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CORPORATE FUNDING ON THE EUROPEAN DEBT CAPITAL MARKET

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CORPORATE FUNDING ON THE EUROPEAN DEBT CAPITAL MARKET:

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Stockholm, April 2008

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1 INTRODUCTION TO THESIS

The science of economics describes how scares resources are allocated within a complex system, where those with an excess of a commodity channel their assets to meet a demand of individuals in need of the resource. The broad field of economics can further be divided into several subcategories, depending on the type of resource considered, or the sphere of agents acting on the supply and demand of a good. In financial economics, that good is money and the activity of finance is the application of a set of techniques that individuals and entities use to manage their financial affairs, particularly the differences between supply and demand of capital and the risks associated with the subsequent use of that resource.

The area of corporate finance deals in turn with the question of how a firm is financed effectively to enhance the capital investments channelled to its activities. Businesses are built on capital that either gives an investor control of the company with residual rights to cash flows (equity), or ensures senior claims to distributed funds without direct ownership (debt). Theory on a firm's optimal mix of these two capital types was established by Modigliani and Miller (1958), who thus opened the floodgates on a vast area of research within modern corporate finance. Their groundbreaking work was followed by further theoretical papers in the field on, among others, agency costs (Jensen and Meckling (1976)), signalling through capital structure (Ross (1977)), and firm's debt policy (Myers (1977)). As these key mechanisms of corporate financing functions took shape, research continued to evolve into areas considering particular aspects of either equity or debt financing. On the liability side, Jensen and Meckling (1976) and Myers (1977) discuss already the maturity of debt within the scope of their framework, while Merton (1977) set forth theories for explicit valuation of debt contracts bearing default risk.

Three decades later, the literature on debt and fixed income research has vastly expanded both in terms of theoretical manuscripts as well as empirical studies. What has changed even more dramatically is the landscape where supply today meets demand; in Europe, a new, wide capital market was established with the inauguration of the Euro-currency in 1999, today common in thirteen European countries[1]. The broad market for capital has not only lowered national barriers, created a more stable interest rate environment and eased frictions for capital flows within the EMU-area, but also enabled firms seeking funding to have access to a vast audience of debt investors as an alternative to Europe's traditionally heavy dependency on bank lending.

It is against this background and in light of these developments that I have conducted empirical studies on corporate funding on the European debt capital markets. Consequently, in this thesis I analyse a firm's access to and behaviour on the capital market, subsequent the decision to raise capital through the issuance of arm's length debt on the bond market. I contribute specifically to enhance our knowledge in the

[1] Currently, the Euro is the official currency in Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Slovenia, and Spain. Greece joined the Eurozone in 2001, Slovenia in 2007 and on January 1st, 2008 the list will be extended by two additional members, namely Cyprus and Malta.

fields of corporate finance and financial markets by considering explicitly firms' primary market activities within the new market area.

My thesis consists of three separate essays, which are briefly outlined below. A more in-depth discussion on their contribution and findings is provided in section 5. The *first essay* considers the reputation of an issuer on the market. The study combines theoretical arguments from the literature on information asymmetries with those of debt maturity and shows that reputation affects the debt maturity choice of firms. Results highlight the market's ability to provide flexible funding to known counterparties, whereas new comers, irrespective of their credit quality, are offered a more restricted term to maturity on debt through the capital markets. *Essay two* examines the choice of interest rate exposure on newly issued debt. Previous studies provide evidence that firms accessing the capital markets limit their use of derivatives and choose their debt type directly to fit their overall funding situation. Thus, firms seeking debt capital through the bond market are not likely to utilise derivatives to alter the original interest rate exposure of issued debt. I show that firms time their interest rate exposure with respect to market movements and find that firms seek increased portions of fixed rate debt as the interest rates are below their long-term averages, a strong characteristic of the post-Euro times. In the *third* and final essay, I explore pricing anomalies on corporate debt issues. Firms do not seem to utilise the full maturity spectrum when choosing the maturity on their debt, whereby new debt issues are highly concentrated to a few, specific maturities. The herding behaviour appears to affect the pricing of new issues and I find empirical evidence suggesting that these issues are priced less favourably than bonds issued at a maturity deviating from the norm.

The remaining part of this introduction is kept on a general level. Section 2 gives a description of the European debt capital market, its birth and identifies some of its unique characteristics. Section 3 reviews the theoretical framework, while section 4 briefly summarizes related empirical work. And finally, section 5 summarizes the contribution of the thesis and provides an overview of the three essays.

2 A SHORT INTRODUCTION TO THE EUROPEAN CAPITAL MARKETS

The integrated European debt capital market has undoubtedly broaden the possibilities for companies to access funding from the public and challenged investors to cope with an ever increasing complexity of its market participants. Well into the Euro-era, it is clear that the unified market has created potential for all involved parties, where investment opportunities are able to meet a supply of funds from a broad geographical area now summoned under a single currency. Europe's traditionally heavy dependency on bank lending as a source of debt capital is thus easing as corporate residents are able to tap into a deep and liquid capital market to satisfy their funding needs. With increased sophistication comes also an improved knowledge and understanding of the market and its participants, whereby market efficiency should be seen improving.

2.1. Transition from bank dependency towards market originated debt

European firms have traditionally relied heavily on their bank-relationships as a source of debt capital; Rajan and Zingales (2003) estimate that some 80% of debt held by German firms in 1994 originated from banks, while only one-tenth was obtained from the securities markets. Similarly, Danthine, Giavazz and Thadden (2000) report that in 1993, more than three-quarters of the total liabilities on the balance sheets of European non-financial corporation was bank debt. By 1996 the figure had fallen and varied between 45-70%, still high compared with the United States (1993: 32%, 1996: 9.4%). Table 1 presents a more detailed view of these statistics.

	all non-financial firms 1993	239 largest manu-facturing firms 1996
Benelux	83.2	48.1
France	80.2	44.3
Germany	85.1	63.2
Italy	94.6	73.9
Spain	77.3	-
United Kingdom	49.4	34.1
United States	32.4	9.4
Japan	-	56.4

Table 1 Bank debt as a share of total debt liabilities. Source: Danthine, Giavazz and Thadden (2000)

Thus, it seems that the importance of bank lending deteriorated during the second half of the 1990s, although Pagano and von Thadden (2004) note the "*it is difficult to tell whether the change towards a stronger reliance on bonds has been driven mainly by firms or the banks themselves.*"[2] The introduction of the Euro-currency in 1999 certainly seems to have had a further impact on the debt financing practices in the Euro area. Bond issuance in the Euro-area surged with the inauguration of the common currency;

[2] M. Pagano and E. L. von Thadden (2004), page 9

volumes in the Euro-area private sector was less than 26% of its US counterpart in 1998, but tripled to 74% in 1999. In terms of absolute volume, the private sector issuance rose from $124 billion to $273 billion between 1994 and 1998. By contrast, the next year, as the new currency was adopted, issuance volume for the private sector reached a remarkable $657 billion. This initial flow of bond issuance did not ebb out, but remained high and in 2004 Euro-area issuance was still at $550 billion, more than four times the volume of 1994.[3]

2.2. Increased sophistication in assessing credit risk

Another prominent characteristic of the market has been its capacity to increasingly absorb debt issues of varying credit qualities. With the development of the market, investors focused efforts on assessing credit risks once the currency and cross-boarder interest rate risks were no longer present. As sophistication increased among investor, they became more willing to bear credit risk, which opened the market for firms of ever lower creditworthiness (Galati and Tsatsaronis (2003)). In the process, the market as a whole saw a change in the profile of issuers, as non-financial firms increasingly sought their funding from the bond markets. In 1998, more than 85% of the total volume of outstanding corporate bonds was issued by financial institutions, while industrial firms stood for a mere 7% and the utility sector for 6% of the volume. Five years later, in 2003, bonds by industrials constituted for 38% of the total volume, while the share of financials had plummeted to 54% (Baele *et al.* (2004)).

A similar picture is given by chart 1, which presents statistics on the evolution of outstanding debt by credit ratings[4]. While the volumes for the two highest credit categories (AAA and AA) have remained fairly stable over the measured period, lower credit rating categories (A and BBB) have seen a substantial increase in their presence in the market. The A-rated segment increased its volume by more than 600%, from €30 billion in to €220 billion between 1998 and 2003. Similarly, the BBB-rated segment accounted for about €3 billion of the outstanding value and was almost non-existent in 1998, but amounted to more than €182 billion only five years later in 2003. In relative terms, issues by firms of BBB-credit rating increased from less than 2 percent in 1998 to about 27 percent in 2003.

[3] Source: BIS statistics, Danthine, Giavazz, and Thadden (2000) and Pagano and von Thadden .

[4] Source: L. Baele*, et al* (2004). The sample covers only investment-grade corporate bonds with a minimum size of issue of €100 million and includes only bonds constituting the Merrill Lynch corporate bond index.

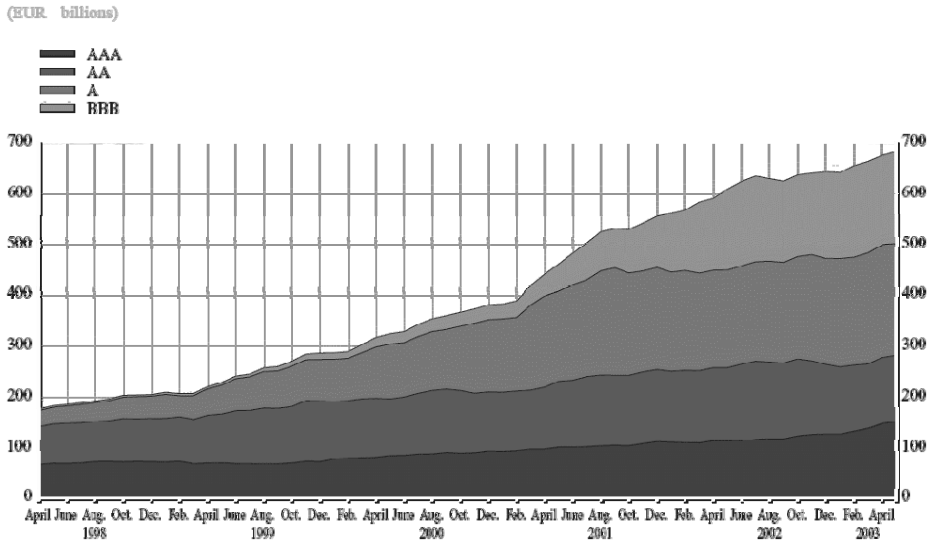

Figure 1 Chart 1 - Outstanding debt by credit rating categories, from highest (AAA) to lowest (BBB) investment-grade quality 1998-2003. Source: ECB (Baele *et al.* (2004)**).**

After the introduction of the common currency, it was the Euro-area firms who displayed strongest activity on the corporate bond market, as shown by Rajan and Zingales (2003), indicative of the opportunities companies sought to seize by diversifying their debt away from bank dependency and accessing the large pool of investors now available through the debt capital markets. One aspect certainly seems to be the increasing availability of long-term funding in the bond market. Pagano and von Thadden (2004) suggest that this in particular has been a driver for the surge in corporate bond issuance in Europe. As national barrier eroded and interest rates for the EMU-members converged towards over-all lower yields, a new source of debt capital emerged to the vast majority of corporate residents under the new currency and gave an alternative to the traditionally more maturity-restricted bank debt. Quoting Pagano and von Thadden (2004), page 27:

> "[But] the benefits have been no less important for European companies, which have acquired cheaper access to a market that can disenfranchise them from banks for the provision of debt finance. The effect on company financing and the attendant effects on credit markets are likely to be the most pervasive legacy of European bond market integration."

3 THEORETICAL FRAMEWORK OF THE THESIS

The irrelevance theorem set forth by Modigliani and Miller (1958) states that the capital structure mix of debt and equity does not affect the value of the firm. As the underlying assumption for MM theorem are relaxed to correspond with real world imperfections, we can identify three different theories claiming affect on the capital structure of a firm; models based on tax considerations, asymmetric information and agency costs. Both corporate and personal taxes affect the optimal capital structure of a firm (Modigliani and Miller (1963), Miller (1977), Kim (1978), De Angelo and Masulis (1980)). Equally, the pecking order theory in corporate finance and the signalling function of debt securities issuance represent models based on asymmetric information. The pecking order theory states the preference to use internal finance, followed by low-risk debt and by equity in the last resort (Myers and Majluf (1984); Myers (1984)). Signalling models contend that a firm's choice to issue debt securities may signal to outside investors information about the firm and its quality (Leland and Pyle (1977), Ross (1977)). Agency models, in turn, state that corporate control considerations may also play a role in the determination of the capital structure (Jensen and Meckling (1976), Myers (1977)).

Debt securities are one of the many financing sources the toolbox of corporate finance. In studying the issuance of corporate debt, my research focuses on three specific aspects of corporate funding through the use of capital markets; namely the determinants of maturity of issued debt, the choice of interest rate exposure and factors affecting term structure of credit risk premiums on newly issued debt. Relevant theories for each of these segments build upon those discussed above, although the context in which they are presented varies for each area. The following subsections review some of the relevant theories for the chosen research topics.

3.1. Theory on the determinants of debt maturity

Academic literature recognises four main classes of theories on the determinants of debt maturity, namely the maturity-matching hypothesis, the tax hypothesis, the agency cost hypothesis, the signalling and liquidity risk hypothesis. In addition, debt subordination has further implication on debt maturity. The maturity-matching hypothesis, proposed by Myers (1977), argues that a firm should match the maturity of its assets with the liabilities it carries. Together with the tax hypothesis (see Brick and Ravid (1985)), which states that corporate debt maturity is positively correlated with yield curve movements due to obtained tax shield benefits as interest rates rise, these two theories reflect specific firm-level asset characteristics and functions of corporate tax ratios on the choice of debt maturity.

While less tangible, models on information asymmetries help explain debt maturity decisions based on the perceived credit quality of the issuing firm. Myers (1977) and Barnea, Haugen and Senbet (1980) argue that agency costs of debt can be alleviated by issuing short-term debt, which can be re-priced to reflect new information Flannery (1986) suggests that the debt maturity structure of a firm signals private information about its quality. Utilising shorter maturity debt generates higher costs due to more

frequent refinancing, thus separating high-quality firms from low-quality firms, where the former will issue at the short end of the maturity spectrum to signal higher quality, while the latter, unable to pay the reoccurring transaction costs, is forced to issue long-term debt.

Diamond (1991a) presents a similar, albeit non-monotonic relationship between debt maturity and firm quality based on liquidity risk; issuing short-term debt increases the roll-over frequency of debt, thus exposing the firm to greater uncertainty on the availability of funds at each maturity date. Short-term debt is issued by either high- or very low-quality firms, while issuers of creditworthiness between these extremes prefer long-term funding. Diamond (1993) shows that firms maximize their debt capacity by bearing short-term senior debt and long-term junior debt. Short-term senior debt is more information sensitive and preferred if firms anticipate positive news to arrive. It also gives control rights to lenders in case of default, at which point lenders prefer to liquidate.

3.2. Theory on the choice of interest rate exposure

Choosing a particular interest rate exposure signals firm quality. Guedes and Thompson (1995) develop a model in which the riskier choice of debt signals favourable news about firm quality. Bearing floating rate debt during periods of higher inflation volatility stabilises operating income after interest expenses, since the inflation component is reflected both in gross operating income and nominal interest rate expanses payable by firms. Fixed rate debt is preferred when *real* market interest rates fluctuate more relative to inflation, while times characterised by relatively higher expected inflation volatility favours floating rate debt. Thus, choosing debt that is destabilising cash-flows and therefore riskier is considered a signalling superior firm quality. Titman (1992) presents a model where interest rate uncertainty subjects firms to greater likelihood of financial distress. An increase in interest rate volatility may induce firms to issue long-term debt despite otherwise preferring to issue short-term debt due to reasons of information asymmetry.

The term to maturity of debt is also reflected in the choice of interest rate exposure. Longstaff and Schwartz (1995a) derive a model for valuing floating and fixed rate debt, which considers both the likelihood of default for risky debt and interest rate risks. They show that a floating-rate payment can be less valuable in the short-term and that the value can be an increasing function of the time until payment when interest rates are below their average long-run levels. This in turn implies that floating rate debt is less favourable than fixed rate debt during periods of low interest rate, since floating rate payments are valued lower relative to fixed rate payments.

3.3. Theory on the term structure of credit risk

Credit risk models can be divided into two main approaches: structural-form models and reduced-form models. Structural-form models originate from the option-pricing framework by Black and Scholes (1973). Merton (1974) utilises this framework to model corporate liabilities as contingent claims on a firm's assets. Models augmenting

the Merton approach for valuing risky debt based on asset values have been developed by, among others, Kim, Ramaswamy and Sundaresan (1993), Longstaff and Schwartz (1995b), Leland and Toft (1996) and Collin-Dufresne and Goldstein (2001). Merton's model assumes non-stochastic interest rates, while Kim, Ramaswamy and Sundaresan (1993) and Longstaff and Schwartz (1995b) allow interest rates to be stochastic. Leland and Toft (1996) provide a closed-form solution to estimate the credit spread, which considers the optimal capital structure when firms are able to choose both the maturity and amount of debt it issues.

