rated firms that possibly results in higher quality ratio, but does not necessarily result in a difference being statistically significantly when compared to the rated firms.

Other firm level characteristics of the rated firms, such as the assets maturity ratio (AMAT) and market to book ratio (MBR) also have higher mean values, but the differences between the two groups are not statistically significant. The insignificance of AMAT indicates that both the groups have a somewhat similar maturity term in their assets structure. The insignificance of MBR contradicts previous US and Canadian studies by Faulkender and Petersen (2006) and Mittoo and Zhang (2010) respectively, who reported significant differences in the market to book ratios of the firms. These studies also report contradictory results from each other with Faulkender and Petersen

(2006) finding that the US rated firms are more stable and have fewer investment opportunities as measured by the market to book ratio, whereas Mittoo and Zhang (2010) find the inverse. The present study does not support that there are any significant differences between the investment opportunities between the two groups.

8.1.4. Debt Maturity Structure of Rated and Non-rated Firms over the Sample Period

Table 8.4 shows the mean debt maturity ratios of the rated and non-rated firms over the sample period.[35] It also shows independent t-test results for the differences in mean values between the groups.

Table 8.4
Test of the Difference in the Mean Debt Maturity Ratios of Rated and Non–Rated Firms over the Sample Period

Years	N	Mean	Mean Difference	Years	N	Mean	Mean Difference
1992	3 627	0.83 0.50	0.33**	**2001**	45 1456	0.75 0.54	0.22***
1993	9 1178	0.76 0.51	0.25***	**2002**	41 1496	0.79 0.56	0.24***
1994	17 1217	0.71 0.52	0.18***	**2003**	52 1508	0.79 0.57	0.22***
1995	23 1272	0.74 0.52	0.22***	**2004**	48 1537	0.81 0.59	0.22***
1996	19 1282	0.73 0.54	0.19***	**2005**	55 1523	0.83 0.57	0.26***
1997	23 1315	0.74 0.55	0.19***	**2006**	45 1506	0.75 0.58	0.17***
1998	32 1434	0.73 0.54	0.19***	**2007**	44 1427	0.80 0.60	0.20***
1999	22 1355	0.73 0.55	0.19***	**2008**	39 1321	0.75 0.59	0.16***
2000	29 1385	0.72 0.54	0.18***	**2009**	18 480	0.82 0.61	0.21***

*Notes: This table displays the average debt maturity ratio (DMR) for rated and non-rated UK firms over the sample period and the results for the differences in mean values of both the groups. *** and ** denotes significance at 1% and 5% level of confidence*

Even taking into account that the sample size of rated firms is very small compared to the non-rated firms, the differences between the respective average maturity ratios is significant at least at 1% or the 5% level of confidence for all the sample years. The significance of Levene's test, which tests the homogeneity of variances between two

[35] Due to the outlier treatment, results from 1989-1991 do not contain any data for the rated firms.

samples (Field, 2005), gives support to rejecting the null hypothesis for the homogeneity of the variances for all the sample years.

The results imply that there are significant differences in the maturity ratios of the rated and non-rated firms, where rated firms have a significantly higher level of long-term debt in their capital structure. Standard deviation statistics indicate that the rated firms have lower variations within the sample, which means that these firms tend not to have a lot of variation in the maturity ratios among themselves, compared with the non-rated group. These results, however, have to be interpreted with caution, as the degree of freedom of the rated firms is considerably lower than that of the non-rated firms.

8.1.5. Credit Ratings and Average Debt Maturity Ratios

Figure 8.2 (A) displays the mean debt maturity ratios of the sample with respect to broad credit ratings. The rated firms, despite being high or low rated, have longer average maturity ratios compared to their counterpart non-rated firms. The average debt maturity of AA and A rated firms is the lowest, followed by B rated firms, while BB rated firms have the highest average debt maturity ratio. The distribution of average debt maturity ratio provides preliminary evidence consistent with Diamond’s (1991) theory and the proposed hypotheses based on it, suggesting a non-linear trend between the broad credit ratings and the debt maturity ratios.

Figure 8.2 (B) displays the debt and debt maturity ratios of the UK firms with respect to the individual credit ratings. Consistent with Figure 8.2 (A), maturity ratios also show a non-linear trend with respect to the individual rating categories. The figure indicates that firms below BB- ratings have shorter maturities in their debt structure. Figure 8.2 (B) also shows that the average debt maturity ratios at each individual rating level also vary with the overall capital structure. Firms with higher debt in their capital structure seem to have higher level of long-term debt as well supporting the argument by Leland and Toft (1996) and Morris (1992) that firms opting for higher leverage also select longer maturities to delay the exposure to bankruptcy and potential cost of financial distress. Moreover, a prior empirical study by Antoniou *et al.* (2006) empirically also find that leverage and the maturity structure of debt have a positive relationship for the UK firms. This preliminary evidence suggests the need for controlling for the level of leverage of firms in the model. However, leverage of firms is not incorporated in the main model due to the concerns for endogeneity in the model, as it is already established in Chapter 6 that credit ratings are an important determinant of capital structure. Nevertheless, following theoretical debate and prior empirical studies, as a measure of robustness check, leverage is incorporated in the model later (See Section 8.3.2).

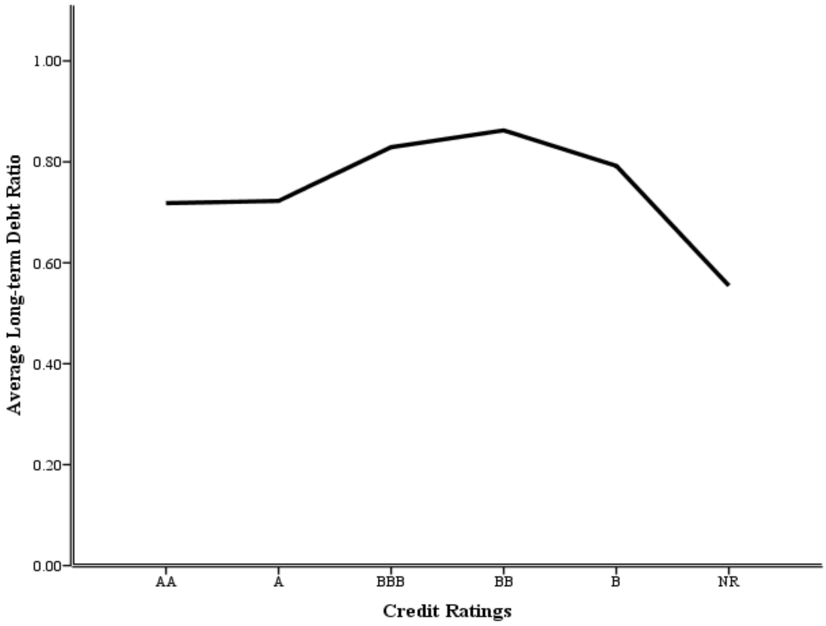


Figure 8.2 (A) Credit Ratings and Average Debt Maturity Structure (DMR)

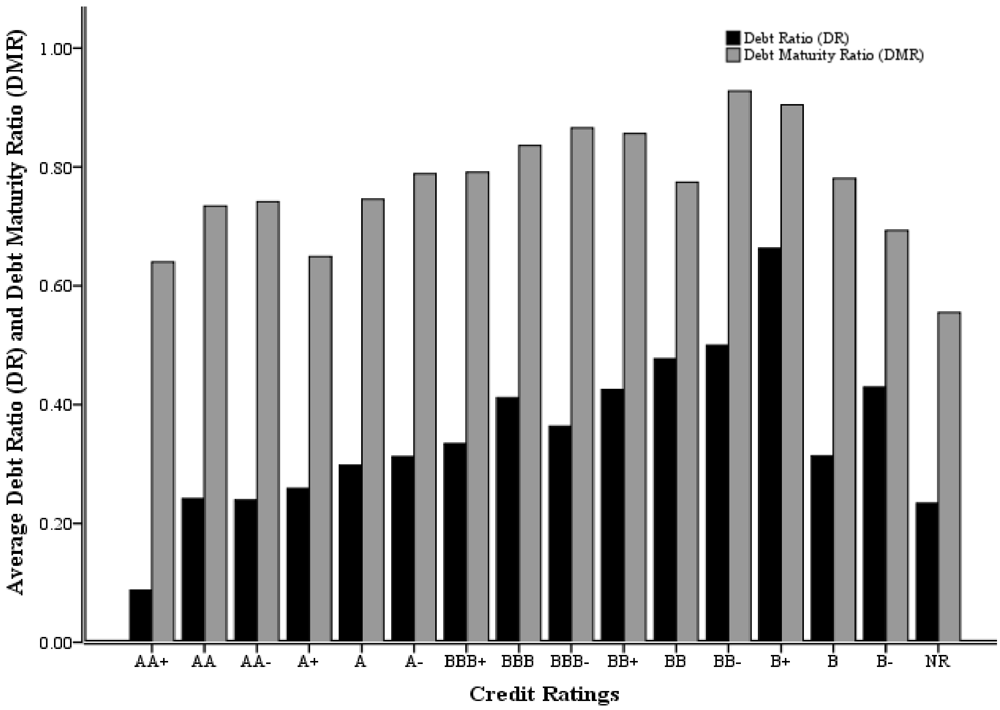


Figure 8.2 (B) Credit Rating and Average Debt (DR) and Debt Maturity Ratios (DMR)

Section 8.2 will formally test whether this observed non-linearity could be attributable to the credit ratings, controlling other factors important for the determination of the maturity structure of firms' debt.

8.1.6. Tests for the OLS Assumptions

Before estimating the relationship of the credit rating on the maturity structure of the firms, it is important to test the validity and suitability of the estimation technique. As discussed in Chapter 5, Ordinary Least Squares (OLS) is used as the main estimation technique for the debt maturity structure. Following the diagnostics for the OLS assumptions in Chapter 6, data for analysis of the debt maturity structure are also tested for the suitability of the estimation technique. Similar to the capital structure analysis, the diagnostics for OLS assumptions indicate three main concerns. The first relates to the multicollinearity of explanatory variables, credit ratings and its functional form. The second main concern is the non-constant variance or heteroskedasticity, while the third relates to the expected non-independence of the error term resulting in an endogenous relationship between the credit ratings and the dependent variable, the debt maturity ratio. Appendices 8A-8G presents the results of the diagnostics tests.

Multicollinearity is diagnosed by VIF, Eigenvalues and a correlation matrix of the dependent, independent and control variables. The results indicate a high correlation between credit ratings and the squared values of credit ratings. A detailed discussion in Chapter 6 suggests that the multicollinearity between the actual variable and its functional form cannot be classified as a pure multicollinearity case. This problem does not therefore require any remedial measure (for a detailed discussion, see Chapter 6 Subsection 6.1.2). For addressing the concern of heteroskedasticity, White Standard Errors are also used.

The concern about endogeneity is likely to arise because of the theoretical reverse relationship between credit ratings and maturity structure of debt. The direction of the relationship between the maturity structure and the credit ratings is not clear, as no theoretical and empirical study has directly looked at the relevance of the maturity structure of debt in the determination of credit ratings. However, since the capital structure and its components are closely associated with the credit ratings, it should be ensured that endogeneity does not affect the estimates of the model. To address any such concerns, different estimation techniques and models are also estimated. A detailed discussion of procedures can be found in Section 8.3.3.

8.2. Testing the Impact of Credit Rating on the Debt Maturity Structure

This section presents the main regression results of the analysis of the impact of credit ratings on the maturity structure of the debt. The hypothesis H_{4a}, which postulates a non-monotonous or an inverted U-shaped relationship between credit rating and debt maturity structure, are tested using Model 6. The hypothesis restated from Chapter 4 is as follows:

> **H_{4a}: *If other things remain constant, there is a non-linear, inverted U-shaped relationship between credit ratings and the debt maturity structures of the firms*.**

As discussed in Chapter 5 Subsection 5.2.3.4, Model 6 explores the relationship between credit rating and debt maturity structure of the firms. The model is re-stated below:

$$DMR_{i,t} = \alpha_0 + \beta_1 CR_{i,t} + \beta_2 CR_{i,t}^2 + \sum_{i=1}^{n} \beta_i X_{i,t} + \varepsilon_{i,t} \quad \textbf{... (6)}$$

Where:

$DMR_{i,t}$	*is the debt maturity ratio of a firm*
α_0	*is a constant term*
$CR_{i,t}$	*is the credit rating of the firm with cardinalzed values of 1,2,…5, where AA=1 to B=5 or with cardinalzed values of 1,2,…6 where NR=6*
$CR_{i,t}^2$	*is the square of credit rating $CR_{i,t}$*
$X_{i,t}$	*are control variables including Rating dummy (RAT_{dum}), size (LOS), firms quality (QUAL), assets maturity (AMAT), growth opportunities (MBR), effective tax rate (ETR) and industry dummies (technology ($TECH_{dum}$), Industrial (IND_{dum}), consumer service (CS_{dum}), consumer goods (CG_{dum}), health care (HC_{dum}), utility (UTL_{dum}), basic material (BM_{dum}), oil & gas (OG_{dum})*
$\varepsilon_{i,t}$	*Error term*

The section is further divided into two subsections. Section 8.2.1 presents the results for the whole sample of rated and non-rated firms, while Section 8.2.2 presents the results for rated firms only.

8.2.1. Results Based on Whole Sample of Rated and Non-Rated firms.

Table 8.5 displays the results of the pooled OLS regression for Model (6) for the whole sample of rated and non-rated firms. Specifically, Columns 1 to 3 present the results for the entire sample including utility firms, while Column 4 displays the results for the sample excluding the utility sector. The utility sector is excluded to maintain consistency with previous studies examining the debt maturity structure of the firms. Column 1 presents the results only for the credit rating (CR) and its squared term (CR^2). Column 2 reports the results for the full model without the rating dummy, while Column 3 contains the results for the full model including the rating dummy.

Table 8.5
Pooled Time-series Cross-sectional Regression of Long-term Debt Ratio on Credit Ratings and Control Variables for the Whole Sample

Variables	1	2	3	4
(Constant)	0.461 (6.85)***	0.014 (0.21)	-0.084 (-0.88)	-0.139 (-1.35)
CR	0.219 (5.28)***	0.249 (6.26)***	0.181 (2.94)***	0.219 (3.34)***
CR^2	-0.034 (-6.60)***	-0.034 (-6.84)***	-0.020 (-1.80)*	-0.025 (-2.14)**
RAT_{dum}			0.170 (1.44)	0.159 (1.28)
LOS		0.029 (37.72)***	0.029 (37.71)***	0.029 (37.54)***
QUAL		-0.001 (-1.01)	-0.001 (-1.02)	-0.001 (-0.99)
AMAT		0.001 (12.79)***	0.001 (12.77)***	0.001 (12.29)***
MBR		-0.003 (-2.23)**	-0.003 (-2.21)**	-0.003 (-2.17)**
ETR		0.003 (0.29)	0.003 (0.31)	0.006 (0.53)
$TECH_{dum}$		-0.116 (-8.06)***	-0.115 (-8.00)***	-0.114 (-7.84)***
IND_{dum}		-0.109 (-8.10)***	-0.108 (-8.01)***	-0.107 (-7.86)***
CS_{dum}		-0.066 (-4.79)***	-0.064 (-4.69)***	-0.063 (-4.55)***
CG_{dum}		-0.175 (-12.42)***	-0.173 (-12.31)***	-0.172 (-12.15)***
HC_{dum}		-0.034 (-2.24)**	-0.033 (-2.18)**	-0.031 (-2.02)**
UTL_{dum}		0.033 (1.84)*	0.034 (1.90)*	
BM_{dum}		-0.072 (-4.76)***	-0.071 (-4.68)***	-0.070 (-4.56)***
OG_{dum}		-0.021 (-1.20)	-0.020 (-1.15)	-0.018 (-1.03)
Adj R^2	.010	.100	.100	.092
F	117.044	177.670	166.703	157.547
Sig	.000	.000	.000	.000
N	23974	23974	23974	22546

Notes: This table displays the OLS regression results of Model 6 for the whole sample (Columns 1-3) and without utility firm (Column 4). Variables are defined as total long-term debt to total assets (DMR) as dependent variable, numerical code 1-6 for credit rating (CR), credit rating square (CR^2),rating dummy (RAT_{dum}), log of sales (LOS) refers to natural logarithm of sales, Quality of the firm (QUAL) is the difference between earnings before interest and taxation ($EBIT_{t+1}$) and $EBIT_t$ scaled by share price SP_t, assets maturity ratio (AMAT) is the ratio of total property, plant and equipment to total annual depreciation, market to book ratio (MBR) is the book value of the assets minus the book value of the equity plus market value of equity divided by book value of assets while and effective tax rate (ETR) is the ratio of total amount of tax charged by total taxable income, technology dummy ($TECH_{dum}$), industrial dummy (IND_{dum}), consumer services dummy (CS_{dum}), consumer goods dummy (CG_{dum}), heath care dummy (HC_{dum}), utility dummy (UTL_{dum}), basic material dummy (BM_{dum}) and oil and gas dummy (OG_{dum}).
*Coefficients are reported outside parenthesis while t-values are in the parenthesis. ***, ** and * denotes p-values significant at the 1%, 5% and 10% levels, respectively.*

Column 1 shows the model with the explanatory variables, credit rating and its squared term only. The F-*value* of 117.04 is significant at the 1% level with an adjusted-R^2 of 1.0%, which gives sufficient support to reject the null hypothesis that the slopes of the explanatory variables are simultaneously zero. In terms of the relevance of the credit ratings for the maturity structure of the firms, the adjusted-R^2 is very low. As previously stated in Chapter 6 Subsection 6.1.2.1, the sample consists of rated and non-rated firms where the rated firms constitute 2.3% of the total sample. This may lower the contribution of the credit rating in the model. Moreover, due to significant variation in the maturity structure of non-rated firms, one can expect that assigning a single code may limit the power of the CR and CR^2 as a whole. Despite these limitations of the variable, both CR and CR^2 explain significantly the maturity structure of the firms as depicted in Column 1.

Column 1 shows that the CR has a positive relationship and CR^2 has a negative relationship with the debt maturity ratio (DMR). The coefficients of CR and CR^2 are both statistically significant at the 1% level. Since both variables are functionally related with each other, the coefficients have to be jointly explained. The positive and negative coefficients of CR and CR^2 respectively, indicate that with an increase in credit rating, debt maturity first increases and then gradually decreases. The negative sign of CR^2 indicates that the maturity of the debt increases at a diminishing rate. The significance of CR and CR^2 with the predicted signs gives strong support for the non-linearity hypothesised in the relationship between credit rating and debt maturity structure.

After adding the firm-level control variables as restrictions in the model, the fit of the model improves considerably, increasing the adjusted-R^2 to 10%, with F-*value* significant at the 1% level. Consistent with the earlier results in Column 1, CR and CR^2 maintain the predicted signs and remain significant at the 1% level of confidence. However, it may be argued that the non-linear relationship between credit rating and debt maturity structure is due to the inclusion of non-rated firms, as they tend to have a lower debt maturity ratio, which is also evident from Tables 8.2 (A and B). To minimise such concerns, RAT_{dum} is added to the model. This restriction is likely to address any possible issues that may arise from the inclusion of large number of non-rated firms to construct the credit rating variables. As stated in Chapter 5, this procedure is also consistent with Stohs and Mauer (1996) and Barclay and Smith (1995), who explore the determinants of the debt maturity structure of US firms.