Structural-form models suffer from difficulty of empirical implementation, since the value of assets may not be known. By contrast, reduced-form models assume that the default process is driven by an exogenous random variable; the probability of default and the recovery rate in case of default vary stochastically with time. For instance, Jarrow, Lando and Turnbull (1997) provide a model where the probability of default follows a Markov process. Other reduce-form models include e.g. Litterman and Iben (1991), Lando (1998) and Duffie and Singleton (1999). Litterman and Iben (1991) recognize that the term structure of credit risk is not flat.

4 CENTRAL FINDINGS IN THE EMPIRICAL DEBT LITERATURE

Empirical research on company debt can generally be divided into two different categories, depending on the context in which these securities are examined. The classical debt maturity literature tests the implications of relaxing assumptions underlying the MM-propositions on the entire liability structure of a company's balance sheet. The merits of such testing rests on the ability to evaluate these theories, while it is from an empirical perspective extremely challenging, since it requires intensive data gathering and handling. As a results, empirical research has acknowledge debt securities as an adequate alternative in studying firm-level use of debt, where accurate data is more readily available.

Debt securities research can further be divided into studies on the primary and the secondary market. In the latter case, the focus has been placed on the pricing of this traded asset class and how the underlying credit risk is reflected in investor decision. The former, however, is more closely related to corporate finance, as the primary market reflects the direct funding costs and attributes of corporations accessing the capital market. Thus, studying incremental debt issues yields valuable insight into firm-level decisions on debt financing. Only in recent years has data for this type of research become adequately available, especially for the European primary debt capital markets. Data on debt securities by European firms seeking funding on their home-market under the Euro-currency represents also a cornerstone in my thesis.

Empirical work in the area of corporate finance and capital markets is vast and the review into the literature is far from comprehensive. Nevertheless, I will review shortly present some of the central findings on debt issuance, as a more extensive survey is beyond the scope of this thesis.

4.1. Evidence on the debt maturity

A central and oft-cited study by Graham and Harvey (2001), in which the authors survey chief financial officers in the US, portrays a wide variety of considerations and practices that company managers act upon as they deal with the funding needs faced by their respective firms. Graham and Harvey find that the top determinants among these practitioners for the choice of debt maturity are the matching of debt maturity with asset life, minimizing liquidity risk by issuing long-term debt and timing the market when short-end interest rates are low relative to long-term interest rates.

Related empirical studies include Barclay and Smith (1995), Stohs and Mauer (1996), Guedes and Opler (1996) and Bali and Skinner (2006), of which the first two evaluate the maturity of the liability structure, while the latter two examine determinants of debt maturity for incremental debt issues. These results, by and large, are parallel to the responses given in the Graham and Harvey (2001) survey. Material contributions arise from recognizing the importance of credit quality categories (Barclay and Smith (1995), Bali and Skinner (2006); Stohs and Mauer (1996)), liquidity risk (Guedes and Opler (1996); Stohs and Mauer (1996)) and debt subordination (Bali and Skinner (2006)).

Main findings support debt maturity theories on credit qualities by Flannery (1986) and Diamond (1991a), maturity matching by Myers (1977), but reject the tax hypothesis by Brick and Ravid (1985). In addition, Baker, Greenwood and Wurgler (2003) and Bali and Skinner (2006) find evidence that firms respond to a steeper slope of the yield curve by shortening the maturity of debt, similar to the responses in survey Graham and Harvey (2001).

4.2. Studies on choosing fixed or floating rate debt

Faulkender (2005) examines the interest rate exposure for firms in the chemical industry and finds that i) firms choose fixed rate exposure when economic conditions are expected to worsen, ii) firms engage in market timing through the use of derivatives but do not hedge cash-flows; and iii) the slope of the yield curve at the time of the debt issue determines whether firms use interest rate swaps to alter the interest rate exposure of their debt. Similarly, Vickery (2005) studies the interest rate exposure choices of small firms and finds evidence suggesting that high real interest rates and a steep yield curve are correlated with a lower proportion of fixed debt.

Other empirical studies have examined the floating rate share of firms' liability structure. Chava and Purnanandam (2007) study how managerial incentives affect the ratio of floating rate debt and report that smaller firms with more valuable growth options that are closer to financial distress adopt a conservative debt financing strategy by maintaining lower levels of floating-rate debt. This is in line with findings reported by Vickery (2005). By contrast Covitz and Sharpe (2005) find that smaller, lower-rated firms tend to have greater initial interest rate exposures on their total liabilities compared with larger firms.

4.3. The term structure of credit risk

Empirical work in the field of credit risk finds evidence both supporting and to some extent conflicting the model prediction for the shape of credit curves (see. e.g. Sarig and Warga (1989), Helwege and Turner (1999), Collin-Dufresne and Goldstein (2001) and on European data van Landschoot (2003)).

Nevertheless, there is consensus in the literature that the credit yield curve for high-grade bonds is increasing with maturity, while disagreement prevails on its shape for lower quality firms. Further, empirical evidence on the determinants of credit risk premiums show that spreads are also affected by tax considerations, secondary market liquidity and non-diversifiable systematic risk (Elton *et al.* (2001) , Elton *et al.* (2004), Collin-Dufresne, Goldstein and Martin (2001), Gabbi and Sironi (2005)). Apart from Gabbi and Sironi (2005), all others conduct their studies on secondary market data.

Time-varying trends and macroeconomic cycle affect the over-all credit risk premiums. Duffee (1998) finds that Treasury yields have a negative correlation with the risk premium for corporate bonds. Evidence also suggests that default probabilities and recovery rates vary through business cycles, affecting the premium required by market participants to bear credit risk (e.g., Acharya, Bharath and Srinivasan (2007), Duffie,

Saita and Wang (2007) and Pesaran *et al.* (2006)). While these studies reflect the pricing of secondary market securities, the premiums are reflected onto new issues of debt in the primary market.

5 SUMMARY OF THE ESSAYS

A general theme in the three essays included in my thesis is the utilisation of data from the primary European capital markets, which in particular contributes to the existing literature by giving understanding of the new market area in the wake of diminishing bank dependency. Additionally, each essay is devoted to individual research questions that contribute to a specific niche in the broader field of corporate finance and capital markets literature.

5.1. Essay 1: With good reputation size does not matter: issue frequency and the determinants of debt maturity

The first essay in my thesis examines the effect firm reputation has on the determinants of debt maturity. Diamond (1991b) argues that reputation helps alleviate information asymmetry problems, since it implies lower degrees of adverse selection to be present in the future. While empirical research in the field of debt maturity has mainly focused on testing various theories, my foremost contribution to the existing literature is combining the reputation argument and the debt maturity literature, which enables me to show that an issuer's reputation in itself affects debt maturity.

Utilising data from the European primary bond market between 1999 and 2005, I confirm previous empirical findings that firms choose the maturity of their debt with changes in the level and slope of the yield curve. In addition, I provide descriptive evidence of the gradual development of the European debt capital market. By focusing the research on non-financial corporate issuers, I provide specific insight into the funding of these firms and industries under the new currency and its capital market.

And finally, credit quality alone is not a key determinant of debt maturity, but in combination with the contractual coupon payments they materially affect the maturity of issued debt. Through this employed methodology, I am able to establish an implied credit quality for issuers lacking a credit rating by a credit rating agency, which gives further insight about the firms utilising the bond market for funding.

5.2. Essay 2: Riding a rollercoaster or the merry-go-round? Market timing and the choice of interest rate exposure on corporate debt.

The second essay examines determinants of interest rate exposure for incremental corporate debt issues. Previous studies reveal that firms only marginally utilise derivatives to swap the original interest rate exposure on new debt. In spite of this evidence, the literature has mainly been focused on studying the use of derivatives and arguing what final risk exposure firms ought to have, while it would seem motivated to specifically examine the drivers affecting the original interest rate exposure of debt in the absence of derivative-instruments. As a result, the second essay in the thesis studies the initial debt type of incremental debt issues on the Euro-denominated capital market excluding derivatives, which allows for a considerably wider cross-sectional sample size compared with previous studies.

The adopted approach yields also a greater insight into the debt capital market's ability and willingness to fund corporate borrowers in different interest rate environments and provides straightforward evidence on firm risk management strategies on a market absent of bank monitoring. And finally, my sample of transaction-level observations, as opposed to measurements and proxies on entity-wide debt structure, produces well-defined and verifiable points in time at which parties agree on terms for each debt contract under specific interest rate regimes and with accurate descriptions on the characteristics of individual debt issues. To the best of my knowledge, there are no similar studies to be found in the current empirical literature.

I show that the maturity of debt is by far the strongest driver for the choice of debt type; longer term to maturity increases the likelihood of fixed rate debt. In addition, the obtained empirical evidence follow predictions by Longstaff and Schwartz (1995a), who suggest higher portions of fixed rate debt when interest rates are below their long-term averages, a strong characteristic of the post-Euro times.

5.3. Essay 3: Costly lemmings in the bond market? An empirical analysis of the term structure of credit spreads.

The third and final paper examines the credit spread between government bonds and bonds issued by firms of varying credit quality at different maturities. Current literature has explored both theoretically and empirically factors affecting the overall credit risk premium with the normal assumption that risky debt pays a premium over the Treasury yield curve that relates to the probability of default, the expected loss in case of default and a compensation of bearing systematic, non-diversifiable credit risk.

On the other hand, researchers have suggested that the credit yield curve may not conform to the assumption of a smooth credit curve and conclude that markets may systematically misprice bonds in parts of the yield curve. Consequently, I study the credit risk premiums at various maturities in order to evaluate the pricing over the maturity spectrum and seek to answer the question of whether the term structure of credit risk for new issues is as smoothly increasing as many theoretical models predict and various studies assume.

The empirical approach adopted in this study departs from previous studies in two essential ways; first, the objective is not to test existing theoretical models, but empirically explore the pricing of credit risk over the yield curve. Second, the study is conducted on spreads observed at issuance in the primary market for corporate bonds, as opposed to traded securities on the secondary market, and constitutes therefore actual pricing of debt faced by firms seeking arm's length funding on the capital market. The evidence provided in the third essay appears to highlight a shortcoming of existing theoretical models, where the credit yield curve is not smooth, but affected by the supply of issues at various parts of the yield curve.

6 SHORT OVERVIEW OF THE DATA MATERIAL UTILISED IN THE ESSAYS

Data utilised in this thesis is a central part of my research and originates from Dealogic's database, which contains issue-specific information on Euro-denominated bond issues by EMU-country residents. I have chosen to restrict each study to include only debt issued by non-financial firms, thus excluding the financial sector. Financial intermediaries differ significantly in their business and financial structure from industrial firms and are therefore commonly studied in isolation. Focusing my study on industrial firms allows for better comparison with earlier empirical literature, which has almost exclusively considered only non-financial firms.

Each essay seeks to answer a unique research question and consequently utilises a slightly different sample of the entire data set. Table 2 highlights these differences and presents additional statistical properties for the data.

The most obvious difference in the samples is the number of observations considered in each essay. Three key elements drive these differences; i) the type of debt included in the study, ii) the credit rating categories and iii) maturity of debt considered in each study. Essay two includes debt issues of both fixed and floating type and has a total of 1353 issues included in its final sample, while essays one and three comprise only fixed-rate debt, with 718 and 486 bond issues, respectively. The third essay is restricted in terms of maturity and credit quality; due to the adopted methodology in the last essay, I include only firms of investment-grade quality and exclude issues with a maturity exceeding 10 years. Also, data utilised in essay one ends in December 2005. Data was unavailable when the project was initialized and due to the construction of the dataset, I was later unable to update the final data sample in the first essay to reflect the same time-period considered in essays two and three.

Table 2 reports a country-breakdown for each data sample and the share of issues originating from each EMU country as well as the number of issues by subsidiaries to non-EMU residents. In my essays, I have studied the European bond market as a whole and have not considered the individual issuer's origin as a factor in my research. From the beginning, I felt the need to keep my research focused and that studying country-specific determinants would require an entirely different approach to the research questions. I hope that stating the county-breakdown here will give rise to new ideas for further studies and that researchers interested in the European bond market find the figures interesting and pursue new research questions in light of these statistics.

	Article 1		Article 2		Article 3	
Number of observations in final sample	718		1353		486	
Considered time-period	Jan.1999-Dec.2005		Jan.1999-Nov.2006		Jan.1999-Nov.2006	
Number of issues by debt type						
Fixed rate debt	718	100%	812	60.0%	486	100%
Floating rate debt	-	-	541	40.0%	-	-
Maturity spectrum of bonds (years)	1.0 - 50.0		0.4 - 50.0		1.5 - 10.3	
Credit quality of issued debt						
Investment grade	514	71.6%	1110	82.0%	486	100%
Speculative grade	127	17.7%	134	9.9%	-	-
Unrated	77	10.7%	109	8.1%	-	-
Breakdown of issues by country						
Austria	9	1.3%	11	0.8%	6	1.2%
Belgium	15	2.1%	37	2.7%	10	2.1%
Finland	17	2.4%	27	2.0%	14	2.9%
France	216	30.1%	389	28.8%	165	34.0%
Germany	72	10.0%	108	8.0%	38	7.8%
Greece	7	1.0%	8	0.6%	2	0.4%
Ireland	16	2.2%	69	5.1%	11	2.3%
Italy	40	5.6%	64	4.7%	22	4.5%
Luxembourg	70	9.8%	89	6.6%	28	5.8%
Netherlands	244	34.0%	514	38.0%	175	36.0%
Portugal	4	0.6%	5	0.4%	5	1.0%
Spain	8	1.1%	32	2.4%	10	2.1%
Issues by subsidiaries to non-EMU residents						
Australia	2	0.3%	2	0.2%	2	0.4%
Bulgaria	1	0.1%	2	0.2%	-	-
Guernsey	1	0.1%	1	0.1%	-	-
Hungary	2	0.3%	2	0.2%	-	-
Japan	2	0.3%	19	1.4%	1	0.2%
Mexico			1	0.1%		
Poland	9	1.3%	7	0.5%	5	1.0%
Russia	2	0.3%	2	0.2%	-	-
Slovakia	2	0.3%	2	0.2%	-	-
South Africa	-	-	1	0.1%	1	0.2%
Sweden	3	0.4%	3	0.2%	1	0.2%
Switzerland	15	2.1%	23	1.7%	14	2.9%
United Kingdom	5	0.7%	12	0.9%	6	1.2%
United States	28	3.8%	76	5.6%	19	3.9%
TOTAL	72	9.9%	153	11.3%	49	10.1%

Table 2 Summary statistics of data used in each essay

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PART 2
THE ESSAYS

WITH GOOD REPUTATION SIZE DOES NOT MATTER: ISSUE FREQUENCY AND THE DETERMINANTS OF DEBT MATURITY

Abstract

This paper examines empirically the effect firm reputation has on the determinants of debt maturity. Utilising data from European primary bond market between 1999 and 2005, I find that reputation is a determinant of the maturity of newly issued debt, where firms of high or low reputation issue short and firms of mediocre reputation issue long term debt. Thus, reputation appears to mimic a non-monotonic relationship between credit quality and maturity. The annualised coupon payments are shown to be a significant factor in determining the debt maturity and reveal a monotonously increasing relationship between credit quality and debt maturity once controlled for. Finally, I show that issuers lacking a credit rating have an implied credit quality positioned between investment-grade and speculative-grade debt.

Keywords: Corporate debt maturity, Debt seniority, Corporate Bonds, Reputation, Eurobonds, Macroeconomic factors.

JEL: G15, G24

1.1. Introduction

This paper examines empirically the effect firm reputation has on the determinants of debt maturity. Theoretical papers provide us with variable projections on a firm's choice of debt maturity, ranging from the matching of asset-maturity to tax-relief benefits and comprising various signalling effects based on information asymmetry and agency cost theories (see e.g. Myers (1977), Barnea, Haugen and Senbet (1980), Brick and Ravid (1985), Flannery (1986), Diamond (1991a)). Diamond (1991b) argues that reputation helps alleviate information asymmetry problems, since reputation implies lower degrees of adverse selection to be present in the future. While empirical research has mainly focused on testing these theories in isolation, my foremost contribution to the existing literature is combining the reputation argument with the debt maturity literature and showing that an issuer's reputation in itself affects debt maturity.

Following Guedes and Opler (1996) and Bali and Skinner (2006), I study incremental debt issues, thereby departing from another strand of literature on debt maturity which looks at the entire liability structure on a firm's balance sheet. The advantage of the incremental approach lies in that individual observations on debt maturity are exact and easily identified, while a weakness may be the wide variation in debt issue characteristics. To limit this disadvantage, I incorporate controls for a variety of debt issue features into my model. Utilising data from the European primary bond market between 1999 and 2005, I confirm previous empirical findings by Guedes and Opler (1996), Baker, Greenwood and Wurgler (2003) and Bali and Skinner (2006) that firms choose the maturity of their debt with changes in the level and slope of the yield curve, similar to conclusions that can be drawn from a survey among US chief financial officers conducted by Graham and Harvey (2001).

I also provide evidence of the gradual development of the European debt capital market. Before the introduction of the common currency, most corporate bond issues where made by firms of highest credit qualities (see e.g. Pagano and von Thadden (2004), p.10). After 1999 and the creation of the Euro-denominated debt capital market, issues of lower credit qualities have dominated the primary bond market, with fully new opportunities to access market-based funding emerging to speculative-grade issuers. The new market place has also been quick to extend the term to maturity available to firms seeking corporate funding in terms of debt capital. By focusing the research on non-financial corporate issuers, I provide specific insight into the funding of these firms and industries under the new currency and its capital market.

Diamond (1993) shows that firms maximize their debt capacity by bearing short-term senior debt and long-term junior debt. Parallel to Bali and Skinner (2006), I find empirical evidence to confirm Diamond's prediction that debt of junior status has longer maturity than senior debt.

Additionally, I contribute further to the literature by showing that by controlling for coupon payments, a monotonically decreasing risk-maturity relationship is observed for debt issues, while omitting this control variable, as done in earlier work, produces on non-monotonic relationship between credit quality and debt maturity similar to Diamond (1991a). Thus, the credit quality alone is not a key determinant of debt maturity, but in combination with the contractual coupon payments they materially affect the maturity of issued debt. Finally, through this methodology, I am also able to establish an implied credit quality for issuers lacking a credit rating by a credit rating agency, which gives further insight about the firms utilising the bond market for funding.

1.2. Theoretical framework and hypothesis development

This section presents the central theories on debt maturity. As the emphasis in this paper lies in factors concerning information asymmetries, I will spend more time discussing related predictions on debt maturity and only briefly touch other strands of theories. The academic literature basically recognises four main classes of theories on the determinants of debt maturity, namely the maturity-matching hypothesis, the tax hypothesis, the agency cost hypothesis, the signalling and liquidity risk hypothesis. Subordination has further implication on debt maturity. Each of the hypotheses provides variable projections on the choice of debt maturity.

Perhaps the most intuitive of the theories is the maturity-matching hypothesis by Myers (1977), which argues that a firm should match the maturity of its assets with the liabilities it carries. Guedes and Opler (1996), Stohs and Mauer (1996) and the qualitative survey by Graham and Harvey (2001) find empirical evidence to support the hypothesis. Together with the tax hypothesis (see Brick and Ravid (1985)), which states that corporate debt maturity is positively correlated with yield curve movements due to obtained tax shield benefits as interest rates rise, these two theories reflect specific firm-level asset characteristics and functions of corporate tax ratios on the choice of debt maturity.

The third pillar in the theoretical framework on debt maturity is the agency cost hypothesis. Myers (1977) and Barnea, Haugen and Senbet (1980) argue that information asymmetries caused by the agency cost of debt can be alleviated by issuing short-term debt, which matures before the growth options are exercised and can be re-priced to reflect new information. In other words, firms holding a wide opportunity set of investments should issue short-term debt. This hypothesis is, however, only supported by weak evidence in the empirical studies by Stohs and Mauer (1996) and Graham and Harvey (2001).

While less tangible, models on information asymmetries help explain debt maturity decisions based on the perceived credit quality of the issuing firm. Flannery (1986) suggests that the debt maturity structure of a firm signals private information about its quality. In a world without costs, a low-quality firm can replicate the debt maturity choices of a high-quality firm. Introducing costs creates a separating equilibrium; utilising shorter maturity debt generates higher costs due to more frequent refinancing, thus separating high-quality firms from low-quality firms, where the former will issue at the short end of the maturity spectrum to signal higher quality, while the latter, unable to pay the reoccurring transaction costs, is forced to issue long-term debt. Kale and Noe (1990) show that the separating equilibrium can exist even without transaction costs.

Diamond (1991a) presents a similar, albeit non-monotonic relationship between debt maturity and firm quality based on liquidity risk; issuing short-term debt increases the roll-over frequency of debt, thus exposing the firm to greater uncertainty on the availability of funds at each maturity date. High-quality firms, confident of their credit quality and the likelihood of continued funding, will issue short-term debt. The risk of facing an illiquid market gives firms with a lower credit quality an incentive to issue longer term debt. However, “circumventing” liquidity risk by issuing long-term debt may not be an option for very low-quality firms. Instead, they are screened out of the long-term maturity segment due to increasing credit risk premiums further along the credit curve and are, as a consequence, restricted to issue shorter-term debt. Short-term debt is therefore issued by either high- or very low-quality firms, while issuers with credit qualities between these extremes prefer long-term funding. Both Guedes and Opler (1996) and Stohs and Mauer (1996) find empirical evidence supporting Diamond’s and Flannery’s models.

Furthermore, theory suggests an inverse relationship between the seniority of debt and debt maturity. Diamond (1993) shows that firms maximize their debt capacity by bearing short-term senior debt and long-term junior debt. Short-term senior debt is more information sensitive and preferred if firms anticipate positive news to arrive. It also gives control rights to lenders in case of default, at which point lenders prefer to liquidate. Thus, too much short-term debt leads lenders to liquidate too often. By bearing long-term junior debt while allowing additional future debt to be raised, the borrower can alleviate unwanted liquidation. Bali and Skinner (2006) provide empirical evidence confirming Diamond's prediction.

Problems associated with information asymmetries are predominant when negotiating debt agreements and remain present over the entire lifespan of such contracts. Firms may try to signal their counterparty quality through behaviour, but in many cases such actions are replicated by the peers from which the firms try to differentiate themselves. Diamond (1991b) argues that reputation "*can eventually deal with moral hazard*"[1] because it implies that less adverse selection will be present in the future. Reputation may therefore be a significant and distinguishable way of alleviating some of the information asymmetry problems. While equity markets and stock exchange regulation obligate their members to reveal information to equity investors and thereby bridging information gaps, the same is not obvious in OTC-type bond markets. The hypothesis I propose suggests therefore that more frequent debt issuers gain from visiting the capital markets regularly and are met more favourably by the investors, where my main argument is that a higher reputation allows a firm to issue debt with longer maturity. Reoccurring debt issuance reveals information about the borrower to debt investors on a continuous basis and helps thereby deal with the information asymmetries. Berger *et al.* (2005) show that the average maturity of bank loans increase significantly when information asymmetries are lessened. From a theoretical perspective, my hypothesis reflects the reputation argument by Diamond (1991b) and it also makes practical sense; if a firm frequently visits the debt capital markets for funding and thereby reveals information about itself more often by building up a reputation among debt investors, it lessens information asymmetries, which in turn should be beneficial to both parties and reflected in the contractual relationship between them.

1.3. Research methodology

The study is restricted to Euro-denominated fixed-rate bonds, issued by non-financial firms residing in EMU-countries and spanning a time-period beginning from the introduction of the Euro in 1999 to the year-end 2005. This choice is motivated by several factors; first, the gradual development of the Euro-denominated corporate bond market in terms of maturity spectrum available to corporate bond issuers has so far been undocumented in the literature. Second, concentrating only on non-financial issuers, gives specific answers to questions about their ability to adapt to and seek funding from a broader debt capital market. Third, the markets' capacity to absorb maturities by a wide range of different qualities of corporate debt is of interest to academics and practitioners alike. Fourth, bonds with embedded features or varying coupon payments are essentially special cases of plain fixed-rate bonds and are therefore outside the scope of this study.

My model relates the maturity of incremental debt issues to macroeconomic factors with control variables for firm-quality and issue-specific characteristics. Using this incremental approach for testing the debt maturity theories is twofold; its strength lies in that individual observations on debt maturity are exact and easily identified, while a weakness may be the wide variation in debt issue characteristics. As a result, my model includes variables to control for the varying characteristics of the bonds in the final sample.

[1] Page 716

The model:

$$MAT_i = \alpha_i + \beta_1^{[-]} LEVEL_t + \beta_2^{[-]} SLOPE_t + \beta_3^{[+/-]} BBBAAA_t + \beta_4^{[+]} COUPON_i +$$
$$+ \beta_5^{[+]} SIZE_i + \beta_6^{[+/-]} BOOKRUN_i + \beta_7^{[+]} SUB_i + \beta_8^{[+/-]} QUAL_i + \beta_9^{[+]} REP_{i+} \varepsilon_i$$

The dependent variable MAT_i is the natural log of one plus the maturity of bond *i* measured in years[2], $LEVEL_t$ is the 3 month EURIBOR-rate at time *t*, $SLOPE_t$ is measured as the difference between the yield of 10-year government bonds and the 3-month EURIBOR rate at time *t*, $BBBAAA_t$ is the market credit risk premium measured as the yield spread difference between AAA-rated and BBB-rated corporate bonds observed in the market, $COUPON_i$ is the annualised fixed coupon of issue *i*, $SIZE_i$ is the log of the amount of debt issued in million euros, $BOOKRUN_i$ is the allocation power of issue *i*, estimated by the number of financial institutions involved in the sale of the transaction. $QUAL_i$ and SUB_i are categorical dummy-variables, where the former reflects the credit quality of an issuer determined by a credit rating from either Moody's, Standard&Poor's or both and the latter indicates whether the issued debt is contractually subordinated and has a junior debt status. REP_i indicates the described reputation categories, to which issuers are allocated based on their activity in the market as measured by the frequency of issuance. Superscripts indicate the expected sign of the coefficients in the model.

1.3.1. Determining reputation

To test whether firm reputation affects the maturity of debt, I observe the frequency of issuance for each individual firm over the entire sample period. I categorise issuers as '*frequent*' or '*infrequent*' based on the absolute number of issues they make during the seven year sample period and perform separate model-regression for each category. Firms with seven or more issues – equivalent to at least one issue per year on average – are categorized as frequent issuers, while those with six bond issues or less are denoted infrequent issuers. These threshold values are not derived from theory and may therefore seem artificial, since the issue-frequency is observed ex post, while the hypothesis implies that reputation has an ex ante effect on debt maturity. In effect, I make the assumption that an issuer has a given reputation before the start of my sample period and that the in-sample issue-frequency is representative of previous behaviour. Lastly, I categorise one-time issuers separately, resulting in three different groups of issuers; *single* issuers, *infrequent* issuers with 2-6 debt issues and *frequent* issuers with 7 or more issues in total.

1.4. Data and Descriptive statistics

The data set originates from the Dealogic database, containing issue-specific information on Euro-denominated bond issues made by EMU-country residents from January 1st, 1999 to December 31st, 2005.

Raw data comprises 12.060 observations. I eliminate issues by governments[3], supranationals, financial institutions and any linked category based on the issuer type and issuer industry coded in the database. I further exclude floating-rate issues; collateralized or covered bonds; bonds with various embedded option-features; currency-, inflation- or index-

[2] Following Allen N. Berger, *et al* (2005) the one in LN(1+Maturity) is included to avoid taking the log of a value close to zero, which would yield negative log maturities.

[3] Debt issues which have been granted a state-guarantee of repayment are also excluded.

PANEL 1

Full sample		N	Mean	Std.Dev	Min	p10	p25	Median	p75	p90	Max
Dependent variable	Maturity	718	7.812	4.649	1.000	3.003	5.003	7.005	10.005	10.318	50.033
	Jan.99-Jun.02	382	6.683	3.022	1.000	3.003	5.003	7.003	10.005	10.014	20.014
	Jul.02-Dec.05	336	9.132	5.689	1.000	4.874	6.010	7.225	10.008	15.011	50.033
Macroeconomic variables	Slope	84	1.458	0.610	0.140	0.620	1.120	1.545	1.930	2.210	2.510
	Level	84	3.142	0.985	2.030	2.120	2.150	2.940	3.750	4.710	5.090
	Bbbaaa	81	1.178	0.373	0.435	0.811	0.923	1.130	1.347	1.755	2.187
Issue specific variables	Coupon	718	5.851	2.047	2.150	3.750	4.555	5.455	6.375	9.000	14.500
	Size (millions)	718	547.255	550.369	10.000	100.000	200.000	500.000	750.000	1000.000	4500.000
	Bookrun	718	2.264	1.156	1	1	1	2	3	4	8
	Qual	718	3.097	1.712	0	0	2	3	4	6	6
	Sub	718	0.020	0.139	0	0	0	0	0	0	1

PANEL 2

Correlation matrix		Maturity	Slope	Level	Bbbaaa	Coupon	Size	Bookrun	Qual	Sub
	Maturity	1.000								
	Slope	0.151	1.000							
	Level	-0.265	-0.762	1.000						
	Bbbaaa	-0.021	-0.147	0.163	1.000					
	Coupon	0.136	-0.059	0.216	-0.021	1.000				
	Size	0.071	-0.104	0.085	0.108	-0.171	1.000			
	Bookrun	0.220	0.125	-0.236	0.029	-0.205	0.483	1.000		
	Qual	0.108	0.105	-0.165	-0.064	0.573	-0.031	0.015	1.000	
	Sub	0.048	0.057	-0.038	-0.092	0.295	-0.091	-0.061	0.250	1.000

Table 1 **Summary statistics.** Variables are defined as follows: *Maturity* is the maturity of bond *i* measured in years, *Level* is the 3 month EURIBOR-rate, *Slope* is measured as the difference between the yield of 10-year government bonds and the 3-month EURIBOR, *Bbbaaa* is the market credit risk premium measured as the yield spread difference between AAA-rated and BBB-rated corporate bonds observed in the market, *Coupon* is the annualised fixed coupon of issue *i*, *Size* is the amount of debt issued in euros, *Bookrun* is the number of financial institutions involved in the sale of the transaction. *Qual* is a categorical variable identifying the firm's credit rating, where AAA = 1, . . . , CCC = 7 and unrated firms receive a code of 0, *Sub* indicates whether the issued debt is contractually subordinated (=1) or not (=0).

linked bonds; bonds with variable payment schedules; tap-issues[4]; and other irregular features as noted in the database[5]. Unclear entries are cross-referenced with the Thomson ONE Banker database, after which incomplete or missing records are also excluded from the final sample, which thus consists of 718 plain fixed-rate bond-issues by 364 individual non-financial corporate EMU-residents[6]. I use the date of the public announcement of a bond issue to identify it to a specific month in the sample period. Table 1 presents summary statistics for each variable.

Data on interest rates is obtained from the European Central Bank (ECB). All yields are monthly averages quoted at mid-month and weighted by the nominal outstanding amounts of national government bonds in each maturity band. This method is chosen, because at the time of announcing a debt issue, the maturity of the issue has already been selected. Hence, economic conditions affecting the maturity must have been considered prior to the announcement of a debt issue.

International Index Company produces iBoxx bond-indices, which I use for calculation of the credit risk premium between AAA- and BBB-category investment-grade bonds. This data is available from April 1st 1999 onwards.

Rating agency						
Moody's	Standard & Poor's		Value	Obs.	Jan.99-Jun.02	Jul.02-Dec.05
Aaa	AAA	Investment-grade	1	56	33	23
Aa	AA	quality	2	84	59	25
A	A		3	208	94	114
Baa	BBB		4	166	89	77
Ba	BB	Speculative-grade	5	33	11	22
B	B	quality	6	88	36	52
CCC	CCC		7	6	1	5
-	-	Unrated	0	77	59	18
Total				718	382	336

Table 2 Credit rating scales by rating agency. Credit rating categories and their corresponding numerical values, with observations frequencies by debt type.

A credit rating by Moody's, Standard and Poor's or both has been assigned to 641 of the 718 bonds in the sample. I recode the rating categories with integer numbers in ascending order, where the highest AAA/Aaa-rating is coded as "1" and the lowest CCC/Caa is coded as "7". For issues with split ratings, a composite rating is calculated corresponding to an average of

[4] Tap-issues are re-issues of a bond, executed in varying amounts and at different times, usually in response to investor demand. The main terms of the bond (issuing conditions, coupon and maturity) remain unchanged, but the issue price can vary according to market conditions. Tap-issues on bonds are thus left outside the sample, since they would induce a bias as the same bond appears multiple times in the sample.

[5] M. Bradley and M. R. Roberts (2004) show that bond covenants are priced. As such, an analogy could be drawn to the maturity of debt as well, since increased bondholder protection could arguably extend the available term to maturity on newly issued debt. Covenant practices in Europe have traditionally been lax and less adopted compared with the US. In addition, research in the field of debt maturity, whether in the US or Europe, has not either accounted previously for covenants. As a result, the role of covenant protection is not considered in this paper.