Column 3 reports the regression results after the addition of RAT_{dum} to the model. After adding the restriction of the rating dummy, the adjusted-R^2 of the full model does not change and remains at 10%. This is comparable to previous UK studies such as Ozkan (2002) and Fan *et al.* (2011) which reported adjusted-R^2 of 13.9% and 8.9% respectively. It can also be compared to previous US studies which generally reported adjusted-R^2 in the same range (e.g., Barclay and Smith, 1995; Guedes and Opler, 1996). The adjusted-R^2 may be low but it is consistent those found in prior literature, specifically Fan *et al.* (2011) who study the maturity structure of 40 countries and report similar statistics for most of the sample countries including the UK. Moreover, the constant term is not significant in the model suggesting that the independent and control variables are appropriately selected.

In the full model, CR and CR^2 still posses the expected sign and are significant even after the inclusion of all restrictions. As expected, CR has a positive sign and is significant at the 1% level; CR^2 also maintains its direction but it is now significant at the 10% level. The coefficients of CR and CR^2 suggest that credit ratings and debt maturity structures have a non-linear relationship, thus providing strong support for H_{3a}, H_{3b}, and H_{3c}. The coefficients indicate that when firms have high ratings, they tend to have a shorter maturity in their capital structure. However, this trend diminishes as the credit rating deteriorates. Specifically, the coefficients suggest that with the deterioration of each rating category, the level of maturity increases by 18 percentage points, but the rate of increase simultaneously decreases by 2 percentage points with each consecutive squared rating. The significance of the CR^2 is low but it remains within an acceptable limit. The rating dummy (RAT_{dum}) is unexpectedly insignificant in the model, but its inclusion has altered the significance of the CR^2. The significance of CR and CR^2 and the insignificance of RAT_{dum} suggest that despite non-rated firms having shorter maturity in their capital structure, they are not significantly different in their debt maturity level when the credit ratings are controlled for in the model. It may be possible that the size of the firms (LOS) also captures some of the effects of credit ratings leading to the statistical insignificance of the rating dummy.

The relationship of CR and CR^2 with the maturity structure is consistent with that found by Stohs and Mauer (1996). They documented a positive relationship of CR and a negative relationship of CR^2 with the maturity structure, both significant at the 1% level of confidence. Moreover, they noted that the rating dummy is also significant in the model. The findings of the present study are slightly contradictory to Stohs and Mauer (1996), as the *t*-statistics for CR and CR^2 is relatively lower than those of the control variables. However, this can be attributed to the differences in the composition of the sample. The proportion of non-rated firms in their sample is 44% and the rest of the sample is composed of rated firms whereas the present sample consists of 2.3% rated firms and 97.7% non-rated firms. It is expected that this difference should result in substantial dissimilarities in the results for both the studies in terms of the validity and strength of credit ratings as an explanatory variable. Nevertheless, the relationship of CR and CR^2 is as predicted and remains evident when all the restrictions are introduced into the model. A separate regression analysis for testing the model solely for the rated firms is carried out in the next section to further analyse the contribution and significance of the credit ratings for the maturity structure of the rated firms alone.

Although these results confirm the assumption made about the non-rated firms, the evident shorter debt maturity structure may be due to reasons other than liquidity risk. For example, being rated reduces information asymmetry between lenders and borrowers (Faulkender and Petersen, 2006) suggesting that the quality of non-rated firms may be more difficult to assess. Therefore, the lenders, specifically banks, may reduce the maturity of debt to possibly gain a superior bargaining position and to maximise the effectiveness of their monitoring activities (Barclay and Smith, 1995).

The control variables also possess the expected signs but only the log of sales (LOS), assets maturity ratio (AMAT) and market to book value (MBR) are significant in the model whereas the quality of firm (QUAL) and the effective tax rate (ETR)[36] possess the expected relationship but are insignificant. The size of the firm, measured by log of sales (LOS), is significantly positively associated with the DMR. Such a relationship between size and the debt maturity structure is in line with that found in Barclay and Smith (1995 and 1996), Stoh and Mauer (1996), Cai *et al.* (2008), Deesomsak *et al.* (2009) and specifically with Ozkan (2000 and 2002), Antoniou *et al.* (2006) and Fan *et al.* (2011) for UK firms. The positive association between the LOS and DMR indicates that large UK firms have a longer maturity in their capital structure, possibly due to lower information asymmetry, better ability to borrow from the public debt markets, fewer potential conflicts of interests and a higher proportion of collateralisable debt.

[36] The truncation process of ETR, as discussed in Section 8.1.1, does not have any effect on the direction or the significance of the variable in any of the models.

The evidence indicates that the quality of the firms (QUAL) is not an important predictor of UK firms' maturity structure. The coefficient of QUAL is negative as expected, but is insignificant, thus contradicting Flannery's (1986) and Kale and Noe's (1990) theory that firms signal their quality to the outsiders through the choice of the maturity structure of their debt. The results are consistent with prior UK studies (Ozkan, 2000 and 2002; Antoniou *et al.* 2006) but inconsistent with most of the US studies (Barclay and Smith, 1995; Guedes and Opler, 1996; Stoh and Mauer, 1996). Nevertheless, as will be discussed later in this section, the empirical results for the sample for the rated firms indicate negative and significant results for the QUAL and DMR.

Consistent with the theoretical argument of Myers (1977), the results for AMAT indicate that UK firms tend to match the maturity structure of their assets with the maturity structure of their debt to circumvent any circumstances where they do not have sufficient cash flows to meet their obligations when these become due. By matching the maturity of the assets structure with the debt structure, they can streamline their cash flows so that they both mature at the same time. These results are in line with most of the previous studies on the debt maturity structure of the UK, US and other international markets (see, Ozkan, 2000 and 2002; Antoniou *et al.* 2006; Barclay and Smith, 1995; Guedes and Opler, 1996; Stohs and Mauer, 1996; Cai *et al.* 2008; Deesomsak *et al.* 2009; Fan *et al.* 2011).

The market to book ratio (MBR) shows a negative and significant relationship with the debt maturity structure of the UK firms. The results support the theoretical predictions of Myers (1977), who argues that when firms have risky debt in their capital structure, the benefits from undertaking positive NPV projects are shared between the bondholders and the shareholders, resulting in a disincentive to invest in such projects. Myers (1977) and Bodie and Taggart (1978) propose that reducing the maturity of debt is likely to solve such problems. Consistent with the suggestions of Myers (1977) and Bodie and Taggart (1978), the negative relationship of MBR with DMR indicates that UK firms are particularly concerned about sub-optimal investment and they use the maturity structure of their debt to minimise such concerns. The results are inconsistent with most of the previous UK studies (Bevan and Danbolt, 2002; Antoniou *et al.* 2006; Fan *et al.* 2011) and literature from other markets (Esho *et al.* 2002; Cai *et al.* 2008; Fan *et al.* 2011) who report either a positive and/or an insignificant relationship between the two variables. The effective tax rate also shows a negative sign, but it is insignificant in the model. These findings are similar to Ozkan (2000 and 2002), in suggesting that tax concerns are not important for the UK firms in making their maturity structure decision.

Industry dummies are mostly negative and are significantly associated with the debt maturity structure indicating that most of these industries have significantly shorter maturity in their capital structure when compared to the base industry, telecommunication. The positive coefficient of the utility dummy (UTL_{dum}), however, suggests that, contrary to most of the industries, firms in the utility sector have on average higher long-term debt as a proportion of their total debt when compared with the base industry. A detailed discussion of reasons why of UK utility firms have higher leverage can be found in BIS (2004).

The inclusion of utility firms in the sample, however, can be subject to criticism. As discussed in the previous chapter, utility firms, being highly regulated, are expected to follow a different capital structure than other non-financial firms and possibly also different determinants as well. It may also be likely that their choice of the maturity structure is also influenced by such factors. A few of the previous studies, which have examined the debt maturity structure, have also included the regulated firms in their sample (Barclay and Smith, 1995; Guedes and Opler, 1996). However, they have used a regulated firm dummy to capture any differences in the results due to such inclusion. The use of a utility dummy in the analysis above (Columns 2 and 3) effectively address such concerns but to be consistent with most of the previous UK studies on the debt maturity structure (Ozkan, 2000 and 2002; Antoniou *et al.* 2006), Column 4 of Table 8.5 also provides the multivariate regression results for the sample when excluding the utility sector.

The results are similar to Column 3, where the coefficients of the explanatory and control variables maintain similar signs and are significant in the reduced sample. The coefficients of CR and CR^2 still show a positive and negative sign, respectively, but the statistically significance for CR^2 has improved from 10% to 5%. A separate regression for the utility firms' does not show any relevance of the credit ratings as a determinant of their debt maturity structure, which possibly attenuates the significance of CR^2. Moreover, as will be discussed in Subsection 8.3.1.1, it is possible that the coding scheme of credit ratings limits the non-linear effect of credit ratings, in relation to the debt maturity structure.

Results reported in Columns 1 to 4 of Table 8.5 provide strong evidence to reject the null hypothesis in favour of the alternative hypothesis that credit ratings do in fact have a non-linear relationship with the debt maturity structure of the firms. Moreover, the results suggest that non-rated firms, similar to other low rated firms, have shorter maturity in their capital structure. These results are in line with Diamond's prediction that a shorter debt maturity structure moderated by the refinancing risk faced by firms leads to a non-monotonic relationship between their credit ratings and the debt maturity structure. A further discussion is postponed until the next subsection.

8.2.2. Results Based on the Rated Firms

The main dataset used in Table 8.4 is composed of the rated and non-rated firms, where non-rated firms, having a proportion of 97.6% in the total sample, dominate the whole sample. As stated earlier, this method of sample selection is in line with previous US studies by Barclay and Smith (1995) and Stohs and Mauer (1996) which examined the debt maturity structure of the US firms. The inclusion of a large number of non-rated firms is based on the assumption that these firms which may be similar to low rated firms, have inferior quality and/or constrained access to the debt markets. The assumption, although valid, might pose some concerns. For example, non-rated firms may not be strictly classified as firms with less access to debt markets and as having poor credit quality leading such firms to rely on short-term debt. Given that several firms in the UK do not acquire credit ratings, it is acknowledged that the assumption may not suffice in many circumstances. Moreover, the number of non-rated firms is proportionally large, which might undermine the effect of credit ratings and other control variables on the maturity structures and may alter the actual relationship among the variables. It can also be noted in Table 8.4 that the marginal contribution of the credit rating is less than expected, with *t*-statistics of the credit rating and its functional form being smaller than several other control variables in the model.

This assumption made about the non-rated firms would only suffice when the sample without the non-rated firms produces similar estimates for the rated firms' sample. Therefore, Model 3 is also tested for rated firms only and the results are displayed in

Table 8.6.[37] Columns 1 and 2 of Table 8.7 show the model estimates for the whole sample of rated firms, while Columns 3 and 4 display the results for rated firms without the inclusion of utility firms in the sample.

Column 1 reports the estimates for the coefficients of CR and CR^2 only. The adjusted-R^2 of 6.6% is notably higher when compared to Column 1 of Table 8.5, indicating the relevance of credit ratings for the rated firms in particular. This might provide sufficient support that the hypothesis that debt maturity structure of the rated firms in the UK varies with their credit ratings, despite the fact that the coefficient of CR^2 is unexpectedly insignificant. A closer inspection suggests that the insignificance of the CR^2 can be attributed to the inclusion of utility sector in the sample and the coding procedures (further details discussed later in the section).

Table 8.6
Pooled Time-series Cross-sectional Regression of Long-term Debt Ratio on Credit Ratings and Control Variables for the Rated Firms

Variables	1	2	3	4
(Constant)	0.599 (12.96)***	0.885 (6.02)***	0.506 (11.88)***	0.706 (4.29)***
CR	0.089 (2.54)**	0.166 (3.89)***	0.134 (4.31)***	0.209 (4.55)***
CR^2	-0.007 (-1.07)	-0.022 (-3.00)***	-0.011 (-2.15)**	-0.028 (-3.48)***
LOS		-0.023 (-2.97)***		-0.016 (-1.87)*
QUAL		-0.012 (-2.03)**		-0.011 (-1.75)*
AMAT		0.003 (2.67)***		0.002 (2.54)**
MBR		-0.003 (-0.43)		-0.001 (-0.19)
ETR		0.008 (0.30)		0.005 (0.11)
$TECH_{dum}$		0.020 (0.28)		0.025 (0.34)
IND_{dum}		-0.020 (-0.51)		-0.009 (-0.22)
CS_{dum}		-0.044 (-1.20)		-0.042 (-1.12)
CG_{dum}		-0.135 (-3.46)***		-0.128 (-3.24)***
HC_{dum}		0.011 (0.20)		0.034 (0.62)
UTL_{dum}		-0.023 (-0.55)		
BM_{dum}		-0.136 (-3.18)***		-0.12 (-2.76)***
OG_{dum}		0.014 (0.29)		0.033 (0.65)
Adj R^2	.066	.164	.114	.181
F	21.234	11.571	49.174	8.772
Sig	.000	.000	.000	.000
N	571	571	495	495

Notes: This table displays the OLS regression results of Model 3 for the Rated firms' sample with utility firms (Columns 1and 2) and without utility firm (Columns 3 and 4). Variables are defined as total long-term debt to total assets (DMR) as dependent variable, numerical code 1-5 for credit rating (CR), credit rating square (CR^2), log of sales (LOS) refers to natural logarithm of sales, quality of the firm (QUAL) is the difference between earnings before interest and taxation ($EBIT_{t+1}$) and $EBIT_t$ scaled by share price SP_t, assets maturity ratio (AMAT) is the ratio of total property, plant and equipment to total annual depreciation, market to book ratio (MBR) is the book value of the assets minus the book value of the equity plus market value of equity divided by book value of assets while and effective tax rate (ETR) is the ratio of total amount of tax charged by total taxable income, technology dummy ($TECH_{dum}$), industrial dummy (IND_{dum}), consumer services dummy (CS_{dum}), consumer goods dummy (CG_{dum}), heath care dummy (HC_{dum}), utility dummy (UTL_{dum}), basic material dummy (BM_{dum}) and oil and gas dummy (OG_{dum}).
*Coefficients are reported outside parenthesis while t-values are in the parenthesis. ***, ** and * denotes p-values significant at the 1%, 5% and 10% levels, respectively.*

[37] The data for the rated firms is winsorized due to the small sample size. QUAL is winsorized at the top and bottom 0.5%, AMAT and MBR at the top 0.5% and ETR at 0-1 criteria as before.

After adding the control variables into the model, the coefficients of CR and CR^2 maintain their direction. However, the relationship of CR^2 with DMR is now significant at the 1% level. The coefficients suggest that the level of debt maturity structure increases by 16.6 percentage points with the deterioration of the broad rating category, but this increase has a diminishing rate of 2.2 percentage points with every squared broad rating. As stated above, one possible reason for the non-significance of CR^2 in Column 1 can be the inclusion of utility firms in the sample. When other firm-level characteristics together with the effect of the inclusion of utility sector are controlled for, Column 2 shows significant coefficient of CR^2. Moreover, results for Model 3 in Columns 3 and 4 without the utility sector indicate a strong non-linear relationship. The exclusion of utility section has not only improved the t-values for credit ratings but has reduced the significance of other firm level factors in determining the maturity structure of UK firms. This may mean that the debt maturity structures of rated utility firms is either not related to the credit ratings or that they do not have a non-linear relationship, which possibly attenuates the significance of credit ratings for the rest of the sample, as displayed in Column 1. An individual regression for the rated utility firms suggests that credit ratings are irrelevant for the maturity structures of such firms. Presumably the sample size is also small, which may contribute to the lack of significance of credit ratings in the model.

The consistency in the relationship of CR and CR^2 with DMR, and its significance in both tables, i.e., Tables 8.5 and 8.6, suggests that firms with high and low credit ratings, despite the inclusion of non-rated firms in the sample, have shorter maturity in their capital structure while mid rated firms have longer debt maturity. These results thus support Diamond’s (1991) theory, which predicts that the maturity structure of debt is dependent on refinancing risk and this refinancing risk is different at each level of creditworthiness. The refinancing risk induces a non-monotonic relationship between the credit ratings, which are explicitly considered a measure of creditworthiness in Diamond (1991).

The results suggest that high rated UK firms have a preference for a high proportion of short-term debt and following Diamond (1991), one can expect that this debt consists mostly of commercial papers and unsecured debt.[38] It is also documented by prior

[38] The availability of data does not permit to investigate further the type of instruments used by firms at each level of ratings.

literature that high rated firms prefer directly placed debt with short maturity. For example, as in 1992-93, 70% of the issues of commercial paper and 90% of the outstanding amount in the UK market were rated by top three rating agencies (Alworth and Borio, 1993). Evidence also suggests that only top rated firms issue commercial papers (Stojanovic and Vaughan, 1998; Financial Times, 2011, A.M Best, 2012). Stojanovic and Vaughan (1998) report that 90.4% of the issues rated by Moody's have high prime ratings (highest Moody's rating P1) and the remaining 9% have low prime ratings (second highest Moody's P2). As the high rated firms have low refinancing risk, they are able to rollover the debt to the next period. Choosing short debt maturity enables high rated firms to take advantage of the favourable information which may reveal at the time of maturity of existing debt, lowering its cost of borrowing in the next period.

Due to the high costs associated with refinancing short-term debt at maturity, it can be argued that low rated firms would also prefer more long-term debt. However, due to the high credit risk they are exposed to, they might be screened out from the long-term debt markets. Low rated firms might be restricted to either issue public debt of shorter maturity or would be limited to bank loans or private placements, which arguably are of shorter maturity than public debt. The results of Tables 8.5 and 8.6 show that similar to non-rated firms, low rated firms have short maturity in their debt structure. This behaviour provide support for the argument by Diamond (1991) indicating that possibility that low-rated and non-rated firms have difficulty in accessing long-term debt markets.

Consistent with Diamond (1991), intermediate rated UK firms seem to be more inclined towards a longer maturity in their capital structure. This is likely because, unlike low quality firms, which have constrained access to the long-term debt markets, mid rated firms can have better access to such financing options. While short-term debt may be cheaper for these firms, evidence suggests that mid rated firms may lack the confidence of being able to easily rollover the debt when it matures. Therefore, these firms take the advantage of being able to access long-term debt markets.

Regarding the other control variables, LOS has a negative relationship with the DMR, which contradicts with earlier reported results in Tables 8.5 and those of previous studies. The negative sign not only indicates that large firms prefer to use shorter maturity in their capital structure, but also suggests a possible interaction between the level of credit ratings and the size of firms. For example, large firms are more likely to have better ratings and thus can easily access short-term instruments including commercial papers. However, it is not feasible to isolate the effect of both the variables on the debt maturity ratios.

The importance of signaling quality through the choice of maturity structure seems to show up more clearly when the analysis is restricted to the rated firms only. Contrary to the prior UK studies, the quality of a firm (QUAL) is found to have a negative relationship with DMR where the coefficient is significant at the 5% level. This supports the signaling theory by Flannery (1986) and Kale and Noe (1990) and the empirical results reported by previous US studies (Barclay and Smith, 1995; Guedes and Opler, 1996; Stoh and Mauer, 1996). This suggests that, similar to US firms where firms choose debt maturity structures which differentiate them from inferior quality firms, the UK rated firms signal their quality to outsiders through the maturity structure.[39] The assets maturity structure (AMAT) has a positive association with the DMR supporting the maturity – matching hypothesis. Investment opportunities measures by market to book ratio (MBR) and effective tax rate (ETR) do not seem to be an important determinant of the debt maturity structure of UK rated firms.