[6] All non-financial corporate issuer residing within the EMU-area are considered; Austria, Belgium, Finland, France, Germany, Greece (2001), Ireland, Italy, Luxembourg, Netherlands, Portugal, and Spain. However, issuers in related colonies or territories to EMU countries, such as the French Polynesia or the Netherlands Antilles are omitted. On the other hand, issues by subsidiaries to other than EMU-residents are left in the sample; e.g. Toyota's European arm, Toyota Motor Finance BV located in the Netherlands belongs to the final sample.

the values of the separate ratings assigned by the rating agencies. Unrated issues are coded as zero. The rating scales and their corresponding values are shown in table 2.[7]

1.4.1. Graphical presentation of general statistics

Figure 1 shows six panels on the distribution of issues by rating categories and different maturity classes over the sample period and highlights a few key insights. Panel 1 graphs the stacked movement of the 3-month interest rate, the slope of the yield curve and the market credit risk premium over the sample period. We observe large fluctuations in the short-end level of interest rates in the beginning of the period, while it has remained low and stable during the last three years. The slope of the yield curve has always remained positive, but was almost flat in early 2001. Based on survey results by Graham and Harvey (2001), we can expect that the larger the difference between the slope and level curve, the more attractive is short term debt issuance to firms. We also notice that the peak of interest rate level in late 2000 is higher than the combination of the short-term rate plus the yield curve slope mark-up from mid-2002 onwards. Meanwhile, the market credit risk premium has fluctuated between 0.497 and 2.192, reaching its peak in august 2002. Lastly, we observe that during the last year of the sample period, the overall issuance cost for long term debt including a credit risk premium is lower than the short-end cost of issuance in early 2001, meaning that a high quality firm issuing a short term bond in early 2001 paid a similar or higher fixed coupon than a firm of lower quality with long term maturity debt during the last years included in the sample.

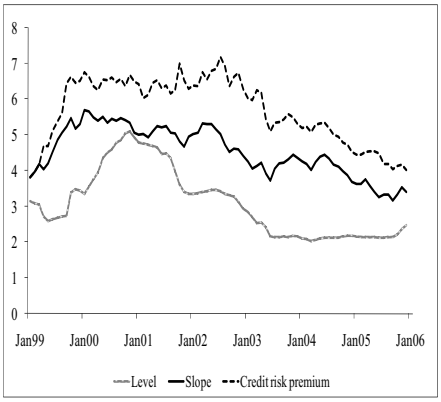
Rating categories A and BBB are predominant among the rated issues represented in the sample, as seen in panel 2. Unrated issues account for roughly 11% of the total number of issues in the sample, but their relative number seems to decrease towards the end of the sample period. By contrast, speculative-grade issues increase in number. In panel 3 we observe that the speculative-grade issuers target almost uniquely the 7-15 year maturity segments and are not present in either very long or short maturity categories, while lower investment-grade categories A and BBB utilise shorter maturities more often. This separation between lower investment-grade and speculative-grade issues follows Diamond (1991a) suggestion that lower quality firms issue longer term debt to minimize liquidity risk problems. Interestingly, almost two-thirds of the unrated issues are shorter than seven years, perhaps reflecting higher information asymmetries due to lacking credit ratings, while the highest quality firms (AAA and AA rated) issue debt in relative terms more evenly over the entire maturity spectrum.

Panel 4 graphs the distribution of issues grouped by maturity classes. Two distinct features can immediately be observed; the diminishing number and quantity of short maturity issues and the birth of bonds with a maturity exceeding 25 years. This may in part be due to the favourable interest rate environment during the latter part of the sample period, but likewise evidence of a maturing and broadening market. The development of the European bond market is visible in panel 5, which shows the average credit rating in each maturity class excluding the unrated issuers. We see that the average numeric credit rating increases, denoting lower credit quality, in virtually all maturity classes over time. This is indicative of the gradual development of the debt capital markets and its ability to absorb a wider variety of debt by issuers of different credit qualities. The phenomenon is especially visible in the categories for bonds with a maturity of 10 to 15 years and 15 to 25 years. Interestingly, the longest dated bonds start with a higher average credit rating (lower credit quality), which is

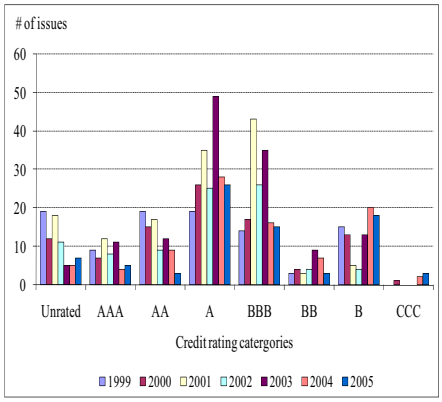
[7] See appendix 1 for a complete summary of the variables and related data sources.

Figure 1 Selected sample statistics presented graphically

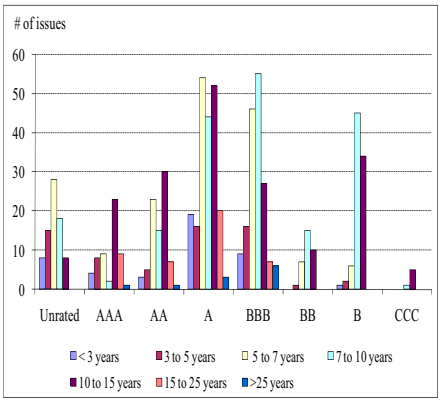
Panel 1



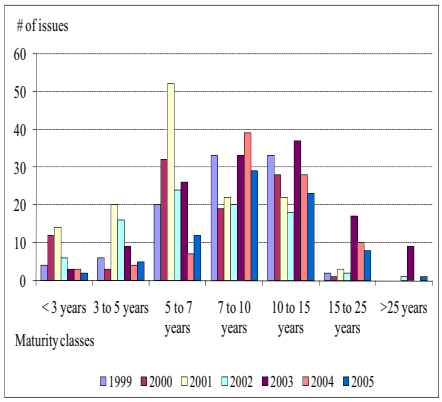
Panel 2



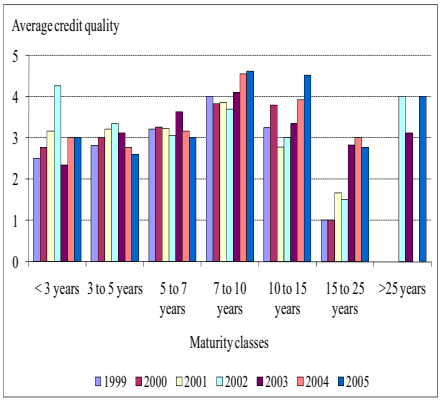
Panel 3



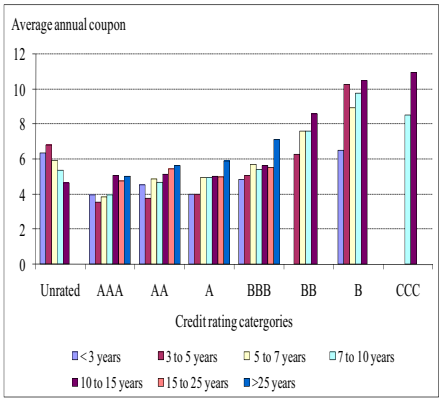
Panel 4



Panel 5



Panel 6



in part due to the relatively few bonds belonging to this category, with only 11 issues at maturities exceeding 25 years during the entire sample period. For instance, the first column in this maturity class corresponds to a single issue made by Olivetti Finance NV, which came to the market with a 30-year bond under a BBB/Baa-credit rating, equalling a numeric value of four. Nevertheless, issuers of lower investment-grade quality have made the inaugural issues of very long-dated bonds[8]. Another noteworthy characteristic is the increase in credit quality (lower numeric rating) in the shortest maturity segment towards the end of the sample period, a time characterized by low interest rates and a steep yield curve. This may again be indicative of Diamond (1991a) argument that high-quality firms issue short when they anticipate beneficial news when coming out of a period of a generally sluggish economic environment. Alternatively, the demand for issues by the highest quality firms in the longer maturity segments may be low, as investors seek higher yields in assets of lower quality firms at times when credit risk premiums are narrow.

Finally, panel 6 of chart 1 presents the average coupon paid in each maturity class grouped by rating categories. It is apparent that longer maturity correlates positively with higher coupon payments. This is mostly true for all issues with a credit rating, while the unrated category displays a negative correlation. I believe this is a result of the diminishing presence of unrated issuers in the market, as we have seen in panel 2, combined with the fact that the majority of issues by unrated firms where initially made in the short maturity segments when interest rates were high. These unrated issuers paid thus a relatively high coupon for short maturity debt, while only a small number of unrated firms secured their funding at lower coupon rates when interest rates were lower with a slightly higher maturity. Also note that unrated issuers are completely absent from maturity classes exceeding 15 years. Another clear feature of the coupon payments is their dramatic increase when credit quality deteriorates to speculative-grade segment, a direct consequence of the higher default rates recorded for the lower quality credits.

1.4.2. Summary statistics by reputation categories

Panels 1 and 2 of table 3 present the average maturity by credit quality and year across the different reputation categories. Overall, we see single issuers being more restricted by maturity than repeating, infrequent issuers, confirmed in panel 3 by the difference in mean test. Issuers deemed frequent issue bonds with comparable average maturity as single issue firms. Maturity exhibits thus a humped shape across the reputation categories, which has parallels to Diamond (1991a) non-monotonic relationship between credit quality and maturity. It would appear that the reputation of an issuer yields similar maturity characteristics as credit quality, where the highest category issues short term debt, the middle category issues long term debt and the lowest category is screened out of the long term segment and forced to issue short. We can also observe that the standard deviation of maturity for both infrequent and frequent issuers is higher than for single issuers. Further, we note that firms lacking a credit rating issue to shortest maturity debt, except for the single observation in the frequent category. Unrated issuers face the highest degree of information asymmetry and may try to signal private information about their credit quality by issuing short term debt, as suggested by Flannery (1986).

[8] The first and only 50-year bond in the sample was issued by Telecom Italia SpA in March 2005, bearing a BBB/Baa-credit rating.

Panel 1	I Full sample			II Single issuers			III Infrequent 2 - 6 issues			IV Frequent Issuers 7 issues or more		
Credit Rating	Mean	Std. dev.	# Obs.	Mean	Std. dev.	# Obs.	Mean	Std. dev.	# Obs.	Mean	Std. dev.	# Obs.
Unrated	5.399	2.244	77	5.076	2.094	57	6.123	2.357	19	10.01	0	1
AAA	9.219	5.348	56	6.255	5.97	4	9.82	5.689	28	9.012	4.872	24
AA	8.368	4.225	84	8.006	3.1	11	8.25	3.51	49	8.774	5.855	24
A	7.835	4.882	208	7.22	2.859	33	8.463	5.457	139	5.976	3.259	36
BBB	7.716	6.007	166	6.644	2.825	30	8.714	6.893	86	6.641	5.542	50
BB	7.795	1.836	33	8.232	1.931	22	6.921	1.303	11	.	.	.
B	8.633	1.818	88	8.685	1.927	58	8.533	1.611	30	.	.	.
CCC	9.782	0.92	6	9.782	0.92	6	.	.	.	.	.	.
Total	7.829	4.634	718	7.165	2.783	221	8.435	5.262	362	7.289	5.056	135

Panel 2	I Full sample			II Single issuers			VI Infrequent			VII Frequent Issuers		
Year	Mean	Std. dev.	# Obs.	Mean	Std. dev.	# Obs.	Mean	Std. dev.	# Obs.	Mean	Std. dev.	# Obs.
1999	7.662	2.833	98	7.326	2.808	31	7.987	2.821	46	7.443	2.954	21
2000	6.768	3.038	95	6.408	2.997	32	7.19	3.185	46	6.303	2.702	17
2001	5.878	2.937	133	5.861	2.177	34	6.251	3.04	69	5.04	3.339	30
2002	6.637	3.877	87	5.171	2.65	24	7.613	4.15	48	5.86	3.925	15
2003	9.954	6.52	134	7.63	2.651	37	10.67	7.073	70	11.29	8	27
2004	8.856	3.817	91	8.788	2.446	35	9.292	4.683	44	7.462	3.482	12
2005	9.103	5.934	80	8.503	1.846	28	10.34	7.92	39	6.696	3.663	13
Total	7.829	4.634	718	7.165	2.783	221	8.435	5.262	362	7.289	5.056	135

Panel 3	Difference in means		Single issuers			Infrequent			Frequent Issuers		
Full sample	Diff.	t-stat	Mean	Std. dev.	# Obs.	Mean	Std. dev.	# Obs.	Mean	Std. dev.	# Obs.
Single - Freq.	-0.124	-0.26	7.165	2.783	221				7.289	5.056	135
Single - Infreq.	-1.27	-3.801***	7.165	2.783	221	8.435	5.262	362			
Infreq,- Freq.	1.146	2.222**				8.435	5.262	362	7.289	5.056	135
Two-sample t test with unequal variances											

Table 3 Average maturities by reputation categories

However, this analysis forgoes the important aspect of overall credit quality. We can read into table 3 and conclude that the average credit quality is increasing (decreasing numerically) with each reputation category and that the credit rating values for single, infrequent and frequent groups are 4.29, 3.27 and 2.84, respectively, ignoring unrated issues. I therefore continue the analysis by regression diagnostics to sufficiently exhaust the variability in credit quality.

1.5. Empirical evidence

Employing the model presented earlier, I evaluate the determinants of debt maturity. Columns I through VI in table 4 present results for regressions including the reputation variable, macroeconomic variables, controls for quality and issues-specific characteristics.

Column I provides a simple regression with reputation dummies as independent variables, where the single-issue category has been dropped. As before, we notice the statistically significant increase in maturity for firms in the infrequent groups. Including dummy

	Dependent Variable : MAT [LN(1+Mat.)]							
	I	II	III	IIII	V	VI	VII	VIII
Independent Variables							Jan99-Jun02	Jul02-Dec05
Slope				-0.083**		-0.293***	-0.171***	-0.303***
				[0.038]		[0.039]	[0.065]	[0.057]
Level				-0.167***		-0.447***	-0.297***	-0.499***
				[0.025]		[0.037]	[0.066]	[0.105]
Bbbaaa				-0.036		-0.175***	-0.199***	-0.163**
				[0.050]		[0.039]	[0.056]	[0.082]
Sub					0.063	0.094*	0.114	0.069
					[0.047]	[0.057]	[0.072]	[0.098]
Size (LN)					0.096***	0.102***	0.101***	0.141***
					[0.024]	[0.019]	[0.025]	[0.032]
Bookrun					0.094***	0.015	0.010	0.002
					[0.019]	[0.016]	[0.025]	[0.022]
Coupon					0.077***	0.271***	0.228***	0.295***
					[0.013]	[0.023]	[0.033]	[0.030]
Reputation dummies								
Infrequent issuer	0.092**		0.079**	0.074**	0.022	0.068**	0.047	0.097**
	[0.036]		[0.037]	[0.034]	[0.036]	[0.033]	[0.047]	[0.047]
Frequent issuer	-0.070		-0.097*	-0.110*	-0.150***	-0.107**	-0.106*	-0.120**
	[0.054]		[0.059]	[0.057]	[0.052]	[0.043]	[0.063]	[0.059]

Continues on next page

Table 4 **Full sample regressions of MAT.** Robust standard errors in parentheses: *** Significant at 1% level, ** Significant at 5% level, * Significant at 10% level. AAA,…, CCC are dummy variables of corresponding credit rating categories, where the omitted base category represents BBB credit quality. Dependent variable MAT is the log of one plus the maturity in years. SIZE is the log of the amount of debt issued in euros. Continues on next page

Credit rating dummies								
AAA		0.388***	0.409***	0.395***	0.503***	0.705***	0.760***	0.582***
		[0.085]	[0.092]	[0.093]	[0.084]	[0.077]	[0.097]	[0.135]
AA		0.350***	0.350***	0.388***	0.353***	0.548***	0.500***	0.587***
		[0.063]	[0.068]	[0.063]	[0.071]	[0.065]	[0.084]	[0.120]
A		0.249***	0.232***	0.201***	0.178***	0.310***	0.208***	0.355***
		[0.055]	[0.057]	[0.053]	[0.064]	[0.059]	[0.079]	[0.105]
BBB		0.232***	0.239***	0.232***	0.122*	0.193***	0.183**	0.176
		[0.056]	[0.057]	[0.053]	[0.063]	[0.058]	[0.071]	[0.110]
BB		0.358***	0.350***	0.289***	0.182***	-0.366***	-0.190*	-0.462***
		[0.055]	[0.057]	[0.059]	[0.064]	[0.087]	[0.108]	[0.145]
B		0.448***	0.439***	0.376***	0.134*	-0.865***	-0.634***	-0.981***
		[0.048]	[0.048]	[0.048]	[0.075]	[0.127]	[0.193]	[0.179]
CCC		0.580***	0.598***	0.472***	0.138	-1.096***	-1.063***	-1.151***
		[0.053]	[0.054]	[0.069]	[0.092]	[0.186]	[0.254]	[0.247]
Constant	2.034***	1.795***	1.776***	2.483***	0.663***	1.728***	1.315***	1.546***
	[0.026]	[0.041]	[0.041]	[0.143]	[0.137]	[0.154]	[0.303]	[0.302]
Observations	718	718	718	693	718	693	357	336
Adjusted R-squared	0.02	0.06	0.08	0.16	0.24	0.49	0.46	0.47

*Robust standard errors in parentheses: *** Significant at 1% level, ** Significant at 5% level, * Significant at 10% level*

Table 4 countinued - Full sample regressions of MAT. Robust standard errors in parentheses: *** Significant at 1% level, ** Significant at 5% level, * Significant at 10% level. AAA,…, CCC are dummy variables of corresponding credit rating categories, where the omitted base category represents BBB credit quality. Dependent variable MAT is the log of one plus the maturity in years. SIZE is the log of the amount of debt issued in euros. Continues on next page

variables for credit quality in column III – with unrated-category being omitted – reinforces the earlier finding that the maturity of issued debt follows a hump-shaped form across the reputation categories. These results seem to tell that the most frequent issuers actually issue the shortest maturity relative to their credit quality.

Estimated coefficients for macroeconomics variables in columns IIII and VI[9] confirm previous findings by Guedes and Opler (1996), Baker, Greenwood and Wurgler (2003) and Bali and Skinner (2006) that firms in the aggregate respond to the level and shape of the yield curve[10] by shortening the maturity of debt as the slope of the yield curve increases or interest rate levels rise. The finding is in contrast with Brick and Ravid (1985) tax-theory, which predicts a positive relationship between the maturity of debt and the SLOPE coefficient.

SIZE-variable appears positive and significant; interpreting the result by assuming that large firms are the most likely candidates to issue sizeable bonds, we can rationalise further that the larger the bond issue, the larger the issuing firm and the longer the maturity of issued debt. This finding gives indirect support for Myers (1977) proposition that smaller (growth) firms issue short term debt to alleviate agency problems, while large, well-established firms issue longer debt. Stohs and Mauer (1996) find moderate empirical evidence to support the theory. By contrast, Guedes and Opler (1996) use firm size as a control for credit quality and attribute their similar finding to Diamond (1991a) model of debt maturity and credit quality, where firms of lower quality (smaller size) are screened out of the long-term end of the maturity spectrum.

The annual coupon of an issued bond (COUPON) is significant at a 1% level, implying that the market seems concerned with the duration, not necessarily the absolute maturity of the issued bond. We observe the effect of including the COUPON variable to the model specifications; coefficients for the credit rating dummies are monotonously increasing with credit quality in columns with the coupon variable included. The result is obvious; as seen in panel 6 of the chart 1, lower quality debt pays a higher coupon to receive funding. Excluding the coupon variable from the regression does not relate the cost of funding (coupon cash flows) to debt maturity. Indeed, sample statistics show that on average, speculative-grade firms issue longer maturity debt than lower investment-grade (A and BBB) firms, while the highest quality issuers receive – on average – longest term on their debt.[11] However, we wish to examine the determinants of debt maturity, where we need to consider the fixed cash flows (coupons) that issuers will make over the lifespan of the debt contract in order to receive such funding. We notice that the debt maturity is determined significantly by the combination of both the credit quality and coupon payments, resulting in the monotonously increasing relationship between credit rating and debt maturity. We also notice a considerable increase in the adjusted R-squared values. All rating dummies are significant at 1% in the full model in column VI. In addition, this methodology allows us to observe an implied credit quality for the omitted dummy category of firms lacking a credit rating based on their position in the maturity spectrum, appearing between low investment-grade (BBB) and high speculative-grade credit quality (BB).

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[9] Since the dependent variable might not be strictly continuous and clustered around maturities, I performed an alternative analysis using an ordered probit regression, where the dependent maturity variable defined by four maturity categories (1-5 years, 6-10 years, 11-15 year and 16+ years). Results are, nevertheless, consistent with the reported figures in table 4.

[10] By including the risk premium BBBAAA variable, I lose 32 observations on individual bond issues from the regressions, since this data is not available before April 1st, 1999.

[11] Table 3, panel 1

Subordinated debt is of longer maturity, as predicted by Diamond (1993). It should be noted that all 16 subordinated debt issues were made by speculative-grade issuers, which are more likely to default on debt than investment-grade issuers. This behaviour follows likewise Diamond's predictions that junior debt is issued to alleviate liquidation in case of default.

The robustness of these findings can be seen in the last two columns in table 3, which splits the sample period in half. No considerable changes in the significance or signs of the variables appear between the two time periods. Also, in separate, unreported regressions I limit the sample by excluding 70 issues belonging to the highest maturity decile to ensure that results are not driven by outlier observations; sensitivities and signs of all variables remain, with the exception of the infrequent category dummy, which shows a reduces explanatory power on maturity, while the frequent group is consistently significant.

1.5.1. Exploring the causality of credit quality and reputation

Table 5 presents separate regression for unrated, investment-grade (IG) and speculative-grade (SG) issues. Column III, showing regressions for IG category, reports similar levels of significance and sensitivities to regression variables as the full model regression in column I, which again is reminiscent of Diamond (1991a) hump-shaped credit quality and maturity relationship. By contrast, we see that the unrated group appears to have a positive coefficient for both reputation dummies and that the frequent issuer-dummy is highly significant.[12] However, the frequent issuer-dummy is represented by a single observation in the regression in column II; one firm issued a single bond in the beginning of the sample period as an unrated issuer, but later obtained a credit rating and subsequently issued several bonds during the entire sample period, thus being allocated to the highest reputation category.

In addition, each rating category coefficient among the investment-grade issuers appear highly significant, consistently following the positive relationship between credit quality and maturity, while credit ratings among issuers of speculative-grade are not significantly different from each other.

It is also worth noting that the different credit quality groups appear to have varying sensitivity to macroeconomic conditions. IG issuers react to changes in the mentioned variables more strongly than unrated or SG issuers, similar to the results by Bali and Skinner (2006). This is equally true if the frequent issuers group is excluded from the regressions (not reported), which would indicate that high quality issuers are more sophisticated than unrated or speculative grade issuers in choosing their maturity in response to market conditions. Alternatively, it could be argued that IG issuers utilize the capital markets as a substitute to bank originated debt when market conditions are favourable, while the two non-investment-grade groups complement their debt funding on the market, thus disregarding market conditions in favour of compensation funding needs.[13]

1.5.2. Regressions by reputation and the determinants of debt maturity

Diamond (1991b) suggests that reputation can help deal with problems involving information asymmetries. Unlike equity markets, where regulation obligates members to reveal information about themselves on a continuous basis, OTC-type bond markets do not have direct mechanisms for providing investors with information on a regular basis. As a

[12] Recall that the reputation variable consisted of three categories; single, infrequent and frequent issuers. The single issuer category has been dropped from the regressions.
[13] Issuers are allocated to their respective categories based on the current rating at the time of issuance.

	Dependent Variable : MAT [LN(1+Mat.)]			
	I	II	III	IIII
Independent Variables	Full sample	Unrated	Inv.grade	Spec.grade
Slope	-0.293***	-0.080	-0.497***	-0.076
	[0.039]	[0.093]	[0.036]	[0.047]
Level	-0.447***	-0.130*	-0.730***	-0.098**
	[0.037]	[0.078]	[0.033]	[0.046]
Bbbaaa	-0.175***	-0.265*	-0.180***	-0.144**
	[0.039]	[0.156]	[0.035]	[0.066]
Sub	0.094*	.	.	0.079**
	[0.057]	.	.	[0.039]
Size (LN)	0.102***	0.002	0.024	0.114**
	[0.019]	[0.068]	[0.016]	[0.049]
Bookrun	0.015	0.005	0.001	-0.001
	[0.016]	[0.048]	[0.015]	[0.020]
Coupon	0.271***	-0.047	0.555***	0.073***
	[0.023]	[0.055]	[0.023]	[0.022]
Reputation dummies				
Infrequent issuer	0.068**	0.079	0.089***	-0.025
	[0.033]	[0.082]	[0.034]	[0.040]
Frequent issuer	-0.107**	0.355***	-0.079*	.
	[0.043]	[0.120]	[0.041]	.
Credit rating dummies				
AAA	0.705***	.		.
	[0.077]	.		.
AA	0.548***	.	-0.231***	.
	[0.065]	.	[0.050]	.
A	0.310***	.	-0.478***	.
	[0.059]	.	[0.045]	.
BBB	0.193***	.	-0.753***	.
	[0.058]	.	[0.048]	.
BB	-0.366***	.	.	.
	[0.087]	.	.	.
B	-0.865***	.	.	-0.060
	[0.127]	.	.	[0.070]
CCC	-1.096***	.	.	-0.086
	[0.186]	.	.	[0.096]
Constant	1.728***	2.861***	2.820***	1.530***
	[0.154]	[0.519]	[0.132]	[0.323]
Observations	693	73	494	126
Adjusted R-squared	0.49	0.31	0.72	0.23

Robust standard errors in parentheses:
**** Significant at 1% level, ** Significant at 5% level, * Significant at 10% level*

Table 5 **Regressions of MAT by credit quality groups.** Robust standard errors in parentheses: *** Significant at 1% level, ** Significant at 5% level, * Significant at 10% level. AAA,…, CCC are dummy variables of corresponding credit rating categories, where the omitted base category represents BBB credit quality. Dependent variable MAT is the log of one plus the maturity in years. SIZE is the log of the amount of debt issued in euros

	Dependent Variable : MAT [LN(1+Mat.)]			
	I	II	III	IIII
	Full sample	Single issuers	Infreq. issuers	Freq. Issuers
Independent Variables			2 - 6 issues	7 issues or more
Slope	-0.284***	-0.133***	-0.442***	-0.336***
	[0.039]	[0.047]	[0.057]	[0.075]
Level	-0.443***	-0.217***	-0.615***	-0.593***
	[0.037]	[0.042]	[0.055]	[0.062]
Bbbaaa	-0.178***	-0.214***	-0.195***	-0.169**
	[0.040]	[0.067]	[0.052]	[0.071]
Sub	0.088	0.086	0.175	0.000
	[0.058]	[0.055]	[0.136]	[0.000]
Size (LN)	0.102***	0.147***	0.072***	-0.007
	[0.019]	[0.037]	[0.026]	[0.028]
Bookrun	0.018	-0.020	-0.007	0.053*
	[0.016]	[0.024]	[0.021]	[0.030]
Coupon	0.272***	0.098***	0.395***	0.504***
	[0.023]	[0.021]	[0.040]	[0.045]
Credit rating dummies				
AAA	0.680***	0.156	0.834***	0.221**
	[0.075]	[0.270]	[0.137]	[0.097]
AA	0.545***	0.442***	0.586***	0.037
	[0.063]	[0.119]	[0.127]	[0.083]
A	0.324***	0.234***	0.381***	-0.273***
	[0.057]	[0.084]	[0.126]	[0.087]
BBB	0.181***	0.126*	0.219*	-0.534***
	[0.056]	[0.070]	[0.128]	[0.087]
BB	-0.355***	0.103	-0.637***	.
	[0.086]	[0.087]	[0.184]	.
B	-0.855***	-0.049	-1.550***	.
	[0.124]	[0.122]	[0.254]	.
CCC	-1.109***	-0.131	.	.
	[0.186]	[0.146]	.	.
Constant	1.667***	1.666***	2.080***	1.786***
	[0.155]	[0.260]	[0.258]	[0.309]
Observations	687	207	352	128
Adjusted R-squared	0.48	0.48	0.53	0.76
F	33.53	14.24	15.62	31.47

Robust standard errors in parentheses:
**** Significant at 1% level, ** Significant at 5% level, * Significant at 10% level*

Table 6 **Regressions of MAT by reputation category.** Robust standard errors in parentheses:
*** Significant at 1% level, ** Significant at 5% level, * Significant at 10% level.
AAA,…, CCC are dummy variables of corresponding credit rating categories, where the omitted base category represents BBB credit quality. Dependent variable MAT is the log of one plus the maturity in years. SIZE is the log of the amount of debt issued in euros.

result, "bondholder value" – a term synonymous with transparency and information content specifically directed to debt investors – has made a debut in recent years to cater information demands specific to debt investors. For individual debt issuers, reputation may be beneficial if it involves bridging information gaps between the issuer and debt investors by repeatedly visiting the market with new debt issues and thereby providing the market with firm specific information.

Table 6 presents regression results for each reputation category. The full-sample regression results in column I are similar to the ones shown in column VI of table 4, with the exception of the SUB-variable which now appears insignificant, although the coefficient is of similar magnitude. Each reputation group appears sensitive to changes in the macroeconomic environment when choosing their maturity. The variable representing the amount of debt issued is significant with a positive sign for all regressions except the highest reputation category, consistent with the size-effect in Myers (1977) agency-cost hypothesis. By contrast, the BOOKRUN variable is significant only in regressions with frequent issuers. The COUPON variable is consistently highly significant and positive.

Recall that the omitted credit rating category is the unrated group of issuers. In the single-issuer group, we find less significant differences between the rating dummies. This would indicate that firms in this particular group of issuers are unable to obtain significantly different maturities on their debt regardless of their credit quality. Or, put in another way, the low reputation of these issuers overwhelms their credit quality, restricting differentiation between the firms in terms of maturity. Also, the COUPON-variable coefficient is lower than in any other reputation group, showing that an incremental increase in coupon payments does not increase the maturity of debt as much as for issuers of higher reputation. Meanwhile, infrequent issuers, that is, issuers with some reputation in the market are highly differentiated by their credit quality.

Interestingly, the BOOKRUN control variable for primary market efficiency appears weakly significant with a positive sign in column IIII. This would indicate that the high reputation issuers are able to secure longer term on their debt due to a larger sales force when issuing debt, a characteristic typical among large firms with many bank relationships to nurture.[14] Thus, it would appear that the placement power at issuance has a relative advantage for the frequent issuers.

1.5.3. Robustness checks

Firms of various industry origins might choose their debt maturity differently, leading to heterogeneity between industry groups. However, of the total number of 34 industry sectors represented in the sample, only nine are present in the frequent issuer category, signifying strong variability between industries to issue bonds. Also, table 7 shows that out of these 34 industries, a cluster of five industry sectors issue half of all the bonds in the sample. The industries[15] roughly correspond to the sectors classified by Bali and Skinner (2006) as having long-term assets on their balance-sheets.

This inevitably gives rise to questions of whether it is plausible to assume that the issuers within each group are homogenous in character or could there exists unobserved heterogeneity *within* an industry groups? Have all firms within industries similar principles of funding their business operations and do they have comparable capital structures? Also,

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[15] The industry sectors include: "Telecoms/Communications", "Energy/Utility", "Automotive", "Food & Drink" and "Retailing & Consumer goods".

	Freq. incl unrated issues	Avg. credit quality excl. unrated issues	Std. dev. of rating	Corresponding credit rating category	Percent of issues	Cum.
Telecoms/Communications	109	4.10	1.18	Baa / BBB	15.18	15.18
Energy/Utility	102	2.65	0.75	A / A	14.21	29.39
Automotive	55	3.40	0.97	A / A	7.66	37.05
Food & Drink	48	3.40	1.17	A / A	6.69	43.73
Retailing & Consumer goods	39	3.82	0.98	Baa / BBB	5.43	49.16
Oil, Coal & Gas	37	2.19	1.31	Aa / AA	5.15	54.32
Engineering	36	3.23	1.81	A / A	5.01	59.33
Construction	35	3.53	0.94	Baa / BBB	4.87	64.21
Chemicals	29	3.93	1.49	Baa / BBB	4.04	68.25
Media & Publishing	29	4.61	1.34	Ba / BB	4.04	72.28
Transport & Shipping	29	2.15	1.56	Aa / AA	4.04	76.32
Railways	22	1.62	0.80	Aa / AA	3.06	79.39
Electronics/Electrical	20	3.17	0.86	A / A	2.79	82.17
Forest products/Packaging	16	5.20	1.21	Ba / BB	2.23	84.4
Hotels & Leisure	12	5.09	0.94	Ba / BB	1.67	86.07
Iron & Steel	11	4.83	0.98	Ba / BB	1.53	87.6
Real Estate	10	3.63	0.74	Baa / BBB	1.39	89
Industrials & Conglomerates	8	3.83	1.17	Baa / BBB	1.11	90.11
Luxury goods	8	4.00	0.00	Baa / BBB	1.11	91.23
Consultancies/Agencies/Services	7	5.40	0.89	Ba / BB	0.97	92.2
Healthcare & Pharmaceuticals	7	3.80	1.30	Baa / BBB	0.97	93.18
Textiles & Clothing	7	5.00	1.73	Ba / BB	0.97	94.15
Aerospace	6	3.83	1.17	Baa / BBB	0.84	94.99
Computers/Software	6	6.25	0.50	B / B	0.84	95.8
Public works/Public services	6	4.00	0.00	Baa / BBB	0.84	96.66
Glass & Ceramics	5	6.00	0.00	B / B	0.7	97.35
Metals & Ores	4	5.33	1.15	Ba / BB	0.56	97.91
Agribusiness	3	4.00	1.73	Baa / BBB	0.42	98.33
Mining	3	3.00	2.00	A / A	0.42	98.75
Rubber & Plastics	3	5.00	1.41	Ba / BB	0.42	99.16
Airline	2	3.00	0.00	A / A	0.28	99.44
Manufacturing	2	6.00	0.00	B / B	0.28	99.72
Tobacco	1	4.00	0.00	Baa / BBB	0.14	99.86
Trading & Dealing	1	4	0.00	Baa / BBB	0.14	100
Total	718				100	

Table 7 Issue frequency and average credit quality by industry sector

recall that only a limited number of individual issuers are actually categorised as frequent, while the number of issues by members of this category is high, meaning that multiple issues by individual firms are present in the regressions of frequent issuers. Could this induce a selection bias between the reputation groups?