To conclude, the two subsections provide strong support for rejecting the null hypotheses in favour of alternative hypothesis, H_{4a}, that credit ratings are non-linearly associated with the debt maturity structure of the UK firms. The next section presents some of the robustness checks to analyse the stability and consistency of the results when alternate coding procedures and estimation techniques are used.

8.3. Robustness and Sensitivity Checks

This section presents the results of a series of robustness and sensitivity checks. The objective is to examine whether the results reported above are robust to alternative estimation techniques and coding procedures. Specifically, Subsection 8.3.1 discusses the results for alternative coding procedures based on individual credit ratings and a dummy method. Subsection 8.3.2 reports the results after controlling for the leverage of

[39] It should be reiterated here that the proxy for quality of firms might not truly capture what it is intended to measure. Abnormal earnings of firms may have restricted ability to measure the true quality of firm, which may arguably be a long-term attribute of a firm.

the firms, while Subsection 8.3.3 reports the results based on alternative estimation technique namely the two-stage least squares model (2SLS) and on lagged explanatory and control variables.

8.3.1. Results based on Alternative Coding for the Credit Ratings

The main results presented in Tables 8.5 and 8.6 were based on coding assigned to each broad rating category from AA to B while the last numeric code of 6 was assigned to the non-rated category when non-rated firms are part of the sample. As argued in Subsection 6.2.2.1, the ordinal scale assigned to the rated categories has a clear ranking from 1 assigned to highest ratings through to 6 for the lowest quality but the distance between the rating categories may not be similar. This may pose a problem in interpreting the results. For example, the debt maturity structure increases with a diminishing rate with the deterioration of every broad rating category but cast doubt on whether the decline in the broad rating category is similar across the whole level of ratings. To address such concerns, similar to Chapter 6, two alternative coding schemes are used for credit ratings, namely the individual rating category coding and the broad rating dummy technique. Subsection 8.3.1.1 presents the empirical results for individually rating categories and Subsection 8.3.1.2 presents the results for the broad rating dummy technique.

8.3.1.1. Results Based on Individual Rating Categories Coding

Table 8.7 reports the results for CR and CR^2 measured by assigning a numeric code to each individual rating level. For example, AA+, AA, AA- are assigned 1, 2 and 3, respectively, and B-, being the last rating level, is assigned 15. The non-rated firms are assigned the numeric code of 16. Using a different coding scheme will ensure to minimise any potential noise arising from the unequal distances between each rating level. Moreover, this system of coding will also test the hypotheses for each individual rating level to analyse whether individual rating levels also have similar relationships with the debt maturity structure of the UK firms as seen with the broad rating categories. Columns 1 to 3 display the results for the whole sample of rated and non-rated firms and Columns 4 to 6 report the results for the rated firms only. Columns 3 and 6 show the results of Model 3 tested for sample firms without including the utility sector.

Table 8.7
Pooled Time-series Cross-sectional Regression of Book Long-term Debt Ratio on Credit Ratings based on Individual Rating Coding

Variables	1	2	3	4	5	6
(Constant)	0.460 (8.13)***	-0.059 (-0.71)	-0.104 (-1.17)	0.554 (15.99)***	0.733 (4.93)***	0.541 (3.20)***
CR	0.086 (6.27)***	0.078 (4.36)***	0.084 (4.49)***	0.049 (4.98)***	0.072 (5.92)***	0.081 (6.29)***
CR^2	-0.005 (-7.70)***	-0.003 (-3.00)***	-0.004 (-3.05)***	-0.002 (-3.06)***	-0.004 (-4.71)***	-0.004 (-4.85)***
RAT_{dum}		0.127 (1.41)	0.137 (1.43)			
LOS		0.029 (37.76)***	0.029 (37.58)***		-0.015 (-1.92)*	-0.006 (-0.67)
QUAL		-0.001 (-1.01)	-0.001 (-0.99)		-0.012 (-2.07)**	-0.012 (-1.87)*
AMAT		0.001 (12.78)***	0.001 (12.29)***		0.003 (2.93)***	0.002 (2.60)***
MBR		-0.003 (-2.19)**	-0.003 (-2.16)**		-0.003 (-0.40)	-0.002 (-0.21)
ETR		0.003 (0.31)	0.006 (0.53)		0.007 (0.26)	-0.002 (-0.04)
$TECH_{dum}$		-0.115 (-7.98)***	-0.114 (-7.81)***		0.025 (0.37)	0.028 (0.41)
IND_{dum}		-0.108 (-8.00)***	-0.107 (-7.85)***		-0.028 (-0.72)	-0.011 (-0.28)
CS_{dum}		-0.064 (-4.69)***	-0.063 (-4.54)***		-0.047 (-1.29)	-0.037 (-0.99)
CG_{dum}		-0.173 (-12.27)***	-0.172 (-12.10)***		-0.125 (-3.19)***	-0.108 (-2.71)***
HC_{dum}		-0.033 (-2.12)**	-0.030 (-1.96)**		0.052 (0.95)	0.080 (1.43)
UTL_{dum}		0.034 (1.89)*			-0.015 (-0.35)	
BM_{dum}		-0.071 (-4.66)***	-0.069 (-4.54)***		-0.127 (-2.97)***	-0.105 (-2.39)**
OG_{dum}		-0.019 (-1.10)	-0.017 (-0.98)		0.039 (0.80)	0.062 (1.23)
Adj R^2	.010	.100	0.092	.104	.193	.209
F	119.717	177.670	158.486	33.927	13.363	10.348
Sig	.000	.000	.000	.000	.000	.000
N	23974	23974	23284	571	571	495

Notes: This table displays results for OLS regression for Model 3, using 1-16 code for credit ratings. Columns 1 to 3 reports the results for the whole sample and Columns 4 to 6 reports the results for the rated firms' only. Column 3 and 6 reports the results for firms without the inclusion of utility firms.. Variables are defined as total long-term debt to total assets (DMR) as dependent variable, numerical code 1-6 or 1-5 for credit rating (CR), credit rating square (CR^2),rating dummy (RAT_{dum}), log of sales (LOS) refers to natural logarithm of sales, quality of the firm (QUAL) is the difference between earnings before interest and taxation ($EBIT_{t+1}$) and $EBIT_t$ scaled by share price SP_t, assets maturity ratio (AMAT) is the ratio of total property, plant and equipment to total annual depreciation, market to book ratio (MBR) is the book value of the assets minus the book value of the equity plus market value of equity divided by book value of assets while and Effective tax rate (ETR) is the ratio of total amount of tax charged by total taxable income, technology dummy ($TECH_{dum}$), industrial dummy (IND_{dum}), consumer services dummy (CS_{dum}), consumer goods dummy (CG_{dum}), heath care dummy (HC_{dum}), utility dummy (UTL_{dum}), basic material dummy (BM_{dum}) and oil and gas dummy (OG_{dum}).
*Coefficients are reported outside parenthesis while t-values are in the parenthesis. ***, ** and * denotes p-values significant at the 1%, 5% and 10% levels, respectively*

Column 1 of Table 8.7, similar to Column 1 of Table 8.5, suggests that the partial model explains a significant proportion of variation in the maturity structure of the firms where the CR and CR^2 have expected signs and are significant at the 1% level. The inclusion of control variables does not result in any change in the direction and significance of CR and CR^2, although the t-statistics have slightly reduced. Compared to the results of Column 3 in Table 8.5, however, the significance level of CR^2 has improved from 10% to a 1% level of significance. This indicates that CR^2, which effectively captures the non-linearity, has a stronger relationship with the debt maturity structure when CR and CR^2 are coded according to individual rating categories rather than broad rating categories. Measuring credit rating through broad rating scheme attenuated the effects of the individual rating levels on the debt maturity structure of the firms. Nevertheless, both the coding procedures confirm the non-linear relationship of credit ratings with the debt maturity structure, where the non-rated firms have shorter maturity in their capital structures similar to other rated firms.

The coefficients of the CR and CR^2 are lower than those of the reported coefficients in Table 8.5, using a broad rating category as the number of coding points has decreased from 6 to 16. When credit ratings are coded individually, there will be less marginal change from one rating to another than the case where credit ratings were coded with respect to broad rating category. Overall, the significance of both the CR and CR^2 suggests that the coding procedure is not likely to suffer from any serious measurement error although the results are slightly sensitive to the coding procedure. Moreover, credit ratings, measured by individual rating categories, also suggest a non-linear relationship with the debt maturity structure of the firms. This indicates, for example, that not only do the firms with the highest and lowest broad rating categories (e.g., AA, B) have shorter maturity in their leverage structure, but the firms within these broad rating categories such as AA+, AA, AA-, B+, B and B-, also exhibit a shorter debt maturity.

These results are consistent with those of Barclay and Smith (1995), who use individual rating categories to test Diamond's non-linearity hypothesis. However, the results of the present study are an improvement to Barclay and Smith's study. They use individual rating levels and a rating dummy to capture the non-linearity of the credit ratings. Their study suggests that the credit ratings on their own have a monotonic relationship with the debt maturity structure while the non-monotonicity is solely driven by the inclusion of non-rated firms. The present study, on the other hand, suggests that the credit ratings on their own have a non-monotonous relationship with the debt maturity structure and, consistent with Stoh and Mauer (1996), the non-rated firms in the sample do not drive such results. The results reported in Columns 4 to 6 for rated firms also show similar patterns, although the results are more pronounced than for the sample with the inclusion of non-rated firms reported in Columns 1 to 3. The CR and CR^2 have significant relationships with the debt maturity structure of the UK firms, where the t-statistics of the coefficients are sufficiently large to conclude that credit ratings are in fact the most important factor in the determination of the debt maturity structure of rated UK firms.

In sum, the significance of the models' estimates for CR and CR^2 have improved when credit ratings have been measured by individual rating levels. The results based on individual rating levels confirm previous findings and refute the null hypothesis in favour of the alternative hypotheses, suggesting that the credit ratings have a non-monotonous or an inverted U-shaped relationship with the debt maturity structure, irrespective of the inclusion of non-rated firms and the utility sector in the sample.

8.3.1.2. Broad Rating Dummy Technique

Similarly to Subsection 6.3.1.2 of Chapter 6, an alternative measure for the credit ratings is constructed by assigning a dummy variable to each broad rating category. For example, for the dummy variable AA_{dum}, the firm-year will take the value of 1 if they have AA+, AA or AA- ratings, otherwise it will be zero. Non-rated firms are kept as the base/ reference category when the model is tested for the whole sample, given that this category has the highest number of observations to make precise estimates about the other categories in the model. For the rated firms' sample, BBB is kept as a reference category. Table 8.8 reports the results for the broad rating dummy technique for the whole sample as well as for rated firms only. Columns 1 to 3 report the results for the whole sample of rated and non-rated firms and Columns 4 to 6 show the results for the rated firms' sample.

Column 1 reports the results for the broad rating category dummies without the control variables. Consistent with Figure 8.2 (A), non-rated firms have the lowest proportion of long-term debt of 0.55, while all other rating categories have, on average, more long-term debt in their capital structure. The result shows that the BB rated firms have the longest maturity in their debt structure, while the AA rated firms have the shortest debt maturity. All the dummies are significant at the 1% level.

After adding the control variables, the results show similar pattern although the AA_{dum} becomes insignificant in the model. The coefficients of A_{dum}, BBB_{dum}, BB_{dum} and B_{dum} indicate that after controlling for the firm level characteristics, A, BBB, BB and B rated firms have respectively 4, 18.8, 17.9 and 16.9 percentage points higher maturity than that of the non-rated firms. It can be noted that when effects of firm-level characteristics are controlled for in the model, the coefficients have reduced their size considerably. This possibly could be attributed to some firm-level characteristics, which can be strongly associated with the credit ratings of the firms. For example, as discussed in Section 8.2.1, the size of the firm may take some of the effects of credit ratings, resulting in lowering of size of the coefficients and their significance. Nevertheless, the credit ratings, whether measured as ordinal variables or dummy variables, retain their significance despite the specifications of the model.

The curvature relationship between credit ratings and debt maturity structure is relatively more apparent when utility firms are excluded from the sample (Column 3). These results are consistent with the reported results in Column 4 of Table 8.5. The coefficient of BB rated firms show that firms within the broad rating of BB have 22 percentage points more long-term debt while B rated firms have 18 percentage points more long-term debt in their capital structure compared to the base category of non-rated firms. The results are different from Column 2 because the debt maturity structure of the utility firms is significantly different as a whole and at each rating level, from other firms in the sample. In unreported statistics, utility firms at each level, from AA category through non-rated firms NR, show significantly different mean maturity ratios than the rest of the sample firms. Moreover, the mean debt maturity ratios show that the point of curvature for the utility firms is much earlier than for firms making up the rest of the sample. These differences are more pronounced for the broad rating categories than for the individual rating levels.

Table 8.8
Pooled Time-series Cross-sectional Regression of Long-term Debt Ratio (DMR) on Explanatory Using Broad Rating Dummy Technique

Variables	1	2	3	4	5	6
(Constant)	0.555 (254.66)***	0.296 (17.57)***	0.289 (16.90)***	0.823 (64.10)***	1.229 (9.91)***	1.153 (8.32)***
AA_{dum}	0.163 (4.02)***	-0.010 (-0.27)	-0.042 (-0.98)	-0.104 (-4.15)***	-0.129 (-3.97)***	-0.159 (-4.28)***
A_{dum}	0.168 (7.81)***	0.044 (2.11)**	0.047 (1.98)**	-0.099 (-5.76)***	-0.104 (-5.45)***	-0.107 (-5.48)***
BBB_{dum}	0.270 (11.16)***	0.188 (8.09)***	0.186 (7.95)***			
BB_{dum}	0.317 (6.00)***	0.179 (3.54)***	0.219 (3.64)***	0.062 (2.09)**	-0.010 (-0.33)	0.017 (0.49)
B_{dum}	0.237 (3.26)***	0.169 (2.53)**	0.179 (2.55)**	-0.013 (-0.33)	-0.118 (-2.36)**	-0.107 (-2.02)**
LOS		0.029 (37.67)***	0.029 (37.52)***		-0.022 (-2.95)***	-0.018 (-2.15)**
QUAL		-0.001 (-1.03)	-0.001 (-1.01)		-0.014 (-2.35)**	-0.012 (-1.85)*
AMAT		0.001 (12.79)***	0.001 (12.29)***		0.002 (2.53)**	0.002 (2.31)**
MBR		-0.003 (-2.24)**	-0.003 (-2.19)**		-0.006 (-0.75)	-0.004 (-0.53)
ETR		0.003 (0.31)	0.006 (0.52)		-0.006 (-0.14)	0.009 (0.19)
$TECH_{dum}$		-0.116 (-8.06)***	-0.115 (-7.88)***		0.066 (0.89)	0.064 (0.85)
IND_{dum}		-0.109 (-8.09)***	-0.108 (-7.91)***		-0.036 (-0.92)	-0.028 (-0.68)
CS_{dum}		-0.066 (-4.79)***	-0.064 (-4.62)***		-0.065 (-1.74)*	-0.060 (-1.59)
CG_{dum}		-0.174 (-12.37)***	-0.173 (-12.18)***		-0.141 (-3.59)***	-0.135 (-3.36)***
HC_{dum}		-0.035 (-2.27)**	-0.032 (-2.09)**		-0.030 (-0.54)	-0.008 (-0.14)
UTL_{dum}		0.035 (1.95)*			-0.021 (-0.50)	
BM_{dum}		-0.072 (-4.73)***	-0.070 (-4.60)***		-0.143 (-3.35)***	-0.132 (-3.01)***
OG_{dum}		-0.022 (-1.26)	-0.019 (-1.11)		-0.026 (-0.52)	-0.010 (-0.18)
Adj R^2	.010	.100	.092	.087	.182	.193
F	47.023	146.866	139.349	14.587	8.483	8.402
Sig	.000	.000	.000	.000	.000	.000
N	23974	23974	23284	571	571	495

*Notes: The table displays OLS regression results for dummy variable technique for Model 3. Columns 1 to 3 reports the results for the whole sample and Columns 4 to 6 reports' the results for the rated firms' only. Column 3 and 6 reports the results for firms without the inclusion of utility firms. AA_{dum}, A_{dum}, BBB_{dum} BB_{dum}, and B_{dum} takes the value of 1, if firm has a rating within broad rating category AA, A, BBB, BB or B, respectively, or 0 otherwise whereas base category for the whole sample is non-rated firms (NR) and for rated firm is BBB. Variables are defined as total long-term debt to total assets (DMR) as dependent variable, log of sales (LOS) refers to natural logarithm of sales, quality of the firm (QUAL) is the difference between earnings before interest and taxation ($EBIT_{t+1}$) and $EBIT_t$ scaled by share price SP_t, assets maturity ratio (AMAT) is the ratio of total property, plant and equipment to total annual depreciation, market to book ratio (MBR) is the book value of the assets minus the book value of the equity plus market value of equity divided by book value of assets , effective tax rate (ETR) is the ratio of total amount of tax charged by total taxable income technology dummy ($TECH_{dum}$), industrial dummy (IND_{dum}), consumer services dummy (CS_{dum}), consumer goods dummy (CG_{dum}), heath care dummy (HC_{dum}), utility dummy (UTL_{dum}), basic material dummy (BM_{dum}) and oil and gas dummy (OG_{dum}).Coefficients are reported outside parenthesis while t-values are in the parenthesis. ***, ** and * denotes p-values significant at the 1%, 5% and 10% levels, respectively.*

The results for the rated firms' sample (Columns 4 to 6) show similar trends as to Table 8.6. When firm-level characteristics are not controlled for in the model, the B_{dum} is insignificant, thus not suggesting a non-linear relationship. However, after controlling for the firm-level characteristics, including industry dummy for the utility sector, the broad rating dummies show a non-linear trend. Column 5 indicates that, compared to the base category, i.e., BBB rated firms, AA rated firms have 12 percentage points, A-rated firms have 10 percentage points and B rated firms have 12 percentage points less long-term to total debt in their capital structures. The results in Column 6 show similar results to Column 5 although the coefficient for AA rated firms has decreased which indicates that AA rated non-utility sector firms have 16 percentage points less long-term debt than the BBB rated firms.

Overall, the results from this section support the earlier conclusion that credit ratings are non-linearly associated with the debt maturity structure of the UK firms, where the non-rated firms have shorter debt maturity compared to the rated firms. Despite the fact that results are generally consistent with different coding schemes, they indicate that categorising credit ratings according to the broad rating categories is not capturing the effects of credit ratings as efficiently as when they are measured according to the individual rating classes. Moreover, the improvement in the results with more definitive non-linear pattern with the exclusion or controlling for the utility sector shows that the utility sector firms do not have similar concerns for refinancing risk as firms in other sectors. These differences can be attributable to the regulations that govern the capital structure decision making of such firms.

8.3.2. Results after Controlling for the Leverage of the Firms

It is argued that leverage has a direct relationship with the debt maturity structure of the firms. Firms that have high leverage also have long maturity in their capital structures compared to firms which have low levels of debt. Leland and Toft (1996) and Morris (1992) argue that this is due to the firms' attitude towards risk, as highly geared firms in a hope to minimise or delay exposure to bankruptcy and avoid the cost of financial distress select to issue more long-term debt. Empirically, Antoniou *et al.* (2006) for the UK firms also find that leverage and the maturity structure of debt have a positive relationship. Furthermore, this relationship is also observable in Figure 8.2 (B). The leverage of firms can therefore potentially be an important determinant of the debt maturity structure which in turn can possibly alter the relationship between credit ratings and debt maturity structure.

It can be noted that leverage of the firms is not controlled for in the main model, as doing so would introduce complex interactions among the explanatory variables. For example, the leverage of a firm is directly related to the size of the firm, as large firms have more access to the capital markets and thus have more debt. Similarly, credit ratings also influence capital structure, as discussed in Chapter 6, while the reverse causality of credit ratings and capital structure is always inevitable. These complex interactions among the variables may cause non-independence of error terms, which may result in producing biased or/and inconsistent estimators.

However, to ensure that credit ratings are reliably associated with the debt maturity structure of the firms, the leverage of the firms is included as a control variable. Table 8.9 presents the results for the whole sample (Columns 1 to 3) and for the rated firms (Columns 4 to 6). Column 1 (4) presents the results for credit rating coding 1-6 (1-5), Column 2 (5) presents the results for credit rating coding 1-16 (1-15) while Columns 3 and 6 display the results for the broad rating dummy technique for the whole sample and the rated firms' sample, respectively.

It can be noted in the table that the leverage of the firms is directly related to the debt maturity structure of the UK firms. This suggests that if the firms have higher leverage they are also likely to have longer maturity in their capital structure supporting the argument by Leland and Toft (1996) and Morris (1992). Nevertheless, the results for the relevance of credit ratings display consistent results with what has been reported earlier in the chapter. Some differences in the level of significance, however, are observable in few cases for the whole sample.

Table 8.9
Pooled Time-series Cross-sectional Regression of Long-term Debt Ratio (DMR) on Explanatory Controlling for the Leverage of the Firms

Variables	1	2	3	4	5	6
(Constant)	-0.014 (-0.15)	-0.008 (-0.09)	0.216 (12.9)***	0.761 (5.20)***	0.656 (4.45)***	1.047 (8.11)***
CR	0.133 (2.20)**	0.059 (3.36)***		0.143 (3.41)***	0.061 (5.06)***	
CR^2	-0.016 (-1.48)	-0.003 (-2.46)**		-0.021 (-2.95)***	-0.003 (-4.36)***	
RAT_{dum}	0.090 (0.78)	0.063 (0.72)				
AA_{dum}			0.012 (0.31)			-0.097 (-2.92)***
A_{dum}			0.038 (1.85)*			-0.085 (-4.39)***
BBB_{dum}			0.144 (6.32)***			
BB_{dum}			0.127 (2.57)***			-0.026 (-0.85)
B_{dum}			0.102 (1.50)			-0.143 (-2.89)***
DR	0.345 (32.26)***	0.345 (32.19)***	0.345 (32.24)***	0.226 (4.48)***	0.191 (3.80)***	0.217 (4.34)***
LOS	0.027 (36.06)***	0.027 (36.10)***	0.027 (36.02)***	-0.014 (-1.76)*	-0.008 (-1.07)	-0.014 (-1.82)*
QUAL	-0.001 (-1.23)	-0.001 (-1.22)	-0.001 (-1.24)	-0.012 (-2.04)**	-0.013 (-2.15)**	-0.013 (-2.12)**
AMAT	0.000 (1.67)*	0.000 (1.69)*	0.000 (1.69)*	0.002 (2.01)**	0.002 (2.24)**	0.002 (1.98)**
MBR	-0.006 (-4.43)***	-0.006 (-4.41)***	-0.006 (-4.45)***	-0.013 (-1.62)	-0.011 (-1.45)	-0.014 (-1.79)*
ETR	0.032 (2.98)***	0.032 (2.97)***	0.032 (2.97)***	-0.014 (-0.33)	-0.021 (-0.51)	-0.008 (-0.19)
$TECH_{dum}$	-0.068 (-4.77)***	-0.068 (-4.77)***	-0.069 (-4.83)***	0.063 (0.87)	0.055 (0.80)	0.098 (1.34)
IND_{dum}	-0.076 (-5.78)***	-0.077 (-5.78)***	-0.078 (-5.85)***	-0.010 (-0.26)	-0.016 (-0.42)	-0.033 (-0.84)
CS_{dum}	-0.043 (-3.18)***	-0.043 (-3.19)***	-0.044 (-3.27)***	-0.038 (-1.06)	-0.041 (-1.13)	-0.064 (-1.75)*
CG_{dum}	-0.146 (-10.56)***	-0.146 (-10.54)***	-0.147 (-10.61)***	-0.150 (-3.88)***	-0.139 (-3.54)***	-0.162 (-4.18)***
HC_{dum}	-0.002 (-0.11)	-0.001 (-0.07)	-0.003 (-0.19)	0.027 (0.51)	0.061 (1.12)	-0.016 (-0.29)
UTL_{dum}	0.042 (2.40)**	0.042 (2.39)**	0.042 (2.44)**	-0.024 (-0.6)	-0.014 (-0.35)	-0.032 (-0.78)
BM_{dum}	-0.044 (-2.95)***	-0.044 (-2.94)***	-0.045 (-3.00)***	-0.131 (-3.12)***	-0.123 (-2.90)***	-0.144 (-3.44)***
OG_{dum}	0.010 (0.59)	0.011 (0.62)	0.008 (0.49)	0.005 (0.10)	0.029 (0.60)	-0.039 (-0.78)
Adj R^2	.137	.137	.137	.193	.213	.209
F	224.907	225.390	201.465	9.510	10.620	9.360
Sig	.000	.000	.000	.000	.000	.000
N	23974	23974	23974	571	571	571

*Notes: The table displays OLS regression results Model 3 with the inclusion of leverage as a control variable. Columns 1 to 3 reports the results for the whole sample and Columns 4 to 6 reports the results for the rated firms' only. Column 1 (4) reports the results for credit rating coding 1-6 (1-5), Column 2 (5) reports the reports the results for credit rating coding 1-16 (1-15) and Columns 3 and 6 reports the results for broad rating dummy technique. AA_{dum}, A_{dum}, BBB_{dum} BB_{dum}, and B_{dum} takes the value of 1, if firm has a rating within broad rating category AA, A, BBB, BB or B, respectively, or 0 otherwise where base category for the whole sample is non-rated firms (NR) and for rated firm is BBB. Coefficients are reported outside parenthesis while t-values are in the parenthesis. ***, ** and * denotes p-values significant at the 1%, 5% and 10% levels, respectively.*

Column 1, based on broad rating coding scheme, suggests a positive relationship between credit ratings and debt maturity structure when the effects of leverage are controlled for. The inclusion of firms' leverage has resulted in non-significance of CR^2 which was earlier significant at the 10% level in Column 3 of Table 8.5. One possible reason for the non-significance may be the strong association between the leverage and credit ratings of firms. However, when credit ratings are measured according to individual rating levels (Column 2), the results seem consistent with the previous findings. The coefficients of credit ratings, CR and CR^2, are significant at the 1% level although the size of the coefficients have been slightly reduced from the earlier reported results in Column 2 of Table 8.7.

Column 3 also indicates a non-linear trend, where the BBB rated firms have a longer maturity than non-rated firms while other rating categories have a shorter debt maturity than BBB rated firms. The inclusion of firms' leverage, however, has altered the significance of B rated firms. The model does not suggest that B rated firms have significantly longer maturity than non-rated firms. The results for the rated firms are qualitatively similar to the previous reported results, despite the different coding techniques. The overall results suggest that irrespective of the level of gearing in firms' capital structure, the concerns for the refinancing risk vary with the level of creditworthiness of the firms. Therefore, firms at different levels of credit ratings have different debt maturity structure. Consistent with the previous reported results, the results in Table 8.9 provide strong support for the rejection of the null hypothesis in favour of the non-linear relationship between credit ratings and the debt maturity structure of the firms.

8.3.3. Addressing the Violations of OLS

As discussed in Subsection 8.1.6 above, all OLS assumptions are tested before estimating the models. The diagnostics show that data do not meet the assumptions of homogeneity of variances and independence of error terms. This section, thus, presents the results of the remedial measures taken to address the possibly violations of OLS.

8.3.3.1. Addressing Heteroskedasticity

White Heteroskedasticity test and graphical presentations indicate the presence of heteroskedasticity in both the samples, i.e., combined sample of rated and non-rated firms and rated firms sample. Therefore, the models are tested by obtaining White Heteroskedasticity-Consistent Standard Errors to ensure reliable and efficient estimators from OLS in the presence of Heteroskedasticity. Table 8.10 displays the OLS results after correcting any Heteroskedasticity present in the models.

Columns 1-3 report the results for the combined sample and Column 4-6 shows the results for rated firms only. The results, in general, remain robust after correcting the heteroskedasticity issue in both samples. However, in Column 6, which shows the results using broad rating dummy technique for rated sample, the coefficients of AA dummy and B dummy become insignificant after correcting for heteroskedasticity.

8.3.3.2. Addressing Endogeneity

Credit ratings, theoretically and empirically, are perceived to be an important factor in determining the maturity structure of firms' debt. As highlighted in Chapter 4 and earlier in the chapter, most US studies (Barclay and Smith, 1995; Stoh and Mauer, 1996) find that credit ratings are an important determinant of maturity structure decisions. However, these studies ignore the potential impact of the debt maturity structure on the credit ratings or the reverse relationship between the two which may result in producing inconsistent and biased estimators for the impact of credit ratings on debt maturity structure.

It is argued that the firms whose maturity structure is composed mostly of short-term debt are more susceptible to the deterioration of their credit ratings (Gopalan *et al.* 2010). This is likely to be because of the rollover risk faced by the firms, where greater exposure to rollover risk leads to higher potential bankruptcy costs and a higher probability of bankruptcy (He and Xiong, 2012). Such differences may exist at all rating levels, whether at investment grade or speculative grade (Gopalan *et al.* 2010). For example, during the recent financial crisis 2007-2009, very high rated firms that were relying largely on short-term debt had to face serious refinancing risk, resulting in the deterioration of their credit ratings and as a consequence some were eventually declared bankrupt.

Table 8.10
Pooled Time-series Cross-sectional Regression of Debt Maturity Ratio on Explanatory and Control Variables (With Heteroskedasticity Corrected Standard Errors)

Variables	1	2	3	4	5	6
(Constant)	-0.059 (-0.84)	-0.084 (-1.01)	0.296 (18.8)***	0.889 (6.11)***	0.743 (5.04)***	1.123 (8.76)***
CR	0.078 (6.09)***	0.181 (3.91)***		0.166 (3.93)***	0.07 (5.87)***	
CR^2	-0.003 (-3.68)***	-0.020 (-2.17)**		-0.023 (-3.08)***	-0.004 (-4.72)***	
RAT_{dum}	0.127 (1.48)	0.170 (1.52)				
AA_{dum}			-0.01 (-0.41)			-0.026 (-0.91)
A_{dum}			0.044 (3.79)***			
BBB_{dum}			0.188 (16.96)***			0.103 (5.40)***
BB_{dum}			0.179 (5.65)***			0.092 (3.05)***
B_{dum}			0.176 (2.38)**			-0.023 (-0.46)
LOS	0.029 (39.07)***	0.029 (39.03)***	0.029 (38.97)***	-0.022 (-2.90)***	-0.014 (-1.87)*	-0.022 (-2.91)***
QUAL	-0.001 (-0.98)	-0.001 (-0.99)	-0.001 (-1.00)	-0.008 (-1.87)*	-0.008 (-1.86)*	-0.009 (-2.11)**
AMAT	0.001 (9)***	0.001 (9.00)***	0.001 (9.02)***	0.002 (2.61)***	0.002 (2.82)***	0.002 (2.52)**
MBR	-0.003 (-1.93)*	-0.003 (-1.95)*	-0.003 (-1.97)**	-0.004 (-0.53)	-0.004 (-0.51)	-0.006 (-0.77)
ETR	0.003 (0.32)	0.003 (0.31)	0.003 (0.31)	-0.034 (-1.40)	-0.028 (-1.20)	-0.031 (-1.28)
$TECH_{dum}$	-0.115 (-8.88)***	-0.115 (-8.89)***	-0.116 (-8.95)***	0.023 (0.32)	0.026 (0.37)	0.067 (0.90)
IND_{dum}	-0.108 (-9.37)***	-0.108 (-9.37)***	-0.109 (-9.45)***	-0.012 (-0.33)	-0.021 (-0.55)	-0.034 (-0.91)
CS_{dum}	-0.064 (-5.41)***	-0.064 (-5.4)***	-0.066 (-5.51)***	-0.038 (-1.09)	-0.042 (-1.20)	-0.064 (-1.79)*
CG_{dum}	-0.173 (-14.19)***	-0.173 (-14.23)***	-0.174 (-14.28)***	-0.125 (-3.34)***	-0.116 (-3.09)***	-0.137 (-3.64)***
HC_{dum}	-0.033 (-2.35)**	-0.033 (-2.41)**	-0.035 (-2.52)**	0.017 (0.31)	0.055 (1.04)	-0.027 (-0.50)
UTL_{dum}	0.034 (2.4)**	0.034 (2.41)**	0.035 (2.47)**	-0.016 (-0.39)	-0.007 (-0.18)	-0.022 (-0.55)
BM_{dum}	-0.071 (-5.44)***	-0.071 (-5.46)***	-0.072 (-5.52)***	-0.129 (-3.11)***	-0.121 (-2.91)***	-0.141 (-3.42)***
OG_{dum}	-0.019 (-1.18)	-0.020 (-1.24)	-0.022 (-1.35)	0.019 (0.40)	0.041 (0.88)	-0.026 (-0.54)
Adj R^2	.100	.101	.100	.187	.196	.183
F	166.704	167.468	148.492	8.137	10.617	9.133
Sig	.000	.000	.000	.000	.000	.000
N	23974	23974	23974	571	571	571

Notes: The table displays results for OLS regression results with heteroskedasticity corrected standard errors for Model (6) for whole sample (Columns 1-3) and rated firms only (Column 4-6). Columns 1 and 4 reports the results for broad rating coding, Columns 2 and 5 for individual credit rating coding and Column 3 and 6 for broad rating dummy technique.
*Coefficients are reported outside parenthesis while t-values are in the parenthesis. ***, ** and * denotes p-values significant at the 1%, 5% and 10% levels, respectively.*

The above argument is more explanatory of the relationship between debt maturity structure and rating changes. A direct theoretical and empirical support for the level of debt maturity structure and credit ratings is not generally found in the previous studies. For example, it is not clear whether firms with longer maturity structure will have higher or lower credit ratings. Nevertheless, previous studies, as discussed above, contend with the direct relationship of capital structure and debt maturity structure (Leland and Toft, 1996; Morris, 1992; Antoniou *et al.* 2006). It is also argued that the level of debt is indirectly associated with the credit ratings i.e., highly geared firms have lower ratings and *vice versa* (see for example, Kaplan and Urwitz, 1979; Ederington, 1985; Molina, 2005; Gray *et al.* 2006, for the relevance of leverage for credit ratings). Following this, it can be argued that firms which have higher leverage, have longer debt maturity and lower ratings, and *vice versa*.

If the above is true, the relationship between credit ratings and debt maturity structure cannot be established by estimating the model simply through OLS, as the coefficients of credit ratings will not be unbiased and consistent. One possible solution that most of the econometric textbooks (see for example, Gujarati, 2004; Brooks, 2008; Wooldridge, 2008) and empirical studies examining the impact of credit ratings on the capital structure (Faulkender and Petersen, 2006; Judge and Mateus 2009; Mittoo and Zhang, 2010) suggest, is the use of two-stage least squares (2SLS). Despite that, the use of 2SLS is common for treating the endogeneity issues in capital structure models; previous studies, investigating the impact of credit rating on the maturity structure, do not tend to use this methodology. This is likely to be due to the lack of any direct theoretical and empirical association established between the two variables. Another method, although less formal, to address the potential endogeneity could be the use of a lagged structure for explanatory and control variables in the model. The results from estimating two-stage least squares and for lagged structure of explanatory and control variables are presented below.

i. Results for the Two-Stage Least Square Estimation

As discussed in Chapter 6, 2SLS involves estimating the equation in two stages. In the first stage, the endogenous variables are regressed over the predetermined variables in the model. In the second stage, the predicted values obtained from the first stage replace the endogenous variables in the original model. The two-stage least square model is only estimated for the rated firms since the non-rated sample will distort the estimation of the first stage as the estimates of predicted values for the credit ratings are likely to be seriously affected if the non-rated code is allowed to dominate the sample.

The main model (6) is restated below:

$$DMR_{i,t} = \beta_0 + \beta_1 CR_{i,t} + \beta_2 CR_{i,t}^2 + \sum_{i=1}^{n} \beta_i X_{i,t} + \varepsilon_{i,t} \ \textbf{...(6)}$$

In model (6), the control variables $\beta_i X_{i,t}$ are all assumed to be exogenously determined in the system, while CR and CR^2 are endogenous variables, such that CR and CR^2 are also influenced by the dependent variable i.e., the debt maturity structure (DMR). In stage one, CR is regressed on the control variables (size of firm (LOS), quality of firm (QUAL), asset maturity ratio (AMAT), market to book ratio (MBR), effective tax rate (ETR) and industry dummies) and two other variables, namely the interest coverage ratio (ICR) and Taffler's z-score (TZS) (see Subsection 6.1.2 for a detailed discussion on the relationship of ICR and TZS with the credit ratings). The model for the first stage estimation is therefore:

$$CR_{i,t} = \beta_0 + \beta_1 ICR_{i,t} + \beta_2 TZS_{i,t} + \sum_{i=1}^{n} \beta_i X_{i,t} + \varepsilon_{i,t} \cdots (6a)$$

Following the procedures discussed in Chapter 6, model (6a) is estimated by the ordinal regression to obtain the predicted values for the CR. The predicted values are squared and used as an instrument in ordinal regression for the estimation of the predicted values for the CR^2. The equation for estimating the CR^2 is stated below as:

$$CR^2 = \beta_0 + \beta_1 (PCR)_{i,t}^2 + \varepsilon_{i,t} \cdots (6b)$$

Model 6*b* is also estimated using ordinal logistic regression. The actual and the functional form, CR and CR^2, are replaced by the predicted values of CR and CR^2, namely PCR and PCR^2 obtained from Model (4a) and (4b). Model (3) can now be rewritten as:

$$DMR_{i,t} = \beta_0 + \beta_1 PCR_{i,t} + \beta_2 PCR_{i,t}^2 + \sum_{i=1}^{n} \beta_i X_{i,t} + \varepsilon_{i,t} \cdots (6c)$$

Model (6c) is estimated by the OLS. As discussed in Chapter 6, the use of ordinal logistic regressions in the first stage and the OLS in the second stage is consistent with procedures suggested by Winship and Mare (1984). Table 8.11 displays the results of the two stage least square regression. Results from the first stage and the second stage are displayed in Panel A and B respectively.