To answer these questions, I perform a final set of regressions on the sub-samples of frequent and infrequent issuers with firm fixed effects included; table 8 presents the results of these regressions, where the similarities with previous regressions are noticeable. Macroeconomic variables do not show any significant changes compared with previous regressions in table 6. The first apparent difference is the lack of significance for the SIZE-variable in the sub-groups of the repeating issuers. Secondly, we observe that the subordinated debt dummy variable appears significant for the infrequent issuer group, supporting theoretical predictions by Diamond (1993) that the maturity of junior debt has longer term than senior debt. Third, we observe again a positive and significant BOOKRUN-variable for in the column IIII representing regressions for the highest reputation group.

Firm fixed effects regressions	Dependent Variable : MAT [LN(1+Mat.)]			
	I	II	III	IIII
	Full sample	Single issuers	Infrequent issuers	Frequent Issuers
Independent Variables		OLS	2 - 6 issues	7 issues or more
Slope	-0.425***	-0.119***	-0.405***	-0.417***
	[0.071]	[0.045]	[0.072]	[0.074]
Level	-0.534***	-0.195***	-0.488***	-0.599***
	[0.071]	[0.029]	[0.070]	[0.064]
Bbbaaa	-0.232***	-0.153**	-0.232***	-0.278***
	[0.063]	[0.064]	[0.068]	[0.062]
Sub	0.635***	0.095	0.607***	.
	[0.124]	[0.058]	[0.113]	.
Size (LN)	0.091**	0.205***	0.081*	0.029
	[0.039]	[0.032]	[0.043]	[0.033]
Bookrun	-0.003	-0.037	-0.042	0.070**
	[0.046]	[0.024]	[0.046]	[0.035]
Coupon	0.363***	0.070***	0.298***	0.484***
	[0.061]	[0.008]	[0.058]	[0.047]
Constant	1.937***	1.432***	2.479***	2.032***
	[0.255]	[0.249]	[0.314]	[0.277]
Firm dummies	Yes	No	Yes	Yes
Observations	693	213	352	128
Number of issuers	356	213	128	15
Adjusted R-squared	0.65	0.48	0.66	0.77

Robust t statistics in parentheses:
**** Significant at 1% level, ** Significant at 5% level, * Significant at 10% level*

Table 8 Fixed effects regressions of MAT by reputation categories.

Employed model : $MAT_{ti} = \alpha_i + \beta1*LEVEL_t + \beta2*SLOPE_t + \beta3*BBBAAA_t + \beta4*COUPON_i + \beta5*SIZE_i + \beta6*BOOKRUN_i + \beta7*SUB_i + \beta7*\text{Firm dummies}_i + \varepsilon i$

AAA,…, CCC are dummy variables of corresponding credit rating categories, where the omitted base category represents BBB credit quality. Dependent variable MAT is the log of one plus the maturity in years. SIZE is the log of the amount of debt issued in euros.

1.6. Discussion and conclusions

The main finding in this paper suggests that repeated bond issues bridge information gaps and firms with multiple issues are rewarded with market recognition and increase flexibility in choosing the maturity of issued debt.

Maturity choice is largely dependent on the prevailing macroeconomic conditions. I confirm previous by findings by Guedes and Opler (1996), Baker, Greenwood and Wurgler (2003) and Bali and Skinner (2006) that firms choose the maturity of incremental debt issues with changes in the level and slope of the yield curve by shortening the term on debt as short-end interest rates or yield curve rise. The result is, however, in contrast with the tax-hypothesis by Brick and Ravid (1985), who predicted a positive relationship between the slope of the yield and maturity of debt.

Nevertheless, while this is true in the aggregate, I observe significant variations in the sensitivity to these macroeconomic conditions depending on the issuer's over credit quality, which could indicate that issuers of varying credit worthiness utilize the markets in different ways; whereas investment-grade issuers are highly responsive to changes in the macroeconomic environment, the same is not true from wholly unrated issuers or issuers of speculative-grade quality. The latter two may turn to funding from the capital markets when other sources of debt capital are exhausted and the need for capital is acute.

Issuers deemed frequent or infrequent are also of higher credit quality than one-time issuers. While Bali and Skinner (2006) find substantial variation in debt maturity within credit categories, we have observed that frequent issuers and one-time issuers have a similar average maturity of issued debt, but frequent issuers display greater variation on the debt maturity for different qualities of credit. Thus, variability in maturity is not only conditional on credit quality alone, but also related to the reputation of an issuer.

Unlike investment-grade issuers, the frequency of issue bears no effect on the speculative-grade issuers, who do not see an increase in the variability of debt maturity for more frequent issuers. It would also appear that the most frequent, good quality issuers are not inclined to extend their debt maturity through bond markets. The frequent use of bond markets as a source of debt capital may be a result of firm specific funding policies, but these firms seem to consider the general economic conditions a as a prominent driver of maturity choice. By contrast, infrequent issuers seek the longest maturities in the market and similar to single issuers, they time the market by altering their debt maturity according to prevailing economic conditions. It may be that firms in the infrequent group have knowingly set out to build a reputation, in order to access the longer term on debt available in the capital markets.

Subordination of debt is issued with a longer maturity than senior debt. Similar to theoretical predictions by Diamond (1993), issuers of subordinated debt are of lower credit qualities, thus at a higher risk of default and a possible liquidation, which the lower debt status seeks to alleviate. The European capital markets have also had an increasing appetite for lower credit qualities and I have documented the growth of the so called junk bond market in Europe.

Finally, I contribute to previous literature by showing that controlling for coupon payments yields a monotonically decreasing risk-maturity relationship, whereas omitting this control produces on non-monotonic relationship between credit quality and debt maturity similar to Diamond (1991a). While speculative-grade quality firms issue on average longer term debt than lower investment-grade issuers, they are screened out of the longest maturity segments due to increased costs in terms of annualised coupon payments.

I have also shown that the implied credit quality of issuers without a credit rating lies on the edge of speculative-grade and investment-grade credit quality. An interesting extension to the presented empirical evidence would be to assess whether the lack of a credit rating alone determines the debt maturity available to these issuers or whether the term of debt for unrated issuers is driven by firm-specific characteristics, which the market correctly recognises. If the first alternative would turn out to be true, it would be a strong signal of the significance of credit rating agencies as agents in bridging gaps in information asymmetries on the debt capital markets.

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APPENDIX 1 VARIABLES AND DATA SOURCES

Variable	Data description	Intervall	Data source
BOOKRUN	Number of financial insitutionals (bookrunners) involved in the sale of a given issue.	Per issue	Dealogic
COUPON	Annualized fixed coupon of a given issue.	Per issue	Dealogic
MAT	Log of one plus the maturity in years of given issue, calculated as the difference between the closing date and the final maturity date of a that issue.	Per issue	Dealogic
RATING	Category variable for credit ratings. For split rating an average rating is calculated based on the assigned values. See table	Per issue	Dealogic
SIZE	Log of the total size denominated in million euros of a given issue .	Per issue	Dealogic
SUB	Category variable, indicating if the debt issued has junior status. Has a value of 1 if subordinated, 0 otherwise.	Per issue	Dealogic
LEVEL	3 month euribor rates	Monthly	European central bank
SLOPE	Yield difference between 10 year harmonized goverment bond and 3 month euribor rate. Bond yields are quoted mid-month and represent the average yield calculated on the basis of harmonised national government bond yields weighted by the nominal outstanding	Monthly	European central bank
BBBAAA	Yield difference between market indices for BBB-rated and AAA-rated bonds.	Monthly	International Index Company: iBoxx indices

RIDING A ROLLERCOASTER OR THE MERRY-GO-ROUND? MARKET TIMING AND THE CHOICE OF INTEREST RATE EXPOSURE ON CORPORATE DEBT

Abstract

This paper examines the original interest rate exposure of debt for incremental corporate debt issues in the absence of derivatives. I find that firms time their interest exposure with market movements and show that the maturity of debt is by far the strongest driver for the choice of debt type. In addition, my results follow model predictions by Longstaff and Schwartz (1995), who suggests higher portions of fixed rate debt when interest rates are below their long-term averages, a strong characteristic of the post-Euro times.

Keywords: interest rate exposure, market timing, macroeconomic, corporate bonds, debt maturity, credit quality

JEL Classifications: G15, G32

1.1. Introduction

This paper examines the determinants for the original interest rate exposure on incremental corporate debt issues. Choosing between fixed or floating rate debt constitutes a fundamental decisions in a firm's funding management; the interest rate exposure on issued debt is a critical risk component on corporate balance sheets and different interest rate environments may provide firms with various opportunities to fund themselves cost efficiently by choosing an appropriate interest rate exposure.

Previously, the literature has been preoccupied studying the use of derivatives and arguing what *final* risk exposure firms ought to have[1], although many authors have reported that the use of derivates and their effect in risk management may be rather limited. Covitz and Sharpe (2005) find that larger firms tend *not* to limit their interest rate exposure through the use of derivatives, but by structuring their initial debt exposure to achieve a desired end result. Guay and Kothari (2003) study whether financial derivatives are an economically important component of corporate risk management and find evidence to suggest that the magnitude of the derivatives positions held by most firms is economically small in relation to their risk exposures. They note that "*the median firm holds derivative securities that could hedge only 3% to 6% of its aggregate interest rate and currency exchange rate exposures.*" A qualitative survey among US chief financial officers conducted by Graham and Harvey (2001) shows that interest rate timing is important factor when firms are preparing debt issues.[2]

Meanwhile, Faulkender (2005) studies the hedging and market-timing behaviour of firms by considering the *final* interest rate exposure of both bank and market originated debt. The study reveals that among the corporate bonds included in the studied sample, only 7% were actually swapped in order to alter the interest exposure of the original issue. Faulkender finds that firms do engage in market timing through the use of derivatives but do not hedge cash-flows.

Thus, there appears to be a void in the current empirical literature and it would seem reasonable to study specifically the drivers affecting the original interest rate exposure of debt *sans* derivative-instruments. The choice of studying the initial debt type of incremental debt issues on the Euro-denominated capital market is therefore motivated by several factors; first, focusing my study on the original interest rate exposure of market-based debt yields also a greater insight into how firms approach and tap the debt capital market under different interest rate environments. Second, this approach provides straightforward evidence on firm risk-management strategies on a market absent of bank monitoring. Third, my sample of transaction-level observations, as opposed to measurements and proxies on entity-wide debt structure, produces well-defined and verifiable points in time at which an issue has been launch under specific interest rate regimes and with accurate descriptions on the characteristics of individual debt issues. Fourth, by effectively utilising data at hand, I am able to include variables motivated by the theoretical literature to control for the

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[1] See e.g. Covitz and Sharpe (2005), A. Purnanandam (2004), J. R. Graham and D. A. Rogers (2002) and G. W. Fenn, M. Post, and S. A. Sharpe (1996) for cross-industry studies on the determinants of firms' use of derivatives and Michael Faulkender (2005), G. D. Haushalter (2000), and P. Tufano (1996) for industry-specific studies. Wayne Guay and S. P. Kothari (2003)examine the quantitative relevance of firms' derivatives holdings.

[2] Critique has also been raised about the literatures tendency to label only those using derivatives as hedgers, while interest rate risk management is certainly considered even in the absence of derivative instruments (see e.g. M. A. Petersen and S. R. Thiagarajan (2000).) However, the approach adopted in this paper identifies the choice of interest exposure from a cost efficiency perspective, much like responses suggests in the survey by John R. Graham and Campbell R. Harvey (2001)

heterogeneous characteristics of the bond issues. And finally, the adopted approach allows for a sample size considerably larger in cross-section than in the Faulkender (2005) study, which is limited to a single industry sector. To the best of my knowledge, there are no similar studies to be found in the current empirical literature.

Results show that the maturity of debt is by far the strongest driver for the choice of debt type; longer term to maturity increases the likelihood of fixed rate debt. Further, firms do time the market, although I find evidence of timing behaviour which is partly opposite to previously reported findings by both Faulkender (2005) and Vickery (2005). My results follow, however, model predictions by Longstaff and Schwartz (1995), who suggests higher portions of fixed rate debt when interest rates are below their long-term averages, a strong characteristic of the post-Euro times.

This paper is organised as follows. Section 2 review related theoretical and empirical literature. Section 3 presents the research methodology, while section 4 provides an overview of the data utilised in the study and definitions for relevant variables. Empirical results are given in section 5, including various robustness checks. In section 6 I discuss some of the results and finally, section 7 gives conclusions on the findings in this paper.

1.2. Review of related literature

Floating-rate debt represents essentially a security consisting of consecutive short-term contracts priced with the same credit risk premium over the entire lifespan of the agreement, but adjusted periodically for the underlying interest rate movements, while a fixed rate contract locks the periodical coupon payments of the contract until maturity. The choice between the two may be driven by firms trying to time the market, that is, firms borrow floating-rate debt when the perceived cost of borrowing floating-rate debt is lower than the fixed rate debt and vice-versa. Thus, according to a general market-timing view, when the yield spread between long and short-term debt increases, firms are more likely to borrow floating-rate debt. A qualitative survey among US chief financial officers conducted by Graham and Harvey (2001) shows that interest rate timing is important factor when firms are preparing debt issues.

Choosing a particular interest rate exposure may also be a way of signalling firm quality. Guedes and Thompson (1995) develop a model in which the riskier choice of debt signals favourable news about firm quality. Their model does not associate the level of risk as being explicitly higher for floating or fixed rate debt per se, but rather, either security type can increase the likelihood of financial distress depending on the relationship between expected real rates and inflation volatility. Fixed rate debt is preferred when real market interest rates fluctuate more relative to inflation, while times characterised by relatively higher expected inflation volatility favours floating rate debt. Bearing floating rate debt during periods of higher inflation volatility stabilises operating income after interest expenses, since the inflation component is reflected both in gross operating income and nominal interest rate expenses payable by firms. Thus, choosing debt that is destabilising cash-flows and therefore riskier is considered a signalling superior firm quality. Flannery (1986) creates a model based on information asymmetries in which frequent refinancing of debt incurs costs. Short-term and more information sensitive debt is issued by firms trying to signal their quality, while firms unable to pay these transaction costs issue long term debt and are perceived to be lower quality. Building on the Flannery's (1986) work, Titman (1992) presents a model where interest rate uncertainty subjects firms to greater likelihood of financial distress. An increase in interest rate volatility may induce firms to issue long-term debt despite otherwise preferring to issue short-term debt due to reasons of information asymmetry.

Research on the predictive power of the term structure of interest rates is vast and rich on many models and empirical studies explaining the relationship between yield curve movements and economic conditions (see e.g. Estrella and Hardouvelis (1991), Campbell (1995), Estrella (2005).) Building empirical work on these theories, Faulkender (2005) examines the final interest rate exposure for firms in the chemical industry and finds that i) firms choose fixed rate exposure when economic conditions are expected to worsen, ii) firms engage in market timing through the use of derivatives but do not hedge cash-flows; and iii) the slope of the yield curve at the time of the debt issue determines whether firms use interest rate swaps to alter the interest rate exposure of their debt. In a similar study, Vickery (2005) examines the interest rate exposure choices of small firms and finds evidence suggesting that high real interest rates and a steep yield curve are correlated with a lower proportion of fixed debt. Vickery (2005) also reports that small loans, which he considers a proxy for firm size, are more likely to be fixed rate loans.

Other empirical studies have examined the floating rate share of firms' liability structure: Chava and Purnanandam (2007) examine how managerial incentives affect the ratio of floating rate debt. While their sample of firms include only of a small number of firms with public debt issues, they report that smaller firms with more valuable growth options and closer to financial distress adopt conservative debt financing strategy by maintaining lower levels of floating-rate debt, similar to Vickery (2005). By contrast Covitz and Sharpe (2005) find that smaller, lower-rated firms tend to have greater initial interest rate exposures on their total liabilities compared with larger firms and that larger firms tend not to limit their interest rate exposure through the use of derivatives, but by structuring their debt directly to fit desired risk exposure strategies. However, the public capital market in itself is not an arena open to every firm. Cantillo and Wright (2000) develop a model to predict how firms choose their lenders. They show empirically that larger, more transparent firms tap the public debt markets, whereas smaller firms are limited to the bank market. Similarly, Diamond (1991) shows that higher quality firms issue public debt, while firms of lower credit worthiness access debt funding through banks acting as monitoring lenders. Faulkender (2005) provides evidence that larger, more profitable firms are more likely to issue fixed rate debt, while smaller, less profitable firms issue floating rate debt. Faulkender (2005) argues that this is partly dependent on market segmentation, where only larger firms are able to access public markets to issue fixed rate debt, while smaller firms are restricted to floating rate bank debt. The paper provides an alternative explanation that fixed rate debt is more expensive and smaller, less profitable firms prefer to bear the interest rate risk associated with the less expensive floating rate debt.