Table 8.11
Regression Results of the Two-Stage Least Squares Estimation (2SLS) of Debt Maturity Ratios

Panel A: Stage I			**Panel B: Stage II**	
Variables	**Estimate**	**Wald**	**Variables**	**Coefficients**
TZS	-0.008*	3.807	**(Constant)**	0.580 (2.86)***
ICR	-0.032***	11.395	**PCR**	0.175 (2.92)***
LOS	-0.746***	108.868	**PCR^2**	-0.022 (-2.28)**
QUAL	0.013	0.119	**LOS**	-0.008 (-1.01)
AMAT	-0.053***	28.208	**QUAL**	-0.001 (-0.38)
MBR	-0.174**	4.901	**AMAT**	0.003 (2.88)***
ETR	0.056*	3.038	**MBR**	-0.010 (-1.35)
$TECH_{dum}$	-2.583***	14.401	**ETR**	0.000 (-0.07)
IND_{dum}	1.443***	16.432	**$TECH_{dum}$**	0.053 (0.79)
CS_{dum}	0.602*	3.521	**IND_{dum}**	0.059 (1.61)
CG_{dum}	1.438***	17.177	**CS_{dum}**	0.011 (0.35)
HC_{dum}	4.003***	49.302	**CG_{dum}**	-0.045 (-1.24)
UTL_{dum}	2.526***	41.998	**HC_{dum}**	0.066 (1.06)
BM_{dum}	2.009***	26.212	**UTL_{dum}**	0.056 (1.35)
OG_{dum}	3.295***	45.369	**BM_{dum}**	-0.046 (-1.10)
			OG_{dum}	0.099 (1.88)*
Pseudo R-Square			**Adj R^2**	.103
Cox and Snell	.447		**F**	6.770
Nagelkerke	.481		***Sig***	.000
-2 Log Likelihood			**N**	571
Intercept Only	2021.17			
Final Model	1572.78			
N	571			

Notes: The table reports the regression results of the two-stage least estimation of DMR. Panel A reports the results of the first stage while panel B report the results for the second stage. Variables are defined as Taffler's z-score (TZS), interest coverage ratio (ICR), predicted values of credit ratings (PCR), predicted values of credit rating squares (PCR^2), log of sales (LOS), Quality of the firm (QUAL), Assets maturity ratio (AMAT), market to book ratio (MBR), Effective tax rate (ETR), technology dummy ($TECH_{dum}$), industrial dummy (IND_{dum}), consumer services dummy (CS_{dum}), consumer goods dummy (CG_{dum}), heath care dummy (HC_{dum}), utility dummy (UTL_{dum}), basic material dummy (BM_{dum}) and oil and gas dummy (OG_{dum}), PCR and PCR^2 are predicted CR and CR^2 from the first stage.
****, ** and * denotes p-values significant at the 1%, 5% and 10% levels, respectively.*

Panel A shows the Cox and Snell, Nagelkerke statistics and -2 Log Likelihood. Cox and Snell and Nagelkerke R^2, indicating the fit of the model (O'Connell, 2006), suggest that the explanatory variables explain substantial variation in the dependent variable, credit ratings. The estimated coefficients show predictive signs and are mostly significant in the model. The Wald statistics show that size is the most influential variable in predicting credit ratings. The Taffler z-score (TZS) is negatively associated with the credit ratings and is significant at the 10% level indicating that an increase in the TZS is likely to be associated with higher credit ratings. The interest coverage ratio (ICR) also has a negative and significant relationship with the credit ratings as predicted.

Panel B of Table 8.11 reports the results for the second stage estimation. The direction of the coefficients of PCR and PCR^2 are in line with previous results reported in Column 2 of Table 8.6. The positive coefficient of PCR and the negative coefficient of PCR^2, significant at the 1% levels and 5% levels respectively, reinforce the previous findings and support the alternative hypotheses postulating a non-linear association between credit ratings and debt maturity structure.

The direction of the relationship of the control variables, reported in Panel B, is also comparable to those reported in Column 2 of Table 8.7. However, most of the variables become insignificant in the second stage of the 2SLS. For example, the size and quality of firms, although negatively associated with the debt maturity structure, are not significant in the second stage. Such results have to be interpreted with caution, as the usual standard errors from the 2SLS tend to be larger than OLS depending on the quality of the instruments used (Wooldridge, 2008). The instruments used in this case have a sizable correlation with the credit ratings but cannot be assumed to be perfectly related with credit ratings. Therefore, one can expect lower significance or even no significance at all (Wooldridge, 2008).

Another issue concerning the use of 2SLS is finding a valid instrument for endogenous variables. While Sargan statistics indicates the validity of the instruments, the interest coverage ratio (ICR) and Taffler’s z-score (TZS) are not perfectly exogenous in the model. Theoretically, they are likely to have also a relationship with the debt maturity structure and thus may be inappropriate instruments for credit ratings. Finding a suitable instrument for credit ratings is difficult, as the factors which affect the leverage structure also affect the credit ratings. It is acknowledged therefore, that the instruments used in the estimation of 2SLS may pose concerns due to their potential relationship with the dependent variable.

ii. Results Based on Lagged Explanatory and Control Variables

An informal test, which can address the reverse causality in the model, could be estimating the same model with a lagged structure of explanatory and control variables. Although, the procedure may not completely address the consequence of endogeneity, i.e., non-independence of error term and explanatory variables, it may theoretically facilitate in explaining the relationship between the dependent and explanatory variables without possible concerns for reverse causality in the relationship. For example, theoretically, it is not possible that the proportion of long-term debt in the subsequent year influences the credit ratings of the previous period.

Model 6 is therefore, also estimated by using a lagged structure for the credit ratings and control variables. Model 6 can be rewritten as:

$$DMR_{i,t} = \alpha_0 + \beta_1 CR_{i,t-1} + \beta_2 CR^2_{i,t-1} + \sum_{i=1}^{n} \beta_i X_{i,t-1} + \varepsilon_{i,t-1} \textbf{... (6d)}$$

Results of Model 6d are presented in Table 8.12 where Columns 1 and 2 present the results for the whole sample of rated and non-rated firms while Columns 3 and 4 display the results for rated firms. Column 1, displaying the results for the credit rating coding 1-6, shows that credit ratings (CR) are significant in the model although the credit rating square (CR^2) has become insignificant with this specification. This may suggest a positive relationship between credit rating and the debt maturity structure of the firms. Similar results can be noted for the rated firms in Column 3, where the coefficient of CR^2 is negative but insignificant. It should be noted that the number of observations have been reduced considerably for both samples due to the lagged structure of explanatory and control variables. For the whole sample, 2,712 firm-years and for the rated firms' sample 62 firm-years had to be discarded for the procedure. A reduced number of firm-years could affect the significance of the CR^2. In the unreported regressions, the CR^2 becomes significant at the 10% level when utility sector is excluded for both the samples, which supports the earlier finding about the utility firms having a different maturity structure than the non-regulated firms. Nevertheless, the estimates for credit rating with coding 1-16 for the whole sample and 1-15 for rated firms are qualitatively similar for CR and CR^2, as reported earlier in Table 8.7 with both coefficients statistically significant at least at the 5% level.

However, similar to Columns 1 and 3, while the direction of the control variables remain the same, the significance of some of the control variables have fallen for both samples when a lagged model is estimated.

Table 8.12
Pooled Time-series Cross-sectional Regression of Long-term Debt Ratio on Lagged Credit Ratings and Control Variables

Variables	1	2	3	4
(Constant)	-0.201 (-1.91)*	-0.151 (-1.67)*	0.783 (5.09)***	0.572 (3.64)***
CR	0.155 (2.41)**	0.072 (3.84)***	0.121 (2.69)***	0.061 (4.72)***
CR^2	-0.012 (-1.06)	-0.003 (-2.23)**	-0.012 (-1.41)	-0.003 (-2.97)***
RAT_{dum}	0.287 (2.23)**	0.212 (2.12)**		
LOS	0.029 (36.09)***	0.029 (36.15)***	-0.016 (-1.93)*	-0.006 (-0.73)
QUAL	-0.001 (-0.70)	-0.001 (-0.69)	-0.001 (-1.09)	-0.001 (-1.08)
AMAT	0.001 (12.73)***	0.001 (12.74)***	0.000 (1.28)	0.000 (1.48)
MBR	-0.002 (-1.15)	-0.002 (-1.13)	-0.012 (-1.55)	-0.012 (-1.58)
ETR	-0.009 (-0.80)	-0.009 (-0.80)	-0.004 (-0.74)	-0.002 (-0.45)
$TECH_{dum}$	-0.110 (-7.14)***	-0.109 (-7.11)***	0.092 (1.13)	0.123 (1.61)
IND_{dum}	-0.102 (-7.07)***	-0.102 (-7.06)***	0.088 (2.12)**	0.088 (2.12)**
CS_{dum}	-0.061 (-4.12)***	-0.060 (-4.11)***	0.038 (1.00)	0.043 (1.14)
CG_{dum}	-0.168 (-11.17)***	-0.167 (-11.12)***	-0.052 (-1.29)	-0.032 (-0.80)
HC_{dum}	-0.023 (-1.42)	-0.022 (-1.35)	0.115 (2.06)**	0.167 (2.98)***
UTL_{dum}	0.037 (1.94)*	0.037 (1.95)*	0.093 (2.20)**	0.113 (2.69)***
BM_{dum}	-0.067 (-4.15)***	-0.067 (-4.12)***	-0.047 (-1.04)	-0.027 (-0.60)
OG_{dum}	-0.005 (-0.27)	-0.004 (-0.21)	0.089 (1.75)*	0.121 (2.40)**
Adj R^2	.101	.101	.183	.214
F	149.505	150.193	8.610	10.230
Sig	.000	.000	.000	.000
N	21262	21262	509	509

*Notes: The table displays the OLS regression results of Model 3 using a lagged structure for credit ratings and the control variables. Columns 1 and 2 report the results for the combined sample and Columns 3 and 4 for the rated firms. Broad rating coding for credit ratings are used in Column 1 and 3 while individual rating coding is used in Column 2 and 4. Coefficients are reported outside parenthesis while t-values are in the parenthesis. ***, ** and * denotes p-values significant at the 1%, 5% and 10% levels, respectively.*

In brief, this section addressed the potential reverse relationship between credit ratings and the debt maturity structure of the firms by estimating two-stage least square and lagged regression models; results generally tend to support the previous findings. This entails that after addressing the potential endogeneity in the model, the results remain robust although minor sensitivities are noted with the use of different coding and significance of some of the control variables is compromised when using alternative estimation techniques and models.

Overall, the checks on robustness and sensitivities of the results for different coding schemes, alternative models and estimation techniques provide strong support to accept the alternative hypotheses that credit ratings are non-monotonously associated with the debt maturity structure of the UK firms.

8.4. Conclusion

This chapter presented the empirical results of the models testing Diamond's (1991) liquidity hypothesis for UK firms. The main finding of the chapter is that the refinancing risk is an important determinant of the debt maturity structure of the UK firms, which induces a non-monotonous inverted U-shaped relationship between credit ratings and debt maturity structures. These findings are in line with prior US study by Barclay and Smith (1995) and Stohs and Mauer (1996), but are inconsistent with Berger *et al.* (2005), thus providing additional support for the Diamond's liquidity hypothesis from a non-US setting. The results of the present study confirm that UK firms at different levels of ratings have varied concerns for managing the liquidity or refinancing risk. Firms with the highest ratings have significantly shorter maturity in their capital structure than mid rated firms, due to their lesser level of concerns over refinancing their existing debt. The firms with the lowest ratings, although having higher refinancing risk, are also found to have shorter maturity. This is likely to be due to their constrained access to long-term debt market. Non-rated UK firms, similar to low rated firms, also have constrained access to the long-term debt and are therefore restricted to issuing more short-term debt, resulting in low levels of long-term debt in their capital structures.

Chapter 9
CONCLUSION

9. Introduction

This thesis has addressed its main research question in that it has empirically evaluated the impact of credit ratings on the capital structures of UK firms. In order to address the main research question, the thesis has three main empirical chapters, which address three different but interrelated dimensions of the relationship between credit ratings and capital structures. First, the question of whether the levels of credit ratings influence the capital structures of UK firms is empirically examined. Specifically, the implications of the *credit rating – capital structure hypothesis* (CR-CS) are tested, which suggests a non-linear relationship between credit ratings and capital structure. High and low rated firms are expected to have low levels of leverage, while mid rated firms are expected to have high levels of leverage. Second, the impact of credit rating changes is also examined with regard to the firms' financial decisions. Following the implications of the *credit rating – capital structure hypothesis*, it is tested whether the concerns for upgrades and downgrades are material, and lead firms to follow a conservative debt policy when faced with potential and actual rating changes. Third, the study also investigates more detailed aspects of capital structure, by extending the analysis to the maturity structure of existing debt. Specifically, the study empirically tests Diamond's 1991 liquidity hypothesis, which theorises a non-linear relationship between credit ratings and the debt maturity structure of firms.

This chapter provides the conclusions of the empirical work carried out in the thesis. It summarises the important findings of the thesis and presents its implications and limitations, as well as suggestions for improvements and extensions of the study. The remainder of the chapter is therefore organised as follows. Section 9.1 presents the main findings of the thesis based on the three empirical chapters. Section 9.2 discusses the implications of the findings for future studies, firms and policy makers. Section 9.3 offers a discussion of the limitations of the study and Section 9.4 offers suggestions for improvement, and highlights potential avenues for future research in the area.

9.1. Main Findings of the Thesis

This section presents the main findings of the three empirical chapters of the thesis.

9.1.1. Credit Ratings and Capital Structure

The first empirical chapter (Chapter 6) examined the relationship between levels of credit ratings and the capital structures of UK firms. By specifically testing the implications of the CR-CS hypothesis developed by Kisgen (2006), it was postulated that credit ratings have a non-linear relationship with levels of debt, where high and low rated firms were expected to have low levels of gearing compared to mid rated firms. High rated firms arguably enjoy certain financial and non-financial benefits of high credit ratings, providing them with a higher incentive to maintain their credit ratings than other rated firms in the market might have. Therefore, high rated firms are expected to have a high concern for benefits enjoyed by their credit ratings and thus have low levels of gearing (H_{1a}). Low rated firms are also expected to have high concern for the costs associated with low credit ratings as low ratings affect the cost of borrowing and may result in restrictive covenants in their debt securities, consequently leading to constrained access to debt markets. Low rated firms may also be more susceptible to rating downgrades, which can have more serious implications for them than for other rated firms. It was argued that if costs of low credit ratings are material for low rated firms, then they are more likely to employ low levels of gearing (H_{1b}). Mid rated firms may possibly have fewer concerns about their credit ratings than firms at each end of the ratings spectrum. Mid rated firms are perhaps too far away to enjoy the benefits of being top rated but are also less exposed to bankruptcy risk or a serious deterioration of their credit ratings. Mid rated firms are, therefore, expected to take advantage of being rated and are likely to have high levels of gearing (H_{1c}).

By specifically testing 874 rated firm-years and 38,800 rated and non-rated firm-years for UK firms over the 1988-2009 period, the study finds that credit ratings are an important determinant of capital structure and that there are systematic differences in the levels of leverage across rating scales depending on the level of concerns which different firms have for their credit ratings. The findings of the present study, support the developed hypotheses of the study and show that credit ratings have a strong non-linear relationship with the capital structures of UK firms. The results are generally robust to different coding schemes for credit ratings, alternate specifications and estimation techniques, and to potential endogeneity in the model. However, the results of the models estimated using market debt ratios as a dependent variable do not support the main conclusions and generally show an indirect linear relationship between credit ratings and market debt ratios.

Specifically, the research finds that high rated firms have low gearing ratios, which is consistent with the CR-CS hypothesis that managers may have high concerns to maintain their credit ratings or to prevent themselves from downgrades. The findings imply that high rated firms take into consideration the costs and benefits of credit ratings when making their capital structure decisions. Although high rated firms can access debt markets more easily, it appears that the perceived benefits of having high credit ratings (i.e., the financial and non-financial benefits of high ratings) exceed the benefits of high gearing ratios as suggested by the traditional trade-off theory. Low gearing ratios of high rated firms, highlights that the benefits of high credit ratings may be material for such firms to trade-off the benefits of high debt ratios.

It is found that low rated firms have also low gearing ratios. These findings point towards the possibility that, similarly to high rated firms, low rated firms may be more concerned about their credit ratings. However, such concerns are likely to be driven by the costs associated with low ratings, i.e., high costs of borrowing, constrained access to debt markets, more susceptibility of downgrades, and the serious consequences of these factors. Although low rated firms can still be expected to have high leverage, given that they are rated and have better access to debt markets than non-rated firms, it can be inferred from the results that for low rated firms, the costs of low ratings outweigh the benefits of having higher leverage. The results provide strong evidence that low rated firms keep their amounts of leverage low, possibly hoping to achieve higher ratings or to prevent themselves from downgrades. These results, however, are inconsistent with a prior Canadian study by Mittoo and Zhang (2010) who find that speculative grade firms have high levels of gearing.

Contrary to high rated and low rated firms, and consistent with the theoretical predictions, mid rated firms are found to have higher leverage. The tendency towards high debt ratios suggests that these firms are possibly quite stable and creditworthy firms, with relatively good access to debt markets. Being far from the level where firms can enjoy the benefits of top ratings or from the level where there may have serious concerns for bankruptcy, these mid rated firms appear to take advantage of being rated and have high gearing ratios. It can be inferred from the financing patterns of mid rated firms that they may have fewer concerns over rating changes compared to high and low rated firms.

The results also show that non-rated firms, which are assumed to be firms with relatively inferior credit quality and constrained access to debt markets compared with rated firms, have low debt ratios when compared to rated firms. These firms, specifically, have lower debt ratios compared to the lowest rated firms, which in the sample are B rated firms. This finding is consistent with the *credit rating – market access hypothesis* (CR-MA) proposed by Faulkender and Petersen (2006), and with the empirical results of Judge and Mateus (2009) and Mittoo and Zhang (2010). The results are in line with the argument put forward by Lemmon and Zender (2010) who argue that rated firms, whether at investment grade or speculative grade, have better access to debt markets than firms which do not have ratings at all.

9.1.2. Credit Rating Changes and Capital Structure Decisions

The second empirical chapter (Chapter 7) extends the first empirical chapter by examining the impact of potential and actual credit rating changes on the capital structure decisions made in the subsequent period. It can be argued that the behaviour of firms towards their leverage might be different (with respect to the level of their credit ratings) compared with instances when there are potential and actual rating changes. By extending the implications of the CR-CS hypothesis to analyse firms' financial decisions, it is hypothesised that if firms are concerned about the benefits achieve by upgrades and costs imposed by downgrades, then they are likely to demonstrate leverage reduction behaviour when they are near an upgrade or a downgrade. Credit rating changes can impose financial and non-financial costs on firms. For example, rating changes can significantly affect firms' costs of capital and their access to short-term debt markets, increase their reputational concerns, and affect their supplier creditor relationships. The implications of the CR-CS hypothesis predict that the benefits and costs of credit ratings are material for firms and they will follow leverage reduction behaviour when they are near rating changes (H_{2a}), whether upgrades (H_{2b}) or downgrades (H_{2c}).

The implications of the CR-CS hypothesis also predict that firms will reduce leverage once they have been downgraded (H_{3a}). Rating downgrades may increase the cost of borrowing for firms, affect the pool of investors that might be otherwise interested, increase agency problems between different stakeholders, and limit the firms' access to short and long-term debt markets. Conversely, upgraded firms are not likely to make any significant changes to their capital structures. While rating upgrades may lead to a firm having better access to debt markets with lower interest rates and an improved reputation in the market, firms are not expected to fully exploit this by taking on sizable amounts of new debt, because of the fear that this may put their high credit ratings in jeopardy (H_{3b}).

The descriptive statistics carried out in the Chapter 7 provide some insights into the general behaviour of UK rated firms towards their capital structures. It is noted that during the sample period, UK rated firms, on average, issue 2% more debt than equity as a proportion of their previous years' total assets. However, rated firms vary considerably in their net debt issuance behaviour. While rated firms can easily access debt markets, they also seem to be active in the equity market. Specifically, it is noted that high rated firms are more active in debt markets (i.e., they issue more debt than equity), while low rated firms seem to be more active in equity markets (i.e., they issue less debt than equity). Individual capital structure activities also show that high rated UK firms issue debt and reduce equity, while low rated firms reduce debt and issue more equity. These observations provide further support to the findings presented in the previous empirical chapter, where low rated firms were found to have lower debt ratios due to their constrained access to debt markets and high concern for maintaining and improving their current credit ratings as suggested by the credit rating – capital structure hypothesis (CR-CS). The size of the average debt issuance by high rated firms is, however, found to be smaller than average issuance by the low rated firms. These findings generally indicate sharp differences between the capital structure activities of high and low rated UK firms.

The following subsections report the findings for analyses conducted to examine the effects of potential and actual rating changes on the financial decisions of firms in the years subsequent to the changes.

9.1.2.1. Potential Credit Rating Changes and Financial Decisions

By testing 770 rated firm-year observations over the period 1988-2009, the findings of the present study do not give support to the argument that the proximity of upgrades and downgrades influences the capital structure decisions of UK rated firms in the subsequent years. This indicates that modifiers, i.e., + or -, with credit ratings, do not matter when firms make adjustments to their capital structure. These findings remain robust to alternative measures of the dependent variable and control variables and to model specifications similar with Kisgen (2006) for US firms. The results suggest that, unlike findings for US firms by Kisgen (2006), the upgrades and downgrades from one broad rating category to another are perceived not to impose any major costs on the firms.

When debt issuances, debt reductions, equity issuances and equity reductions are analysed separately to assess whether potential rating changes have had any significant effect for them, none of these decisions seem to be influenced by the proximity of rating changes, with the exception of debt reductions when firms have a PLUS sign. It is noted that firms with a PLUS sign are more likely to reduce leverage than firms which do not have a PLUS sign.

However, when the impact of potential rating changes is tested across rating levels, significant differences are observed between high and low rated firms. The results indicate that high rated firms with a PLUS sign issue more debt than equity (approximately 5.6% more debt than equity as a proportion of their previous years' total assets). An individual analysis shows that high rated firms with a PLUS sign are more likely not to issue equity, while high rated firms with a MINUS sign are more likely not to reduce equity. Inconsistent with the CR-CS hypothesis, the results indicate that the PLUS sign for high rated firms possibly serves as additional evidence of their superior credit quality within the broad rating category. Moreover, it can also be argued that, in having low leverage (as found in Chapter 6), these firms may have reserved borrowing capacities to raise debt when required. This behaviour seems to indicate that high rated firms are confident that issuing debt will not result in a deterioration of their ratings or that the cost associated with any possible deterioration of ratings is not material for high rated firms.

Conversely, firms towards low ratings display debt reduction behaviour (around 1% less debt than equity as a proportion of their previous years' total assets with every notch decrease in credit ratings) when they have a PLUS sign where they specifically issue equity to bring reduction in their debt ratios. Leverage reduction by low rated firms with a PLUS sign is an indication of their making efforts towards achieving higher target credit ratings. By reducing their amount of leverage, low rated firms may have a better chance of getting an upgrade. However, MINUS signs do not indicate any specific patterns of leverage. It appears that low rated firms with a MINUS are reluctant to reduce any leverage, since doing so may not save them from downgrades or ensure upgrades. The findings for the high rated firms contradict the CR-CS hypothesis and support the trade-off theory, which suggests that firms with a lower likelihood of bankruptcy have higher levels of leverage. However, the implications of the CR-CS hypothesis are more apparent for low rated firms.

9.1.2.2. Actual Credit Rating Changes and Capital Structure Decisions

When the effects of actual credit ratings are examined with regards to firms' financial decisions, the results do not support the underlying CR-CS hypothesis and are inconsistent with the findings of Kisgen (2009) for US rated firms. Nevertheless, the results present interesting insights into the behaviour of upgraded and downgraded firms in the UK market. The results indicate that, in general, upgraded firms issue almost 4% less debt than equity. The downgraded firms, on the other hand, issue 3% more debt than equity, scaled by their total assets in the previous year.

These results are surprising as well as conflicting with the expected relationship. It seems possible that upgraded firms had debt reducing behaviour before they were upgraded and continued to issue less debt than equity after favourable outcomes from the rating agencies were achieved. This may also indicate the possibility that firms target higher credit ratings and that the perceived benefits of achieving upgrades outweigh the benefits of high leverage (such as the advantages of tax shields). Prior studies also argue that firms target debt ratings and those which are below (above) their targets follow leverage reduction (issuance) behaviour (Hovakimian *et al.*, 2009). For downgraded firms, the benefits of high leverage, as proposed by the trade-off theory, seem to outweigh the cost and benefits of credit ratings implied by the CR-CS hypothesis. A separate analysis shows that upgraded firms issue more equity as a percentage of their previous years' total assets, to reduce the proportion of debt in their capital structure. Conversely, downgraded firms continue to issue debt in the subsequent period, suggesting that costs associated with downgrades are not material for such firms. However, downgraded firms are also found to issue equity.

When the effects of actual rating changes are examined across rating levels, the results present interesting findings about the differences in the capital structure activities with respect to the different rating categories. It is noted that, similar to the usual behaviour following potential rating changes, high rated firms and low rated firms behave differently when they are faced with actual rating changes. The results indicate that when high rated firms are upgraded, they display debt issuance behaviour, whereas when low rated firms are upgraded, they tend to display debt reducing behaviour with each notch decrease in credit rating. Specifically, the findings show that upgraded high rated firms issue around 8.5% more debt than equity, while firms towards low ratings, when upgraded, issue 1.5% less debt than equity as a percentage of their previous years' total assets with every notch decrease in credit ratings.

These results suggest that concerns over rating changes are not equally shared across all rating levels. High rated firms appear to take advantage of their superior position within the rating classes to issue more debt. It seems that concern about credit rating changes is either not material for this class of firms or that they are confident that leverage issuance will not jeopardise their higher ratings. These findings are consistent with the argument by Shivdasani and Zenner (2005) who state that debt issuance by high rated firms with already low levels of gearing might not significantly affect their cost of future borrowing and would not result in credit rating deterioration compared with low rated firms. These findings can also be interpreted in terms of the trade-off theory, which predicts a negative relationship between the probability of firms' level of bankruptcy risk and their leverage levels. On the other hand, it appears that low rated firms foresee the possibility of future upgrades and continue to reduce their amounts of leverage after they have been upgraded.

Overall, the findings of Chapter 7 suggest that credit ratings changes, whether potential or actual, do not have implications, as is suggested by the CR-CS hypothesis, for the financial decisions of the subsequent years. From the results, it appears that marginal changes in credit ratings do not impose any material financial or non-financial costs on rated firms. It seems that only low rated firms are concerned about the costs associated with their credit ratings, and that they expect that reducing leverage can help them get upgraded and also that they continue to reduce debt once they are actually upgraded. High rated firms appear to take advantage of their superior credit quality within the range of all rated firms. For these firms, rating changes do not seem to be a specific major concern.

9.1.3. Credit Ratings and Debt Maturity Structure

The third empirical chapter (Chapter 8) investigates the relationship between credit ratings and debt maturity structures by testing Diamond's liquidity hypothesis, which provides a theoretical framework for the relationship between the two variables. The central idea of the chapter is that the level of refinancing or liquidity risk induces a non-linear relationship between a firm's debt maturity structure and credit quality (H_{4a}). Due to their limited refinancing risk, firms with high ratings are likely to prefer shorter maturity in their debt structure as they are confident that they can easily refinance the existing debt at low cost at the time of its maturity when favourable information will be revealed to the market. Conversely, low rated firms know that they may not be able to refinance their debt and they therefore prefer long-term debt in order to avoid refinancing risk. However, low rated firms may have to rely on short-term debt, as the supply of long-term debt may be limited for such firms due to the high probability of such firms having insufficient funds to service their long-term debt payments. It is expected that mid rated firms will mostly issue long-term debt, because while having good ratings helps them in accessing long-term debt markets, these firms are exposed to a level of refinancing risk (although to a lesser degree than low rated firms).

By analysing a combined sample of 23,974 rated and non-rated firm-years and a sample of 571 rated firm-years, the overall results provide strong support for a non-linear relationship between the credit ratings and debt maturity structures of UK firms. The results are robust to alternative coding of credit ratings, model specifications, potential endogeneity in the model and the exclusion of utility firms from the models. It is also noted that the relative contribution of credit ratings compared to other firm level factors, which is argued to be an important determinant of debt maturity structure, is much higher.

It is found that high rated firms tend to shorten the maturity in their capital structures, indicating the possibly that they possess favourable private information which will be likely to facilitate them in refinancing the retiring debt at a later stage. These findings are consistent with Diamond (1991), giving support that high rated firms face lower liquidity risk compared to low rated and mid rated firms. The non-linear association found between credit ratings and capital structures confirms that low rated and non-rated firms have shorter debt maturities, despite being at a higher refinancing risk than other, rated, firms. Consistent with Diamond's theory, it appears that they encounter constrained access to long-term debt markets due to their credit quality. Only intermediate or mid rated firms seem to prefer more long-term debt, since they have a choice of whether to issue debt with longer maturity but they also face a certain degree of refinancing risk, which prevents them from issuing more short-term debt. These findings are consistent with a prior US study by Stohs and Mauer (1996) who also find that credit ratings are non-linearly associated with debt maturity structures.

The results show that the turning or peak point of the curvature pattern for the debt maturity ratio is the BB rated category for the whole sample as well as for the rated firms' sample. The firms rated above and below this category have shorter maturities in their debt structures. For example, for the rated firms' sample, AA rated firms have on average 13 percentage points and A rated firms have 10 percentage points less long-term debt than BBB rated firms, while B rated firms have 12 percentage points less long-term debt in their capital structures, compared with BBB rated firms.

From the findings of the three empirical chapters, it can be concluded that credit ratings are an important determinant for the level and maturity structures of the debt of UK firms. Rated firms have better access to public debt markets, particularly long-term debt markets. Firms with high and low ratings not only have lower levels of debt but also have shorter debt maturity than mid rated firms. However, in general, credit ratings changes, whether potential or actual, do not appear to be a major concern for rated firms in the UK. Only the low rated firms seem to be highly concerned about their rating changes leading them to follow leverage reduction behaviour. High rated firms seem to take advantage of their credit ratings and reserved borrowing capacity and issue debt when they require. Thus, it can be concluded that concerns over the costs and benefits of credit ratings only matter in determining the levels of debt but are, in general, not of significant importance to influence decisions in subsequent years with the exception of low rated firms.

9.2. Implications and Recommendations

The empirical findings of the study have particular relevance for the theoretical framework of capital structure and future empirical studies. They may also provide assistance for the management of firms, who may have an interest in understanding the general behaviour of firms with respect to their credit ratings. Moreover, the study also provides guidance to policy makers who might benefit from an assessment of rating agencies and the role they play in financial markets in the UK.

9.2.1. Implications for Theories of Capital Structure and Future Empirical Research

The study provides implications for the two dominant theories of capital structure: the trade-off and the pecking order theory. It indicates that credit ratings are important considerations in managerial capital structure decisions, as firms appear to weigh the costs and benefits of credit ratings when they weigh other costs and benefits of debt, as suggested by the trade-off theory. The study finds that despite having better access to debt markets, not all rated firms behave in line with the trade-off theory. The implications of the *credit ratings – capital structure hypothesis* (CR-CS) tested in the present study are distinct from the trade-off theory. The trade-off theory suggests that high risk firms (low rated) have low leverage while low risk firms (high rated) have high leverage. Contrary to this, however, the results of the present study indicate that high and low rated firms prefer lower leverage which may highlight the concerns for the associated costs and benefits of different rating levels. Since presumably high creditworthy firms acquire credit ratings, where credit ratings are relative risk measures, it can be argued that low rated firms are also safe and creditworthy firms. This suggests that the implications of the CR-CS hypothesis may be unique and distinct from the trade-off theory and the generic version of the trade-off theory should therefore also incorporate the costs and benefits of credit ratings along with the other costs and benefits of debt.

Similarly, the results of this study also have implications for the pecking-order theory by suggesting that if credit ratings provide certain benefits or impose costs, they may have higher levels of equity compared to debt and may choose to issue equity instead of debt. After controlling for the profitability of firms, high and low rated firms seem to have low levels of gearing suggesting that possible rating concern alters their behaviour towards debt financing. This also indicates that firms may not follow the hierarchy of financing as suggested by the pecking-order theory and may instead choose to issue equity instead of debt, if costs and benefits associated with rating are material. It can be noted from the results of Chapter 7 that low rated firms generally tend to issue equity, where specifically low rated firms which have higher chances of being upgraded or which are actually upgraded issue more equity.

This study further finds that credit ratings are an important factor in determining the capital structures of rated firms. After controlling for the firm-level characteristics argued to be important for determining capital structures, the substantial marginal contribution of credit ratings in the models highlights the significance of credit ratings in the determination of capital structures. The relationship of credit ratings with capital structures provides unique insights into the behaviour of firms, which are generally not explained by previous theories of capital structure. Future studies would benefit, therefore, if they include credit ratings as a determinant of capital structure. This will ensure that the correct inferences are drawn from the empirical analysis conducted and will provide a more accurate depiction of the actual behaviour of firms.

The study also finds that the explanatory power and the relationship of the factors that determine the capital structures of rated firms are different from non-rated firms. For example, firm-level factors including the size of a firm, its profitability and growth opportunities either have limited power in comparison to credit ratings and/or the relationship with capital structure contradicts existing theories of capital structure. Studies conducted on capital structure determination should, therefore, recognise these differences and treat rated firms as a distinct group of firms, with varied firm-level characteristics and different explanatory factors affecting their capital structures.

It should be of interest for future studies that credit ratings do not have material implications for financial decisions in subsequent periods for UK firms. Firms with potential or actual rating changes do not show any particular behaviour towards leverage indicating that they may not have concerns for minor changes in their credit ratings. One reason, discussed in Chapters 2 and 3, could be the institutional settings of the markets. Firms operating in a market where credit ratings agencies have established themselves as an important part of financial system, specifically being an integral part of its regulations, are likely to be more careful about minor changes in their credit ratings.

This study also finds that refinancing risk is an important determinant of debt maturity structure. High rated firms with low perceived refinancing risk opt for short maturity while mid rated firms with high refinancing risk choose long-term debt. Low rated and non-rated firms, although having a high level of refinancing risk, rely on more short-term debt due to being restricted from long-term debt markets. It is also noted that credit ratings, a measure of firms’ levels of refinancing risk, are one of the most important variables in determining the debt maturity structures of firms. Future studies would therefore benefit by including measures of refinancing risk in their models to capture the actual behaviour of firms towards the maturity of debt in their capital structures.

9.2.3. Implications/Recommendations for Firms

The present study also suggests that the possession of credit ratings helps with regards to unconstrained access to debt markets. If possession of credit ratings can help them to access debt markets, then firms may consider obtaining credit ratings to shift their reliance form traditional sources of financing such as bank and equity financing. It can be argued that firms relying on bank financing and specifically the firms that are least transparent may be directly affected by any shocks in the supply of funds. However, possession of credit ratings does not automatically lead to better access to debt markets or higher levels of leverage. Empirical evidence in this study shows that maintaining certain rating levels ensures the flexibility to issue debt, better access to short-term debt markets and assurance that rating shocks will not increase the fundamental risk for firms. For example, high and mid rated firms have better access to debt markets compared to low rated firms. Nevertheless, high rated firms appear to purposely keep their amounts of leverage low in order to increase their financial flexibility to the extent that debt issuances would not seriously jeopardise their credit ratings and thereby affect the cost of their borrowings.

The analysis of debt maturity structures indicates that high rated firms prefer short-term maturity in their capital structures. Although high credit ratings may facilitate firms in accessing short-term debt, specifically directly placed debt, firms need to weigh the benefits and costs associated with short-term debt. On the one hand, a dependence on short-term debt may increase the chances of favourable re-pricing of the debt but it may also increase the liquidity risk of firms. A firm, therefore, needs to select an optimal debt maturity structure; one which balances out the costs of certain debt maturities against the benefits.

9.2.3. Implications/Recommendations for Policymakers

Regulators and policymakers should ensure that credit rating agencies are objective and fair and that their ratings reflect the actual creditworthiness of firms. For example, high rated firms, due to their credit ratings, seem to be assured of low refinancing risk, and they therefore prefer short maturity. However, the recent financial crisis highlighted several instances where refinancing risk augmented the distress concerns of firms. As management of firms and investors believe in credit ratings' ability to provide a reliable measure of firms' creditworthiness, policy makers should stress upon rating agencies the need to keep improving their rating methodology so that it appropriately incorporates the specific risks a firm is exposed to. Increasing competition among rating agencies and transferring the responsibilities of misjudgement to rating agencies would further ensure that their ratings reflect the actual credit standing of firms.

The findings also demonstrate that regulators and policy makers should also focus on developing the domestic bond market in the UK. Rated UK firms, which are argued to be large and highly creditworthy, mostly have access to international debt markets. A well functioning domestic debt market would provide alternative and cheap sources of financing for non-rated UK firms. Moreover, the proper functioning of credit rating agencies would improve the financing environment of the UK bond market by encouraging small and less informed investors to actively invest in local markets.

9.3. Limitations of the Study

Although this thesis contains several important findings, it also possesses a few limitations, which should be acknowledged. As has been discussed in Chapter 5, financial statements data available from DataStream is provided on an annual basis, while credit ratings data is more frequent, with more than one observation during a financial year. This can result in different firms having different length of periods between their credit ratings and year-end accounting data. Such differences may undermine the actual effect of credit ratings on capital structure. As discussed in Chapter 5, previous studies do not indicate any particular procedure for handling such an issue. Following Kisgen (2006, 2009) and Hovakimian *et al.* (2009), the difference between the date of the rating change and the financial year-end is assumed to be constant across the firms and the credit rating closest to the financial year-end is used as the credit rating for that particular year. This is based on the assumption that firms' capital structure decisions would show stronger variations when the credit ratings closest to the financial year-end are analysed.

It can also be noted that this study does not distinguish between different types of debt. As has been discussed in Chapter 2, UK firms are more active in international debt markets than in domestic debt markets. This distinction between types of debt can have a meaningful impact on the relationship between credit ratings and capital structures. Specifically, when capital structure decisions are analysed with respect to credit rating changes, such details can potentially be important to the analysis. For example, a firm may substitute debt raised in the domestic market with debt from international markets and *vice versa*, if the costs or the benefits are greater for either source over the other. However, due to data unavailability and limitations of time period for the present study, such differentiations in the type of debt have not been taken into consideration.

It should also be noted that while the endogeneity issue is extensively addressed in the thesis to ensure that the results are reliable and unbiased, the procedures followed for the two-stage least square estimation may not entirely resolve the issue. The additional variables, i.e., Taffler's z-score and the interest coverage ratio, used to explain the credit ratings in the first stage, may not be entirely independent of the dependent variable and therefore may have a correlation with the error terms. However, the study had to rely on these variables in line with data availability, as well as the nature of the credit ratings variable itself, creates difficulty in finding appropriate explanatory variables.