The term to maturity of debt is also reflected in the choice of interest rate exposure. Longstaff and Schwartz (1995) derive a model for valuing floating and fixed rate debt, which considers both the likelihood of default for risky debt and interest rate risks. They show that a floating-rate payment can be less valuable in the short term and that the value can be an increasing function of the time until payment when interest rates are below their average long-run levels. This in turn implies that floating rate debt is less favourable than fixed rate debt during periods of low interest rate, since floating rate payments are valued lower relative to fixed rate payments.

1.3. Research strategy

Previous research suggests that using derivatives to alter interest rate exposure is limited (Guay and Kothari (2003)) and larger firms, with access to capital markets, generally issue debt which directly fits their risk management strategies (Covitz and Sharpe (2005).) Therefore, it seems motivated to study explicitly the determinants of the original interest exposure of newly issued debt. By examining incremental debt issues, I am able to study a

wide cross-section of issues over a long time-period and by focusing on market-based debt, I gain insight into how firms access the debt capital market under different interest rate environments. The strength of the incremental debt approach lies in that individual observations on debt are exact and easily identified in time, while a weakness may be the wide variation in debt issue characteristics. As a result, my model includes variables to control for the varying characteristics of the bonds in the final sample. Focusing solely on bond issues, as I do, has another weakness in that it evades the issue of dealing with the overall interest rate exposures of individual firms. While the argument is true in part, it undermines the value of understanding how directly place debt is utilised by firms. By concentrating on this particular segment of debt, I am able to study a wide range of debt issues, compared with many earlier studies on narrow samples or pooled estimates on liability structures. The obvious shortcomings of the incremental approach should therefore be more than outweighed by the new insight into firms' issuance behaviour on the European debt capital market. Thus, I examine the determinants of the original interest rate exposure by performing bivariate analysis on the choice of debt type under varying macroeconomic conditions with controls for both firm quality and various issue specific characters.

The dependent variable is dichotomous, with a value of 1 if debt is issued as floating rate and 0 if it is fixed. In my analysis, I consider the slope of the yield curve and the short-end level of interest rates as my primary macroeconomic variables. These variables convey information about the current state of the economy and provide indicators of future economic activity (see e.g. Estrella and Hardouvelis (1991), Campbell (1995), Estrella (2005).) If the macroeconomic environment affects a firm's choice of debt, these variables should capture such behaviour. I also include a variable for market credit-risk premiums, since investor's credit risk appetite tends to change over time, which is translated to fluctuations in funding costs for individual firms. The credit risk-premium variable is defined as the average credit spread between AAA-rated and BBB-rated corporate bonds.

Higher degree of uncertainty about the future state of the economy increases the likelihood of financial distress and may as a consequence affect the choice of interest rate exposure. To quantify potential sources of uncertainty firms may face in their considerations for debt type, I include variables on inflation, short-term interest rate volatility and the volatility of 10-year interest rate swaps as suggested by models by Titman (1992) and Guedes and Thompson (1995). I use daily observations of ten-year interest rate swaps to estimate monthly volatility as a measure of future uncertainty. Choosing swap data for the volatility measure instead of corresponding government bond data is motivated by the fact that the European bond markets use interest rate swaps as the standard benchmark yield curve for non-sovereign bond issues (see e.g. Danthine, Giavazz and Thadden (2000) and Casey and Lannoo (2005)). Data on interest rate swaps is also more reliable due to the high liquidity of the swap market, compared with the alternative of using synthetically constructed sets of daily bond yield data.

Unlike previous empirical studies, I include the maturity of debt as a variable in the model as suggested by Guedes and Thompson (1995)[3]. Bridging together Titman's (1992) argument of signalling through interest rate sensitive debt with predictions by Flannery (1986) that higher quality firms issue shorter maturity debt to signal their quality with, suggests that longer maturity debt is more likely issued with fixed coupon payments, while higher quality firms issue floating-rate, short-term debt.

[3] The model given by J. Guedes and R. Thompson (1995) argues that a positive correlation between firms' cash-flows and interest rates favours floating rate debt. However, as debt maturity increases the long-run correlation may be less obvious and fixed rate is preferred. While their own empirical work lacks controls for debt maturity, the authors note that maturity is a possible determinant of the choice interest rate exposure.

Other issue specific variables include in the model are issue size, the credit quality of the firm and term to maturity of the issued debt and industry sectors. If firms are trying to signal their superior quality by issuing interest rate sensitive debt, the expectance would be that lower quality firms issue more fixed rate debt than high quality issuers. By contrast, Covitz and Sharpe (2005) find evidence that larger firms issue proportionally more fixed rate debt, assuming that issue sizes are related to firm size.

1.4. Data and descriptive statistics

My data set originates from the Dealogic database, containing issue-specific information on Euro-denominated bond issues made by EMU-country residents from January 1st, 1999 to November 31st, 2006. The study is restricted to include debt issued by non-financial firms; excluding the financial sector allows a better comparison with earlier empirical literature, which has focused almost exclusively on non-financial firms.

Raw data comprises 14.902 observations. I eliminate issues by government[4], supranationals, financial institutions and any linked category based on the issuer type and issuer industry coded in the database. I further exclude collateralized or covered bonds; bonds with various embedded option-features; subordinated bonds; currency-, inflation- or index-linked bonds; bonds with uneven payment schedules; tap-issues[5]; and other irregular features as noted in the database. Unclear entries are cross-referenced with the Thomson ONE Banker database and internet sources when available. Incomplete or missing records are excluded from the final sample, which consists of 1353 plain vanilla bond-issues by 423 individual non-financial corporate EMU-residents[6]. I use the date of the public announcement to identify a bond to a specific month in the sample period.

Data on interest rates representing the yield curve is obtained from the European Central Bank (ECB). All yields are monthly averages and weighted by the nominal outstanding amounts of national government bonds in each maturity band. The slope of the yield curve is defined as the difference between 10-year government bonds and the 3-month Euribor rate. Annual inflation data is provided by Eurostat. Monthly volatility (annualized standard deviation) measures are calculated from log changes in respective daily quotes on 3-month and 12-month Euribor rates and 10-year interest rate swaps obtained from Reuters. International Index Company produces iBoxx bond-indices, which I use for calculation of the credit risk premium between AAA- and BBB-category investment-grade bonds. iBoxx-data is available from April 1st 1999 onwards.

A credit rating by Moody's, Standard and Poor's or both has been assigned to 1244 of the 1353 bonds in the sample. I recode the rating categories with integer numbers in ascending order, where the highest AAA/Aaa-rating is coded as "1" and the lowest CCC/Caa is coded as "7". For issues with split ratings, a composite rating is calculated corresponding to an average of the values of the separate ratings assigned by the rating agencies. Unrated issues

[4] Debt issues, which have been granted a state-guarantee of repayment, are also excluded.

[5] Tap-issues are re-issues of a bond, executed in varying amounts and at different times, usually in response to investor demand. The main terms of the bond (issuing conditions, coupon and maturity) remain unchanged, but the issue price can vary according to market conditions. Tap-issues on bonds are thus left outside the sample, since they would induce a bias as the same bond appears multiple times in the sample.

[6] All non-financial corporate issuer residing within the EMU-area are considered; Austria, Belgium, Finland, France, Germany, Greece (2001), Ireland, Italy, Luxembourg, Netherlands, Portugal, and Spain. However, issuers in related colonies or territories to EMU countries, such as the French Polynesia or the Netherlands Antilles are omitted. On the other hand, issues by subsidiaries to other than EMU-residents are left in the sample; e.g., Toyota's European arm, Toyota Motor Finance BV located in the Netherlands belongs to the final sample.

are coded as zero. The rating scales, corresponding values and issue frequencies are shown in table 1.

Rating agency						
Moody's	Standard & Poor's		Value	Obs.	# fixed	# floating
Aaa	AAA	Investment-grade	1	117	66	51
Aa	AA	quality	2	156	102	54
A	A		3	558	243	315
Baa	BBB		4	279	196	83
Ba	BB	Speculative-grade	5	42	36	6
B	B	quality	6	85	80	5
Caa	CCC		7	7	5	2
Ca	CC		8	0	.	.
C	C		9	0	.	.
D	D		10	0	.	.
-	-	Unrated issuers	0	109	84	25
			Total	1,353	812	541

Table 1 **Credit rating categories.** Credit rating categories and their corresponding numerical values, with observations frequencies by debt type**.**

Firms in the sample are represented by 34 different industry sectors. For later regression diagnostics, I compose four super-categories based on industry definitions by Fama and French (F&F)[7]. The original F&F-industry classification includes five industry categories (Consumer/Wholesale/Retail, Manufacturing/Energy/Utility, High-technology, Healthcare and Other), but due to a small number of issues by relevant firms in the "Healthcare" category, I merge it with the "Other" category, resulting in a total of four super-categories, named hereafter in short Consumer, Manufacturing, Hitech and Other.

Table 2 presents summary statistics for the regression variables. Panel 1 shows central statistics for macroeconomic variables observed at monthly intervals. The slope of the yield curve remains positive throughout the sample period, while the short-end interest rate variable Level corresponding to the 3m Euribor rate has fluctuated between a low of 2.03 (March 2004) and a high of 5.09 (November 2000) over the sample period. Data for the credit risk variable Bbbaaa is only available from April 1999 onwards, resulting in 92 monthly observations until November 2006. The second panel in table 2 displays the issues-specific variables by issue-type and reports results for a difference in means test in column IIII. Consistent with findings by Covitz and Sharpe (2005), debt issues with fixed coupon payments are significantly larger in size compared to floating rate issues. The average credit quality score excluding unrated (zero coded) issuers is higher for fixed rate issuers, indicating a lower firm quality among issuers of fixed rate debt. We notice also that fixed rate issues have a longer term to maturity. These observations follow Flannery's (1986) and Titman's (1992) predictions that both longer term and fixed rate debt tend to be of lower credit quality. Panel 3 presents annual statistics for selected variables. Columns I and II show the average amount issued in Euros and the number of issues in brackets for fixed and floating rate debt, respectively. The cumulative size of fixed rate issues is consistently larger than floating rate issues, while there are two years – 2004 and 2006 – during which the number of floating rate issues exceeded that of fixed rate issues. Inflation rose in the beginning of the sample period, but settled then to levels slightly above 2%. Meanwhile, the market credit-risk premium nearly doubled from an annual average of 0.852 in 1999 to 1.593 in 2002 in the midst of corporate scandals and high profile bankruptcies, but narrowed again sharply towards the end of the sample period. Finally, panel 4 presents a correlation matrix

[7] Available at http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/det_5_ind_port.html

PANEL 1 : Macroeconomic variables

Full sample	N	Mean	Std.Dev	Min	p25	Median	p75	Max
Slope	95	1.395	0.629	0.14	0.88	1.48	1.9	2.51
Level	95	3.112	0.931	2.03	2.15	2.99	3.54	5.09
Bbbaaa	92	1.129	0.367	0.435	0.871	1.07	1.306	2.187
Inflation	95	2.078	0.443	0.79	1.9	2.1	2.38	3.12
3m Eurib. vol.	94	0.067	0.071	0.008	0.026	0.042	0.09	0.453
10y swap vol.	94	0.132	0.039	0.055	0.101	0.126	0.161	0.294

PANEL 2 : Issue-specific variables

	I : Full sample		II : Fixed rate issues		III : Floating rate issues		IIII : Difference in means	
	Mean	# Obs.	Mean	# Obs.	Mean	# Obs.	[II] - [III]	t-stat
Maturity	5.737	1353	7.754	812	2.709	541	5.045	26.696***
Size	429.264	1353	545.827	812	254.312	541	291.515	11.717***
Credit qualilty	3.206	1244	3.404	728	2.926	516	0.477	7.303***
							Unequal variances	

Continues on next page

Table 2 **Summary statistics.** *Level* is the monthly average of the 3m Euribor, *Slope* is the difference between 10-year government bonds and the 3-month Euribor rate. *Bbbaaa* is the credit spread between AAA and BBB rated corporate bonds in the market. *Inflation* is the annual Eurozone inflation. Annualized volatility measures are the calculated from log changes in daily over the trailing month. *Size* is the size of the bond issue in Euros and *Maturity* is the term to maturity of an issue measured in years. Mean values for credit quality are calculated based on the corresponding numeric values in Table 1, excluding 0-coded, unrated issuers.

PANEL 3 : Annual statistics

	I	II	III	IIII	V	VI	VII	VIII
Year	Fixed Eur {Obs}	Floating Eur {Obs}	Avg.yield 3m Eurib.	Avg.diff. 10y - 3m	Avg. Bbbaaa	Avg. Inflation	St.dev Inflation	Avg. 3m vol.
1999	467.1 {101}	330.1 {42}	2.918%	1.818%	0.852	1.107%	0.237	0.123
2000	421.8 {96}	334.9 {65}	4.497%	0.956%	1.032	2.114%	0.278	0.088
2001	684.1 {139}	348.1 {52}	4.328%	0.722%	1.304	2.414%	0.402	0.115
2002	551.8 {98}	149.6 {82}	3.355%	1.687%	1.593	2.275%	0.234	0.045
2003	604.1 {132}	159 {55}	2.319%	1.821%	1.435	2.033%	0.161	0.063
2004	447.2 {91}	222.7 {99}	2.105%	2.076%	0.915	2.142%	0.276	0.042
2005	458.8 {79}	211.1 {50}	2.168%	1.299%	0.865	2.149%	0.184	0.025
2006	653.8 {76}	314.9 {96}	3.047%	0.784%	0.827	2.169%	0.326	0.040
Avg.	545.8 {102}	254.3 {68}	3.108%	1.399%	1.127	2.077%	0.443	0.067
Total	4288.7 {812}	2070.5 {541}						

PANEL 4 : Correlation matrix

	Slope	Level	Bbbaaa	Inflation	3m vol	10y vol	Maturity	Size	Vif
Slope	1.000								2.84
Level	-0.697	1.000							2.30
Bbbaaa	0.030	0.184	1.000						1.58
Inflation	-0.315	0.246	0.214	1.000					1.28
3m Eurib, vol	-0.021	0.268	0.206	-0.053	1.000				1.21
10y swap vol.	0.469	-0.515	0.002	-0.277	0.123	1.000			1.19
Maturity	0.069	-0.144	0.021	-0.019	0.003	0.040	1.000		1.09
Size	-0.090	0.078	0.036	0.028	0.078	-0.073	0.231	1.000	1.08

Table 2 **Summary statistics continued.** *Level* is the monthly average of the 3m Euribor, *Slope* is the difference between 10-year government bonds and the 3-month Euribor rate. *Bbbaaa* is the credit spread between AAA and BBB rated corporate bonds in the market. *Inflation* is the annual Eurozone inflation. Annualized volatility measures are the calculated from log changes in daily over the trailing month. *Size* is the size of the bond issue in Euros and *Maturity* is the term to maturity of an issue measured in years. Mean values for credit quality are calculated based on the corresponding numeric values in Table 1, excluding 0-coded**,** unrated issuers.

for the independent variables. Correlation among the macroeconomic variables is to some extent high, but their corresponding variance inflator factor (VIF)-values do not indicate multicollinearity problems[8].

1.5. Empirical Results

This section examines the empirical findings from testing the model presented earlier. The first series of regressions in table 3 examines the model in varying compositions. I perform a range of robustness checks to verify findings and detail results for each regression specification. I discuss and interpret the results at the end of this paper.

Table 3 presents regression results for various model specifications. An immediate observation is the highly significant and negative coefficients obtained for the macroeconomic variables Level and Slope. This result is in sharp contrast with expectations and findings by Faulkender (2005) and Vickery (2005), who both found a positive relationship between these macroeconomic variables and the likelihood of floating rate debt[9]. Regression results also show that the debt maturity variable is a highly significant determinant for the type of debt.. As expected, the obtained coefficient for the maturity variable is negative, indicating that increasing maturity decreases the likelihood of floating rate debt, following predictions by both Guedes and Thompson (1995) and Titman (1992). By comparing columns III and IIII we see the impact of adding the maturity variable to the regression specification, which increases the pseudo R-squared value from 0.003 to 0.425. While the pseudo R-squared cannot be directly compared to similar figure familiar in linear regression models, it does suggest that the maturity of debt improves the fit of the model and that it is an important determinant for the choice of interest rate exposure.