The study uses Standard and Poor's credit ratings, due to the availability and comprehensiveness of the data for UK public firms. Standard and Poor's had the largest number of firm-years available at the time of data collection. Previous studies find a very high correlation between the ratings of the two major rating agencies, Standard and Poor's and Moody's, which would imply that the results would not be qualitatively different if data from other rating agency was used instead. However, it can still be argued that the results are limited to Standard and Poor's ratings only. Moreover, following the criticism faced by rating agencies, there is a possibility that credit ratings do not in fact reflect the actual credit worthiness of the firms.

The study has also not covered the period of the recent financial crisis, due to limited data being available for those years at the time of the data collection. It remains an empirical question, therefore, as to whether the relationship between credit ratings and capital structure/debt maturity structure holds for the period following the financial crisis.

This study also does not take into account external factors such as level of stock and bond market development, legal enforcement and economic conditions, for the determination of firms' capital and debt maturity structures. The main reason for their exclusion was for consistency with the prior literature on the firm-level determinants of financial structure, and analysis of the incremental contribution and relevance of credit ratings to the capital structure and its components. However, the exclusion of external factors may possibly introduce omitted variable bias into the models.

9.4. Suggestions for Further Research

This study is one of the few studies which examines the association between credit ratings and capital structure and its components for the UK market. Although the study provides a comprehensive examination of the relationship between credit ratings and financial structures, the present study, as with other studies, can be extended, and the questions raised in the present thesis can provide potential avenues for future research.

The study, following Kisgen (2006), used PLUS or MINUS with rating changes to surrogate potential rating changes for the firms where the results are generally inconsistent with the *credit rating – capital structure hypothesis* (CR-CS). Future research could investigate other measures of potential rating changes, such as *rating outlooks* and *credit watch,* to analyse and compare whether these measures are more appropriate for use as a proxy for potential rating changes.

Due to data unavailability, this study uses balance sheet and cash flow data to examine whether potential and actual credit rating changes influence the subsequent year's capital structure decisions. However, the time lag between the credit rating changes and the year-end are different for each firm-year, something that could possibly undermine the marginal contribution of rating changes on capital structure decisions. Future research could examine the same question when using incremental debt issuance data, which could be matched with the credit ratings in the preceding period to directly analyse the influence of these changes on the financial structure decision making more accurately.

The present study provides strong evidence for Diamond's 1991 liquidity risk hypothesis, which predicts a non-monotonous relationship between credit ratings and the debt maturity structures of firms. As has already been discussed in Section 4.3.1, incremental debt issuance should ideally be used to test Diamond's theory. However, as stated above, due to the unavailability of incremental debt issuance data, this study has had to rely on balance sheet data. Future studies could examine whether the results hold if incremental debt maturity data is used instead of existing average maturity of balance sheet debt, as the maturity of incremental debt issuances is expected to be different from the average debt maturity of the existing debt.

The main objective of the present study was to analyse the impact of an independent measure of credit quality, which is generated by *independent* external assessors who have superior access to public and private information, on the financial structures of UK firms. It is argued in the literature that such measures can be obtained via accounting information available from firms' financial reports. If the above were true, it would be interesting to note whether or not the credit quality measures generated through using such procedures have similar effects on the financial structures of UK firms. The study can also be extended to other markets which are not active users of credit ratings, by incorporating credit quality measures generated by using models which can predict credit ratings.

Further research could be carried out to investigate whether there are any systematic differences in the behaviour of firms with respect to credit rating changes triggered by external conditions beyond firms' control, and credit rating changes due to deterioration or improvement of firms' internal conditions. It can be expected that credit rating changes triggered by firms' internal conditions will be more influential in explaining their capital structure decision-making than those changes that were due to factors beyond the firms' control, such as general economic conditions and changes to interest rates. Moreover, a comparative study might also be conducted by examining the sensitivities of firms towards their financial structure in light of their credit rating pre and post the financial crisis of 2008. Since the recent financial crisis, the credit rating agencies have been in the spotlight and are blamed as being among the major culprits of the current crisis. It would be interesting to note differences in the firms' behaviour, specifically the US firms, which are found to be more sensitive when they have potential and actual rating changes (Kisgen, 2006 and 2009). Investigations in this area would provide further insights into the perception of management about the significance of credit ratings and whether these changes still have any meaningful impact on their financial decisions.

Future research could also compare the results gained through using ratings from different credit rating agencies. For example, it can be argued that firms may well be more sensitive to an initial rating change than the other ratings which might follow the initial ratings change. A comparative study could therefore examine the differences in the responses of firms towards their capital structures with initial rating changes and with any following changes. Moreover, the research could be extended by using qualitative measures such as interviews and surveys with the management of the firms in order to investigate the causes of differences between the responses of UK firms and US firms, when they are faced with potential and actual rating changes. This may help to build a better understanding of the factors, which trigger capital structure decision-making in both countries, and to better assess the marginal contribution of rating changes towards such decisions.

APPENDICES

Appendix 2A
Definitions of Long-term Issuers' Ratings

AAA	An obligation rated 'AAA' has the highest rating assigned by Standard & Poor's. The obligor's capacity to meet its financial commitment on the obligation is extremely strong.
AA	An obligation rated 'AA' differs from the highest-rated obligations only to a small degree. The obligor's capacity to meet its financial commitment on the obligation is very strong.
A	An obligation rated 'A' is somewhat more susceptible to the adverse effects of changes in circumstances and economic conditions than obligations in higher-rated categories. However, the obligor's capacity to meet its financial commitment on the obligation is still strong.
BBB	An obligation rated 'BBB' exhibits adequate protection parameters. However, adverse economic conditions or changing circumstances are more likely to lead to a weakened capacity of the obligor to meet its financial commitment on the obligation.
BB, B, CCC, CC, and C	Obligations rated 'BB', 'B', 'CCC', 'CC', and 'C' are regarded as having significant speculative characteristics. 'BB' indicates the least degree of speculation and 'C' the highest. While such obligations will likely have some quality and protective characteristics, these may be outweighed by large uncertainties or major exposures to adverse conditions.
BB	An obligation rated 'BB' is less vulnerable to non-payment than other speculative issues. However, it faces major ongoing uncertainties or exposure to adverse business, financial, or economic conditions which could lead to the obligor's inadequate capacity to meet its financial commitment on the obligation.
B	An obligation rated 'B' is more vulnerable to non-payment than obligations rated 'BB', but the obligor currently has the capacity to meet its financial commitment on the obligation. Adverse business, financial, or economic conditions will likely impair the obligor's capacity or willingness to meet its financial commitment on the obligation.
CCC	An obligation rated 'CCC' is currently vulnerable to non-payment, and is dependent upon favorable business, financial, and economic conditions for the obligor to meet its financial commitment on the obligation. In the event of adverse business, financial, or economic conditions, the obligor is not likely to have the capacity to meet its financial commitment on the obligation.
CC	An obligation rated 'CC' is currently highly vulnerable to non-payment.
C	A 'C' rating is assigned to obligations that are currently highly vulnerable to non-payment, obligations that have payment arrearages allowed by the terms of the documents, or obligations of an issuer that is the subject of a bankruptcy petition or similar action which have not experienced a payment default. Among others, the 'C' rating may be assigned to subordinated debt, preferred stock or other obligations on which cash payments have been suspended in accordance with the instrument's terms or when preferred stock is the subject of a distressed exchange offer, whereby some or all of the issue is either repurchased for an amount of cash or replaced by other instruments having a total value that is less than par.
D	An obligation rated 'D' is in payment default. The 'D' rating category is used when payments on an obligation, including a regulatory capital instrument, are not made on the date due even if the applicable grace period has not expired, unless Standard & Poor's believes that such payments will be made during such grace period. The 'D' rating also will be used upon the filing of a bankruptcy petition or the taking of similar action if payments on an obligation are jeopardised. An obligation's rating is lowered to 'D' upon completion of a distressed exchange offer, whereby some or all of the issue is either repurchased for an amount of cash or replaced by other instruments having a total value that is less than par.
Plus (+) or minus (-)	The ratings from 'AA' to 'CCC' may be modified by the addition of a plus (+) or minus (-) sign to show relative standing within the major rating categories.

Source: Standard and Poor's (2011)

Appendix 6A
Descriptive Statistics: Sector-wise

INDUSTRY	Variables	Minimum	Maximum	Mean	Std. Deviation
Basic Materials	**LOS**	0.69	22.30	13.23	3.63
	PROF	-0.99	0.55	0.09	0.16
	FAR	0.00	1.00	0.46	0.22
	MBR	0.16	17.51	1.48	1.12
	LIQD	0.00	36.54	2.01	2.48
Consumer Goods	**LOS**	0.69	23.21	12.75	3.44
	PROF	-0.99	0.55	0.11	0.13
	FAR	0.00	0.98	0.30	0.19
	MBR	0.12	20.10	1.52	1.19
	LIQD	0.00	34.05	1.90	1.77
Consumer Services	**LOS**	0.69	22.47	11.78	2.80
	PROF	-1.00	0.55	0.10	0.17
	FAR	0.00	0.98	0.38	0.28
	MBR	0.13	18.93	1.77	1.41
	LIQD	0.00	36.81	1.37	1.53
Health Care	**LOS**	0.69	21.15	11.14	3.66
	PROF	-1.00	0.50	0.00	0.26
	FAR	0.00	0.97	0.22	0.19
	MBR	0.13	19.75	2.74	2.31
	LIQD	0.00	35.13	3.47	3.99
Industrials	**LOS**	0.69	25.23	12.24	3.12
	PROF	-0.98	0.56	0.11	0.15
	FAR	0.00	0.99	0.28	0.20
	MBR	0.12	17.77	1.59	1.13
	LIQD	0.00	35.61	1.65	1.39
Oil & Gas	**LOS**	0.69	22.74	11.80	4.11
	PROF	-0.98	0.55	0.08	0.18
	FAR	0.00	0.99	0.47	0.27
	MBR	0.12	15.22	1.69	1.35
	LIQD	0.01	36.75	2.49	3.56
Technology	**LOS**	2.20	22.43	11.48	3.18
	PROF	-1.00	0.55	0.06	0.24
	FAR	0.00	0.96	0.15	0.14
	MBR	0.12	19.72	2.61	2.40
	LIQD	0.00	36.19	2.57	2.77
Telecommunications	**LOS**	1.95	21.74	14.08	3.32
	PROF	-0.98	0.53	0.11	0.20
	FAR	0.00	0.91	0.41	0.25
	MBR	0.14	20.15	1.99	1.94
	LIQD	0.09	20.04	1.32	1.50
Utilities	**LOS**	1.10	22.50	14.39	2.94
	PROF	-0.89	0.53	0.12	0.08
	FAR	0.00	0.97	0.66	0.19
	MBR	0.17	16.18	1.25	0.66
	LIQD	0.00	21.82	1.18	1.44

Notes: This table displays the descriptive statistics for the control variables used in testing the relationship between levels of credit ratings and leverage structure.

Appendix 6A
Credit Ratings and Capital Structure
Tolerance and VIF

	Rated and Non-rated Firms		Rated Firms	
	Tolerance	**VIF**	**Tolerance**	**VIF**
CR	.004	264.506	.037	27.348
CR^2	.002	518.234	.037	27.048
RAT_{dum}	.016	64.297		
LOS	.824	1.214	.635	1.575
PROF	.868	1.152	.775	1.290
MBR	.750	1.334	.569	1.758
FAR	.893	1.120	.681	1.469
LIQD	.829	1.206	.838	1.193
$TECH_{dum}$	.181	5.530	.751	1.331
IND_{dum}	.105	9.527	.358	2.791
CS_{dum}	.131	7.652	.230	4.347
CG_{dum}	.166	6.024	.302	3.308
HC_{dum}	.284	3.517	.471	2.122
UTL_{dum}	.470	2.126	.327	3.055
BM_{dum}	.252	3.970	.442	2.262
OG_{dum}	.397	2.520	.568	1.759

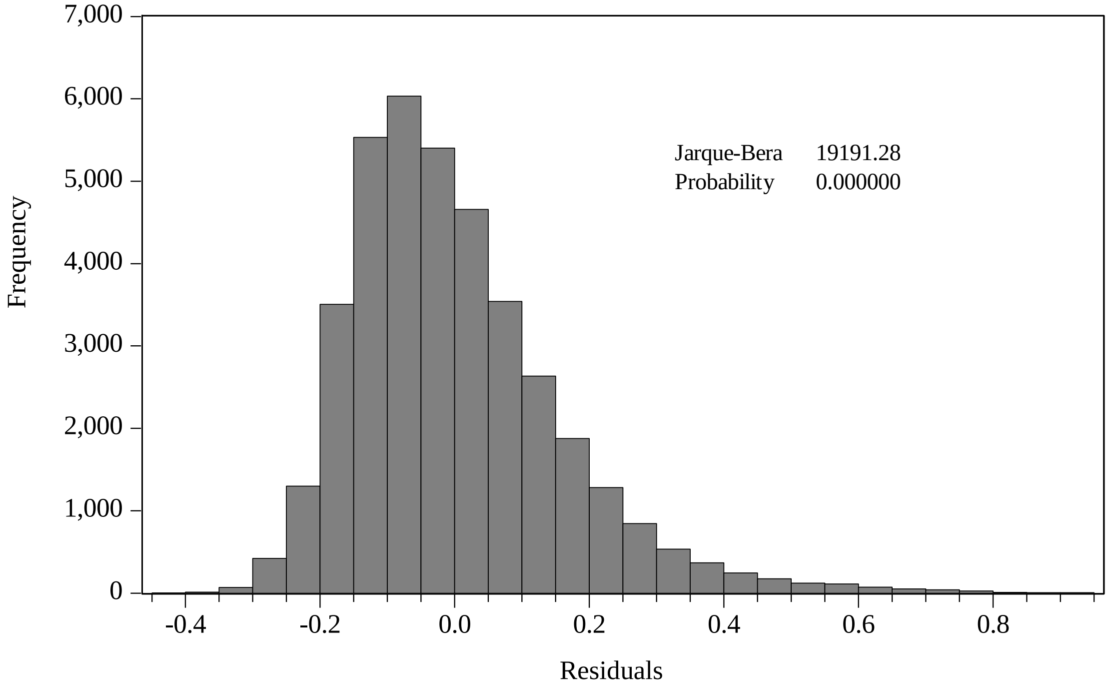
Notes: This table displays the multicollinearity diagnostics (tolerance and VIF) for Model (3). The results indicate that CR, CR^2 and RAR_{dum} have low tolerance and high VIF indicating that these variables have high multicollinearity.

Appendix 6B
Credit Ratings and Capital Structure: Eigenvalues and Conditional Index

			Variance Proportions																
Dimension	**Eigenvalue**	**Condition Index**	**Constant**	**CR**	**CR^2**	**RAT_{dum}**	**LOS**	**PROF**	**MBR**	**FAR**	**LIQD**	**$TECH_{dum}$**	**IND_{dum}**	**CS_{dum}**	**CG_{dum}**	**HC_{dum}**	**UTL_{dum}**	**BM_{dum}**	**OG_{dum}**
1	6.876	1.000	.00	.00	.00	.00	.00	.00	.00	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	1.289	2.309	.00	.00	.00	.00	.00	.05	.01	.01	.04	.02	.00	.00	.00	.04	.04	.00	.00
3	1.097	2.503	.00	.00	.00	.00	.00	.03	.00	.00	.01	.00	.01	.00	.00	.05	.08	.00	.01
4	1.023	2.592	.00	.00	.00	.00	.00	.00	.00	.00	.00	.03	.00	.01	.00	.01	.01	.09	.09
5	1.008	2.611	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.04	.07	.00	.03	.00	.00
6	1.001	2.621	.00	.00	.00	.00	.00	.00	.00	.00	.00	.04	.01	.00	.00	.07	.00	.00	.14
7	1.000	2.622	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00	.01	.01	.01	.03	.09	.09
8	1.000	2.622	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02	.01	.04	.00	.08	.02	.03
9	.899	2.765	.00	.00	.00	.01	.00	.00	.00	.00	.00	.00	.01	.00	.00	.00	.14	.00	.00
10	.712	3.108	.00	.00	.00	.00	.00	.65	.00	.00	.03	.01	.00	.00	.00	.05	.00	.00	.00
11	.472	3.816	.00	.00	.00	.00	.00	.17	.06	.02	.58	.02	.00	.00	.00	.03	.02	.00	.00
12	.348	4.447	.00	.00	.00	.00	.00	.00	.02	.86	.16	.02	.00	.00	.00	.01	.01	.00	.00
13	.209	5.736	.00	.00	.00	.00	.02	.00	.85	.08	.10	.00	.00	.01	.00	.00	.05	.02	.03
14	.048	11.913	.00	.00	.00	.00	.84	.07	.01	.01	.06	.07	.08	.07	.09	.07	.09	.10	.06
15	.017	20.279	.00	.00	.00	.00	.12	.01	.02	.01	.01	.76	.84	.82	.76	.64	.41	.65	.53
16	.000	143.015	.98	.02	.01	.29	.01	.00	.00	.00	.00	.02	.02	.02	.02	.02	.02	.02	.02
17	.000	692.783	.02	.98	.99	.69	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

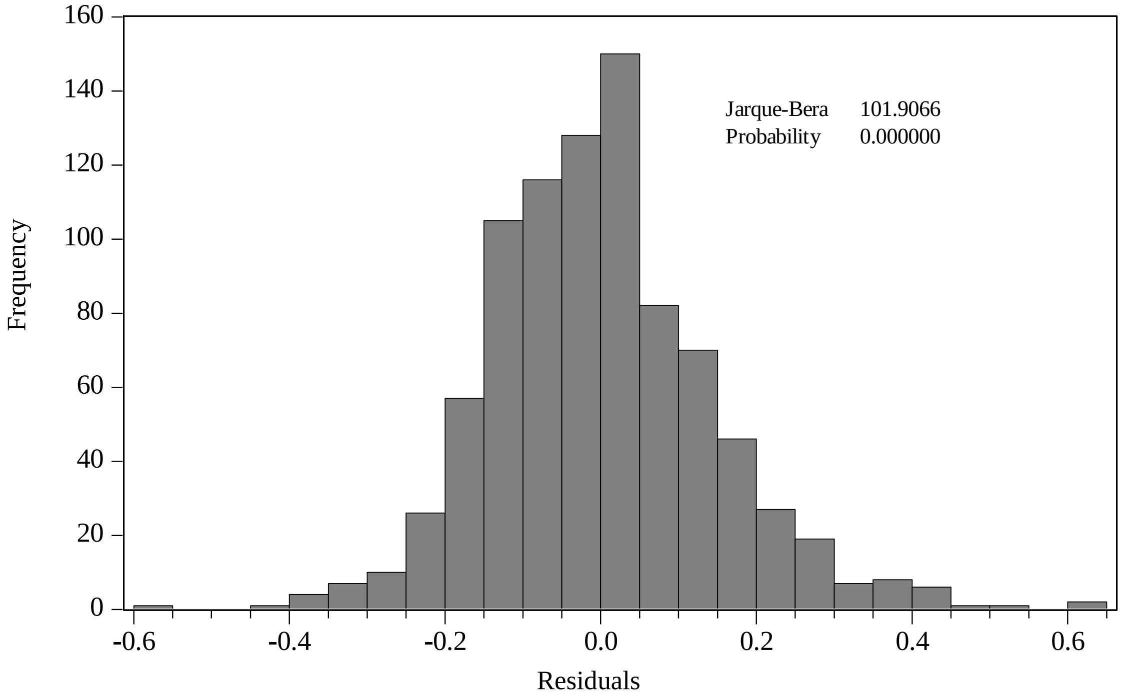
Notes: This table displays the multicollinearity diagnostics for Model (3). Eigen Values near 0 and Conditional Index above 15 suggests that CR, CR^2 and RAT_{dum} have high multicollinearity issues.

Appendix 6C
Credit Ratings and Capital Structure
Distribution of Residuals (Rated and Non-Rated Firms)



Notes: This figure displays the distribution of residuals from Model (3) for the combined sample of rated and non-rated firms, indicating the concerns for non-normality in error terms

Appendix 6D
Credit Ratings and Capital Structure
Distribution of Residuals (Rated Firms)



Notes: This figure displays the distribution of residuals from Model (3) for rated firms' sample, indicating the concerns for non-normality in error terms

Appendix 6E
White Heteroskedasticity Test
Pooled Time-series Cross-sectional Regression of Book Debt Ratio on Credit Ratings and Control Variables

Panel A: Rated and Non-Rated Firms			
F-statistic	46.09238	Prob. F(16,38863)	0.0000
Obs*R-squared	724.0607	Prob. Chi-Square(16)	0.0000
Scaled explained SS	1614.668	Prob. Chi-Square(16)	0.0000
Panel B: Rated Firms			
F-statistic	11.83531	Prob. F(15,858)	0.0000
Obs*R-squared	149.8373	Prob. Chi-Square(15)	0.0000
Scaled explained SS	243.5117	Prob. Chi-Square(15)	0.0000

Notes: The table displays the results of the White Heteroskedasticity Test for combined sample (Panel A) and rated firms' sample (Panel B) for Model (3) indicating the presence of heteroskedasticity.

Appendix 8A
Credit Ratings and Debt Maturity Structure: Tolerance and VIF

	Tolerance	VIF	Tolerance	VIF
	Rated and Non-rated Firms		Rated Firms	
CR	.004	274.714	.033	30.293
CR^2	.002	560.640	.034	29.697
RAT_{dum}	.013	75.042		
LOS	.838	1.193	.672	1.488
QUAL	.992	1.009	.865	1.156
AMAT	.957	1.044	.720	1.390
MBR	.920	1.087	.701	1.426
ETR	.896	1.116	.768	1.301
$TECH_{dum}$	.209	4.792	.703	1.422
IND_{dum}	.108	9.284	.291	3.437
CS_{dum}	.132	7.559	.179	5.582
CG_{dum}	.177	5.645	.235	4.264
HC_{dum}	.292	3.425	.384	2.604
UTL_{dum}	.478	2.091	.259	3.856
BM_{dum}	.289	3.466	.355	2.818
OG_{dum}	.449	2.226	.480	2.083

Notes: This table displays the multicollinearity diagnostics (tolerance and VIF) for Model (6). The results indicate that CR, CR^2 and RAR_{dum} have low tolerance and high VIF indicating that these variables have high multicollinearity.

Appendix 8B

Debt Maturity Structure: Eigenvalues and Conditional Index

Dimension	Eigenvalue	Condition Index	Variance Proportions																
			Constant	CR	CR^2	RAT_{dum}	LOS	QUAL	AMAT	MBR	ETR	$TECH_{dum}$	IND_{dum}	CS_{dum}	CG_{dum}	HC_{dum}	UTL_{dum}	BM_{dum}	OG_{dum}
1	6.317	1.000	.00	.00	.00	.00	.00	.00	.00	.01	.01	.00	.00	.00	.00	.00	.00	.00	.00
2	1.169	2.324	.00	.00	.00	.00	.00	.02	.08	.01	.00	.03	.00	.01	.00	.01	.08	.00	.01
3	1.050	2.453	.00	.00	.00	.00	.00	.00	.03	.02	.00	.04	.01	.00	.00	.07	.06	.00	.01
4	1.039	2.466	.00	.00	.00	.00	.00	.00	.07	.00	.01	.00	.01	.03	.02	.02	.04	.00	.05
5	1.004	2.509	.00	.00	.00	.00	.00	.21	.00	.00	.00	.02	.00	.02	.00	.08	.00	.04	.03
6	1.000	2.513	.00	.00	.00	.00	.00	.00	.00	.00	.00	.03	.01	.00	.00	.04	.00	.17	.00
7	1.000	2.513	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00	.01	.01	.02	.02	.01	.26
8	1.000	2.513	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00	.09	.00	.05	.00	.03
9	.987	2.530	.00	.00	.00	.00	.00	.74	.00	.00	.00	.01	.00	.00	.00	.01	.00	.02	.01
10	.912	2.631	.00	.00	.00	.01	.00	.00	.10	.00	.00	.00	.00	.00	.00	.00	.16	.00	.01
11	.747	2.909	.00	.00	.00	.00	.00	.00	.67	.00	.01	.02	.00	.01	.00	.00	.04	.00	.02
12	.415	3.903	.00	.00	.00	.00	.00	.01	.00	.51	.35	.01	.00	.00	.00	.02	.00	.00	.00
13	.299	4.594	.00	.00	.00	.00	.01	.02	.04	.42	.56	.01	.00	.00	.00	.01	.00	.00	.00
14	.043	12.079	.00	.00	.00	.00	.79	.00	.01	.02	.06	.09	.12	.11	.12	.08	.11	.12	.07
15	.017	19.150	.00	.00	.00	.00	.19	.00	.00	.01	.01	.71	.81	.78	.72	.63	.41	.61	.48
16	.000	137.579	.94	.02	.01	.27	.01	.00	.00	.00	.00	.02	.02	.02	.02	.02	.02	.02	.02
17	.000	648.045	.06	.98	.99	.71	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

Notes: This table displays the multicollinearity diagnostics for Model (6). Eigen Values near 0 and Conditional Index above 15 suggests that CR, CR^2 and RAT_{dum} have high multicollinearity issues.

Appendix 8C
Debt Maturity Structure: Pearson's Correlation Matrix of Dependent, Explanatory and Control Variables (Rated and Non-rated Firms)

	DMR	**CR**	**CR**^{2}	**RAT**$_{dum}$	**LOS**	**QUAL**	**AMAT**	**MBR**	**ETR**	**TECH**$_{dum}$	**IND**$_{dum}$	**CS**$_{dum}$	**CG**$_{dum}$	**HC**$_{dum}$	**UTL**$_{dum}$	**BM**$_{dum}$	**OG**$_{dum}$	**TELE**$_{dum}$
DMR	1																	
CR	-.089**	1																
CR^2	-.092**	.996**	1															
RAT$_{dum}$	.097**	-.967**	-.984**	1														
LOS	.260**	-.165**	-.166**	.164**	1													
QUAL	-.015*	0.01	0.01	-.007	-.025**	1												
AMAT	.073**	-.004	-.003	.004	-.079**	-.017**	1											
MBR	-.046**	-.006	-.005	.004	-.135**	-.005	-.079**	1										
ETR	.070**	-.049**	-.048**	.045**	.296**	-.086**	-.050**	-.073**	1									
TECH$_{dum}$	-.056**	.050**	.051**	-.047**	-.076**	0.01	-.088**	.156**	-.066**	1								
IND$_{dum}$	-.042**	.060**	.060**	-.061**	-.009	.007	-.063**	-.083**	.059**	-.237**	1							
CS$_{dum}$	.039**	-.023**	-.028**	.033**	-.058**	-.001	.106**	-.004	-.019**	-.184**	-.355**	1						
CG$_{dum}$	-.082**	-.015*	-.017**	.016*	.059**	-.003	-.011	-.084**	.039**	-.141**	-.273**	-.211**	1					
HC$_{dum}$	.016*	.001	.006	-.011	-.092**	-.001	-.023**	.161**	-.071**	-.093**	-.180**	-.139**	-.107**	1				
UTL$_{dum}$	.103**	-.107**	-.104**	.098**	.123**	-.013*	.055**	-.056**	.009	-.060**	-.116**	-.090**	-.069**	-.046**	1			
BM$_{dum}$	.036**	-.019**	-.016*	.011	.068**	-.006	.027**	-.043**	.012	-.095**	-.184**	-.142**	-.109**	-.072**	-.047**	1		
OG$_{dum}$	.043**	-.020**	-.016*	.012	-.001	-.003	.065**	-.015*	0.01	-.064**	-.124**	-.096**	-.074**	-.049**	-.031**	-.050**	1	
TELE$_{dum}$	.070**	-.018**	-.021**	.032**	.104**	-.005	-.032**	.022**	-.007	-.057**	-.110**	-.085**	-.065**	-.043**	-.028**	-.044**	-.030**	1

Notes: *Variables are defined as total long-term debt to total assets (DMR) as dependent variable, numerical code 1-5 for credit rating (CR), credit rating square (CR^2), rating dummy (RAT_{dum}), log of sales (LOS) refers to natural logarithm of sales, quality of the firm (QUAL) is the difference between earnings before interest and taxation ($EBIT_{t+1}$) and $EBIT_t$ scaled by share price SP_t, assets maturity ratio (AMAT) is the ratio of total property, plant and equipment to total annual depreciation, market to book ratio (MBR) is the book value of the assets minus the book value of the equity plus market value of equity divided by book value of assets while and effective tax rate (ETR) is the ratio of total amount of tax charged by total taxable income, technology dummy ($TECH_{dum}$), industrial dummy (IND_{dum}), consumer services dummy (CS_{dum}), consumer goods dummy (CG_{dum}), heath care dummy (HC_{dum}), utility dummy (UTL_{dum}), basic material dummy (BM_{dum}), oil and gas dummy (OG_{dum}), telecommunication dummy ($TELE_{dum}$).*

***Correlation is significant at the 0.01 level (2-tailed)*

** Correlation is significant at the 0.05 level (2-tailed)*

Appendix 8D

Debt Maturity Structure: Pearson's Correlation Matrix of Dependent, Explanatory and Control Variables (Rated Firms)

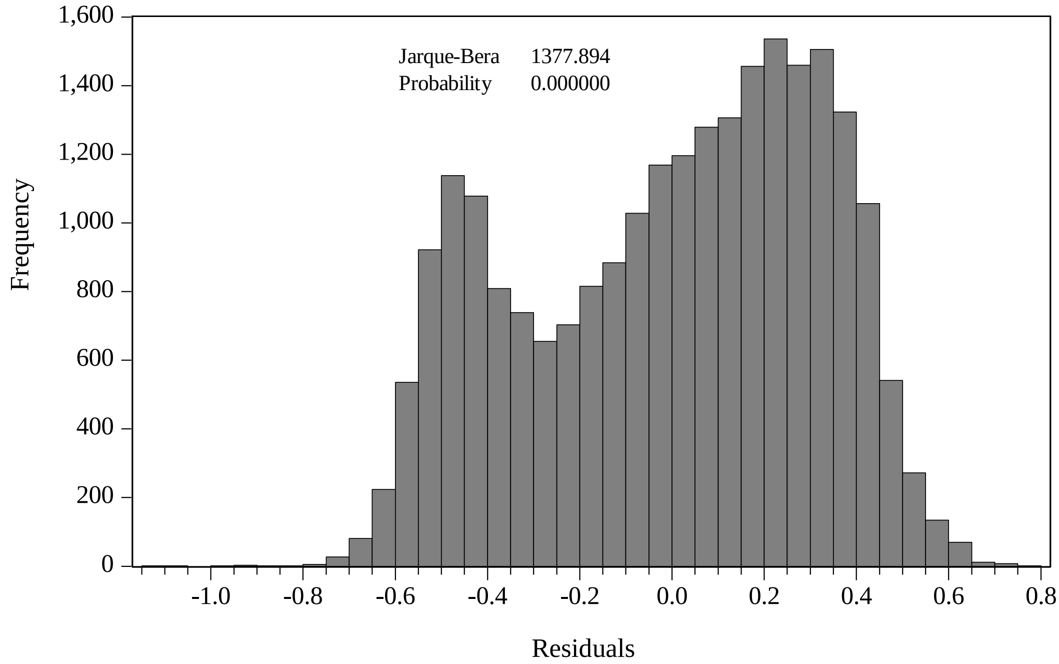
	DMR	**CR**	**CR^2**	**RAT_{dum}**	**LOS**	**QUAL**	**AMAT**	**MBR**	**ETR**	**$TECH_{dum}$**	**IND_{dum}**	**CS_{dum}**	**CG_{dum}**	**HC_{dum}**	**UTL_{dum}**	**BM_{dum}**	**OG_{dum}**
DMR	1																
CR	.282**	1															
CR^2	.265**	.974**	1														
LOS	-.113**	-.113**	-.138**	1													
QUAL	-.054	.147**	.158**	0.05	1												
AMAT	.103**	-.132**	-.102**	-.154**	.002	1											
MBR	-.121**	-.112**	-.094**	-.340**	.004	-.206**	1										
ETR	-.097**	-.160**	-.177**	.089**	-.300**	-.011	-.013	1									
$TECH_{dum}$	.030	.250**	.299**	-.043	.135**	-.084*	-.017	-.062	1								
IND_{dum}	.114**	.051	.036	-.014	-.044	-.047	-.112**	.056	-.053	1							
CS_{dum}	0.054	.146**	.097**	-.184**	.056	.038	.143**	-.015	-.095**	-.268**	1						
CG_{dum}	-.141**	-.026	-.065	.084*	-.022	-.098**	.046	.107**	-.059	-.167**	-.301**	1					
HC_{dum}	-.128**	-.271**	-.207**	.114**	-.012	-.070*	.339**	.036	-.029	-.081*	-.146**	-.091**	1				
UTL_{dum}	.092**	-.148**	-.131**	-.032	-.023	.361**	-.173**	-.072*	-.053	-.149**	-.269**	-.168**	-.081*	1			
BM_{dum}	-.130**	-.123**	-.112**	.109**	-.014	-.023	-.052	.058	-.041	-.116**	-.210**	-.131**	-.063	-.117**	1		
OG_{dum}	.010	-.138**	-.097**	.068*	.002	-.073*	-.071*	.119**	-.029	-.082*	-.148**	-.092**	-.045	-.083*	-.064	1	
$TELE_{dum}$	0.05	.226**	.248**	.039	-.023	-.166**	-.100**	-.258**	-.037	-.105**	-.189**	-.118**	-.057	-.105**	-.082*	-.058	1

Notes: Variables are defined as total long-term debt to total assets (DMR) as dependent variable, numerical code 1-5 for credit rating (CR), credit rating square (CR^2), log of sales (LOS) refers to natural logarithm of sales, quality of the firm (QUAL) is the difference between earnings before interest and taxation ($EBIT_{t+1}$) and $EBIT_t$ scaled by share price SP_t, assets maturity ratio (AMAT) is the ratio of total property, plant and equipment to total annual depreciation, market to book ratio (MBR) is the book value of the assets minus the book value of the equity plus market value of equity divided by book value of assets while and effective tax rate (ETR) is the ratio of total amount of tax charged by total taxable income, technology dummy ($TECH_{dum}$), industrial dummy (IND_{dum}), consumer services dummy (CS_{dum}), consumer goods dummy (CG_{dum}), heath care dummy (HC_{dum}), utility dummy (UTL_{dum}), basic material dummy (BM_{dum}), oil and gas dummy (OG_{dum}) telecommunication dummy ($TELE_{dum}$).

***Correlation is significant at the 0.01 level (2-tailed)*

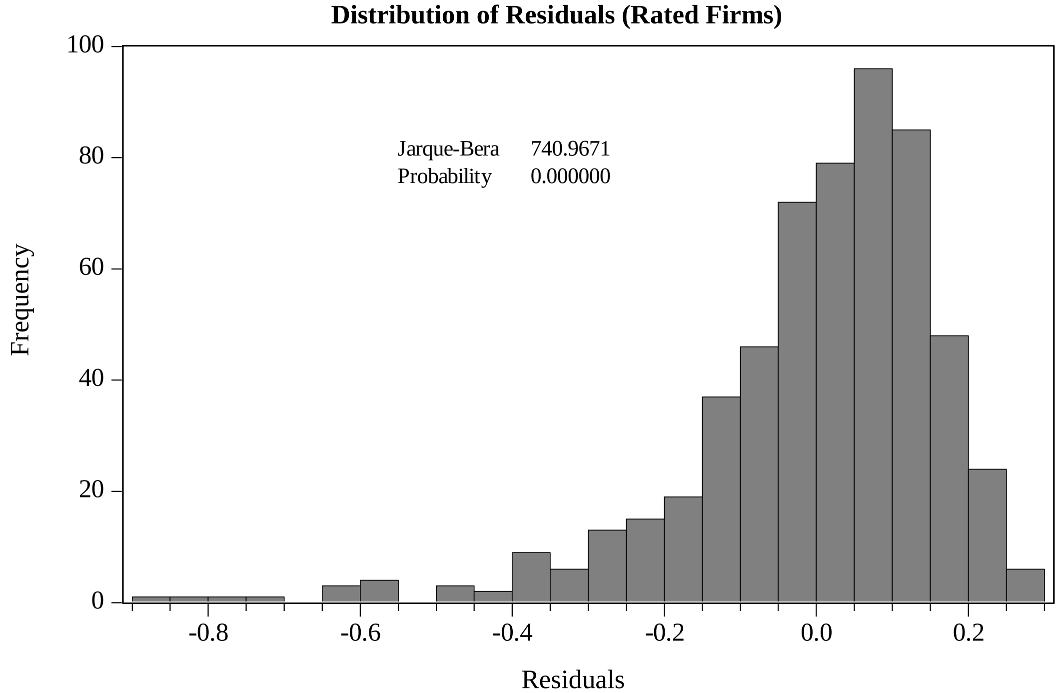
** Correlation is significant at the 0.05 level (2-tailed)*

Appendix 8E
Credit ratings and Debt Maturity Structure
Distribution of Residuals (Rated and Non-Rated Firms)



Notes: This figure displays the distribution of residuals from Model (6) for the combined sample of rated and non-rated firms, indicating the concerns for non-normality in the distribution of error terms

Appendix 8F
Credit ratings and Debt Maturity Structure
Distribution of Residuals (Rated Firms)



Notes: This figure displays the distribution of residuals from Model (6) for the sample of rated firms, indicating the concerns for non-normality in the distribution of error terms

Appendix 8G
White Heteroskedasticity Test
Pooled Time-series Cross-sectional Regression of Debt Maturity Ratio on Credit Ratings and Control Variables

Panel A: Rated and Non-Rated Firms			
F-statistic	100.9757	Prob. F(16,38863)	0.0000
Obs*R-squared	1514.616	Prob. Chi-Square(16)	0.0000
Scaled explained SS	744.1988	Prob. Chi-Square(16)	0.0000
Panel B: Rated Firms			
F-statistic	2.364984	Prob. F(15,555)	0.0026
Obs*R-squared	34.30475	Prob. Chi-Square(15)	0.0031
Scaled explained SS	104.308	Prob. Chi-Square(15)	0.0000

Notes: The table displays the results of the White Heteroskedasticity Test for combined sample (Panel A) and rated firms' sample (Panel B) for Model (6) and indicate the presence of heteroskedasticity.

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