Also in line with expectations, we observe the Size variable appearing statistically significant with a negative sign, meaning that larger issues are more likely to issued as fixed rate debt, consistent with findings by Faulkender (2005) and Covitz and Sharpe (2005), but in contrast with Vickery (2005). The dummy variable, which takes the value 1 if an issuer has a credit rating and 0 otherwise, has a positive and statistically significant coefficient, implying that rated, and thus more transparent firms are more likely to issue floating rate debt, while unrated issuers prefer fixed rate. It could be argued that unrated issuers are of generally lower credit or they are opaque firms, sporadically tap the public capital market to access fixed rate debt as an alternative source for bank driven floating rate funding. The other macroeconomic control variables do not appear significant.[10]

1.5.1. Robustness checks with fixed effects

The employed approach of studying incremental debt issues overlooks firm specific characteristics, which are not included in the model. For instance, candidate variables could be the targeted ratio of fixed-to-floating rate debt, firm size, total debt to assets, and a

[8] VIF values exceeding 10 or 20 are considered indicative of multicollinearity problems, depending on the school of thought (see e.g. W. Greene (2003), G. S. Maddala (1992).)

[9] Recall that the slope variable represents the term spread for government bonds. Corporate bond issues in the Euro-area are commonly priced against interest rate swaps, due to higher liquidity of swaps and thus better suitability as a benchmark (see e.g. G. R. Duffee (1996), Danthine, Giavazz, and Thadden (2000), John Hull, Mirela Predescu, and Alan White (2004) and J. P. Casey and K. Lannoo (2005)). However, changing the slope variable in the regression to correspond to the swap term spread does not materially alter the magnitude, sign or significance of estimated coefficients (results not reported).

[10] I loose 21 observations when the market credit risk premium variable is included, since this data is available only from the beginning of April 1999 onwards.

Probit regressions									
	Dichotomous dependent variable: Floating 0/1								
Independent Variables	I	II	III	IIII	V	VI	VII	VIII	IX
Interest rate variables									
Level	-0.055	.	-0.121	-0.417***	-0.402***	.	-0.047	-0.408***	-0.388***
	[0.060]	.	[0.074]	[0.069]	[0.070]	.	[0.083]	[0.079]	[0.074]
Slope		-0.018	-0.142	-0.376***	-0.396***	.	-0.087	-0.364***	-0.349***
		[0.077]	[0.091]	[0.093]	[0.094]	.	[0.096]	[0.097]	[0.098]
Issue characteristics									
Maturity (LN)				-2.045***	-1.883***	-1.795***	.	-1.941***	-1.870***
				[0.124]	[0.119]	[0.119]	.	[0.121]	[0.123]
Size (LN)					-0.176***	-0.169***	.	-0.194***	-0.195***
					[0.052]	[0.047]	.	[0.052]	[0.052]
Rated					0.398***	0.555***	.	0.431***	.
					[0.150]	[0.150]	.	[0.153]	.
Macro economic controls									
Bbbaaa							-0.111	-0.131	-0.138
							[0.115]	[0.155]	[0.151]
Inflation							0.004	-0.129	-0.140
							[0.101]	[0.121]	[0.119]
3m Euribor volaltility							-1.711**	-0.370	-0.427
							[0.668]	[0.784]	[0.774]
10y swap volatility							0.359	-1.987	-1.659
							[1.201]	[1.388]	[1.321]
Constant	-0.083	-0.229**	0.321	4.914***	5.222***	3.083***	0.210	6.063***	5.857***
	[0.234]	[0.114]	[0.358]	[0.372]	[0.468]	[0.332]	[0.464]	[0.596]	[0.585]
Credit rating dummies	No	No	No	No	No	No	No	No	Yes
Observations	1353	1353	1353	1353	1353	1353	1322	1322	1322
Pseudo R-squared	0.001	0.000	0.003	0.425	0.438	0.419	0.010	0.453	0.460
Robust standard errors (White(1980)) in brackets adjusted for clustered by issuer *** p<0.01, ** p<0.05, * p<0.1									

Table 3 **Determinants of the Original Interest Rate Exposure.** Probit regressions, where the dependent variable is coded 0 if fixed rate debt and 1 if floating rate debt. *Level* is the monthly average of the 3m Euribor, *Slope* is the difference between 10-year government bonds and the 3-month Euribor rate. *Bbbaaa* is the credit spread between AAA and BBB rated corporate bonds in the market. *Inflation* is the annual Eurozone inflation. Annualized volatility measures are the calculated from log changes in daily over the trailing month. *Rated* is a dummy variable with value 1 if issuer is rated, and zero otherwise. *Size* is the size of the bond issue in Euros and Maturity is the term to maturity of an issue measured in years. Robust standard errors in brackets.

measure of the interest rate sensitivity of a firm's cash flows[11]. That is, some of the results may be driven by unobserved firm characteristics, which could produce a bias in the estimated coefficients. Assuming that such unobserved firm characteristics are relatively constant over time, we can curb the problem by introducing fixed effects to the model.

Regressions with industry- and firm-level fixed effects are thus presented in table 4. A word of caution is in place regarding the "excessive" use of dummies to capture fixed-effects in probit regressions. Generally, fixed-effect probit regressions have been deemed to produce biased estimates (see e.g. Baltagi (2001); Greene (2003); Hsiao (2003).), although Heckman and Macurdy (1980) shows by means of Monte Carlo simulation that the estimated parameters in fixed-effects probit regressions behave well and are close to their true values, while Greene (2003) adds that the use of fixed-effects regressions have attractive practical properties despite some statistical shortcomings. To curb some of these weaknesses in regression with probit models, I estimate fixed-effects regressions by utilising a linear probability model (LPM) regressions, thus following Vickery (2005). Of course, LPM method is not a perfect alternative either for performing regression with a dichotomous dependent variable, since the model cannot constrain probabilities to the [0-1] interval. While the presented methods represent a somewhat naïve approach, it should sufficiently prove the robustness of the estimated coefficients. The first column in table 4 presents results where only credit rating dummies[12] are included and the subsequent two columns report estimated coefficients with additional industry[13] and firm dummies[14], respectively. As in previous regressions, we observe statistical significance for the interest rate variables with negative signs in all of the regressions in table 4. When firm fixed effects are included, the statistical significance for interest rate variables deteriorates slightly. Maturity and Size variables are also consistently significant for all regression specification. In addition, we see hardly any variation in the adjusted R-squared values, indicating that the unobserved firm characteristics captured in fixed effects do not increase the fit of the model. The significance and explanatory power of the presented variables appear robust in the presence of both industry- and firm-specific fixed effects.

Results from modifications on the regression model with firm fixed effects are presented in the last two columns of table 4, including only the interest rate variables in both presence and absence of the maturity variable. If we are still assuming that the firm fixed effects can capture much of firm specific characteristics, column IIII highlights results that conform to those reported by Faulkender (2005), with positive signs appearing in front of the interest rate coefficients. In other words, a higher interest rate level and a steeper yield curve would increase the likelihood of floating rate debt. With firm-level dummies included, this naïve model help explain some 27% of the variation in the dependent variable.[15]

[11] Guedes and Thompson argue that cash flow sensitivity is a determinant of interest rate exposure. Faulkender includes the variable in his model, but reports insignificant predictability for the variable.

[12] The previously reported dummy variable indicating whether an issue is rated is not included anymore, since credit rating dummies are now included. The dummy representing the unrated issuers is dropped from the regressions.

[13] Regression in columns II includes a full set of 33 industry dummies, with one category dropped.

[14] The sample includes issues by 423 individual firms.

[15] Recall that the market credit risk premium variable Bbbaaa is available only from the beginning of April 1999,

Linear probability model					
	Dichotomous dependent variable: Floating 0/1				
Independent Variables	I	II	III	IIII	V
Interest rate variables					
Level	-0.092***	-0.091***	-0.063**	0.015	-0.079***
	[0.016]	[0.016]	[0.026]	[0.027]	[0.023]
Slope	-0.077***	-0.083***	-0.062*	0.015	-0.070**
	[0.022]	[0.022]	[0.033]	[0.038]	[0.031]
Issue characteristics					
Maturity (LN)	-0.471***	-0.483***	-0.433***	.	-0.489***
	[0.020]	[0.022]	[0.032]	.	[0.029]
Size (LN)	-0.059***	-0.063***	-0.075***	.	.
	[0.012]	[0.013]	[0.019]	.	.
Macro economic controls					
Bbbaaa	-0.022	-0.031	-0.017	.	.
	[0.031]	[0.031]	[0.043]	.	.
Inflation	-0.025	-0.025	-0.015	.	.
	[0.025]	[0.025]	[0.036]	.	.
3m Euribor volatility	-0.093	-0.103	-0.231	.	.
	[0.165]	[0.167]	[0.221]	.	.
10y swap volatility	-0.410	-0.293	-0.227	.	.
	[0.294]	[0.296]	[0.409]	.	.
Constant	1.901***	2.093***	1.794***	-0.106	1.357***
	[0.116]	[0.159]	[0.229]	[0.209]	[0.187]
Credit rating dummies	Yes	Yes	Yes	Yes	Yes
Industry dummies	.	Yes	.	.	.
Firm dummies	.	.	Yes	Yes	Yes
Observations	1322	1322	1322	1353	1353
Adjusted R-squared	0.50	0.50	0.50	0.27	0.48
Robust standard errors (White(1980)) in brackets *** p<0.01, ** p<0.05, * p<0.1					

Table 4 **Examining the Determinants of Debt Type with Fixed Effects.** Linear probability model (OLS) regressions.

However, negative coefficients return with the inclusion of the maturity variable to the model and adjusted R-square values increase substantially to 0.48. Apparently the maturity variable is an important determinant of the interest rate exposure, but we are also faced with a potential new problem, namely that of endogeneity.

1.5.2. Dealing with endogeneity

So far, I have emphasised the role of the negative slope coefficient, which has remained in focus due to the opposite results found by Faulkender (2005) and Vickery (2005). However, this paper introduces the maturity of debt as a determinant of interest rate exposure. Results have shown that the variable has a highly significant impact on whether a firm's choice is floating or fixed rate debt. This also gives raise to a potential bias in the results, due to the fact that the choice of interest rate exposure and the maturity of debt are most likely jointly determined. That is, we are unable to distinguish the causality between the two; is the maturity driving the choice of interest rate exposure on newly issued debt or vice versa? Also, the model might still suffer from an omitted variable bias, since we are unable to observe all underlying firm characteristics. That is, if unobserved firm characteristics change over time, contrary to the assumptions in the fixed effects regressions, we are again faced with an endogeneity problem.

Dealing with the issue is not straight forward. To ease the potential bias described above, we would need to find an instrumental variable that is correlated with the potentially endogenous maturity variable, but uncorrelated with the independent variable. I argue that a suitable instrument could be found in a variable describing the number of financial institutions involved in the sale of a given bond issue. This variable can also be interpreted as the primary market efficiency, or placing power, of an issue. It is reasonable to assume that the longer the term to maturity of an issue is, the more difficult it is to place in the market place. Or, corollary, more placing power is needed to successfully issue a bond of lengthier term to maturity in the market. On the other hand, it is less clear why a link should exist between the choice of fixed or floating rate debt and the number of book-runners of an issue. Therefore, I deem such a variable suitable as an instrument for the following analysis.

Probit regression with instrumental variable	Dep.var. Maturity (LN)	Dep.var. Floating
	First-stage	Second-stage
Independent Variables	I	II
Instrument		
Bookrun	0.134***	.
	[0.019]	.
Interest rate variables		
Level	-0.080***	-0.458***
	[0.026]	[0.070]
Slope	0.007	-0.309***
	[0.033]	[0.098]
Issue characteristics		
Maturity (LN) *hat*	.	-2.656***
	.	[0.110]
Size (LN)	0.163***	0.107
	[0.017]	[0.086]
Macro economic controls		
Bbbaaa	0.033	-0.081
	[0.047]	[0.145]
Inflation	-0.006	-0.073
	[0.038]	[0.101]
3m Euribor volatility	0.347	-0.062
	[0.257]	[0.684]
10y swap volatility	-0.515	-2.212*
	[0.446]	[1.229]
Constant	0.815***	6.008***
	[0.182]	[0.690]
Wald test of exogeneity		
chi2(1)		12.42
p-value		0.0004
Observations	1322	1322
Robust standard errors (White(1980)) in brackets		
*** p<0.01, ** p<0.05, * p<0.1		

Table 5 Instrumental variable regressions under probit. Instrumented by Bookrun-variable.

Table 5 details the results of probit regressions with the instrumental variable[16]. As noted, the Bookrun variable is defined as number of financial institutions involved in the sale of a given issue. Column one presents the first stage regression, where the endogenous maturity variable is regressed against the exogenous variables and the instrument. Column two reports in turn regressions with the familiar dichotomous dependent variable on the exogenous variables and fitted values for the maturity. A Wald test of exogeneity is also reported, where the null is that the variable is exogenous. We can easily reject the null and conclude that the maturity variable was endogenous.

The interest rate variables still appear statistically highly significant and negative in column II. The magnitude of the estimated coefficients does not vastly differ from previously reported. Fitted values for the maturity variable are also significant, while the Size variable bears no longer a statistical significance. This is not entirely surprising, since sizeable bonds are more often fixed rate and of longer maturity, as was seen in table 2. Hence, the effect was captured in the first stage regression in column one and neutralized in the second stage regression.

1.5.3. Robustness over credit qualities

In the following section I explore whether the quality of the firm bears relevance to issuance behaviour and the choice of interest rate risk exposure. We have seen earlier in table 3 that an assigned credit rating has a significant impact on the choice of debt; rated firms, deemed more transparent, are more likely to issue floating rate debt. On the other hand, panel 2 in table 2 showed that the average credit quality (excluding unrated issuers) is significantly lower among fixed rate issuers.

Table 6 details the results where the sample is split by credit quality super-categories into 'Unrated', 'Investment-grade' and 'Speculative-grade' issuers. The interest rate variables appear negative and significant only for investment grade issuers, while the Slope coefficient for speculative-grade issuers is insignificant.

Regressions performed on a sub-sample of unrated issuers display insignificant estimates for both interest rate variables, suggesting that unrated firms are not timing the market in any respect. Interestingly, increases in inflation seem to tilt unrated issues towards fixed rate debt, but it would seem unlikely that unrated firms would choose their interest rate exposure based on inflation figures. High inflation may be a general indicator of periods when there is more "loose money" in the market and unrated firms have successfully made opportunistic issues to access the public debt markets in order to diversify their liability structure away from bank-originated debt.

Debt maturity remains highly significant and negative, except for speculative grade issuers. For both investment-grade and unrated issuers, Size seems to correlate negatively with the likelihood of issuing floating rate debt.

Finally, the table reports again the adjusted R-squared values. An interesting observation is that the explanatory power of the model is only fractional for the speculative grade and unrated issuers (0.02 and 0.12, respectively) compared with investment grade issuers. The number of issues performed by the first two constitutes only about 18% of the total number of issues in the sample, meaning that only a few of non-investment-grade issues come to the market each month. Thus, their issuance behaviour may very well be better explained by

[16] I use the IVPROBIT command available in Stata 9.2. It fits probit regression models of binary outcomes with endogenous regressors. Estimations are be performed by maximum likelihood estimation. Fixed effects or rating dummies are not included in the regressions.

factors other than those related to market timing. For instance, unrated issuers are usually not continuously active but more likely to be issuing their first bond in the market, in which case market timing can reasonably is not the most prevalent factor in determining the interest rate exposure. Nevertheless, results presented in earlier regressions are robust and not materially affected by whether or not non-investment-grade issuers are included in the sample.

Linear probability model			
	Dichotomous dependent variable: Floating 0/1		
	Investment grade	Speculative grade	Unrated
Independent Variables	I	II	III
Interest rate variables			
Level	-0.098***	-0.059**	-0.023
	[0.018]	[0.027]	[0.080]
Slope	-0.079***	-0.071	0.008
	[0.024]	[0.056]	[0.099]
Issue characteristics			
Maturity (LN)	-0.481***	-0.197	-0.298**
	[0.020]	[0.132]	[0.140]
Size (LN)	-0.057***	0.039	-0.126**
	[0.013]	[0.066]	[0.061]
Macro economic controls			
Bbbaaa	-0.013	-0.069	0.068
	[0.034]	[0.075]	[0.155]
Inflation	0.006	-0.014	-0.235***
	[0.027]	[0.067]	[0.088]
3m Euribor volatility	-0.275	0.195	0.156
	[0.185]	[0.295]	[0.444]
10y swap volatility	-0.299	-0.267	-1.593
	[0.340]	[0.531]	[1.358]
Constant	2.045***	0.903*	2.037***
	[0.122]	[0.516]	[0.637]
Credit rating dummies	Yes	Yes	Yes
Fixed effects	No	No	No
Observations	1085	133	104
Adjusted R-squared	0.52	0.02	0.12
Robust standard errors (White(1980)) in brackets			
*** p<0.01, ** p<0.05, * p<0.1			

Table 6 Credit quality and the determinants of interest rate exposure. Linear probability model (OLS)

1.5.4. Sampling by industry categories and sub-periods

Hitherto, we have seen that the statistically significant negative coefficients for the macroeconomic variables are very consistent and that the maturity of debt is a major determinant for the choice of debt type. The estimated coefficients for the interest rate variables are, however, in contrast to previously reported findings. Can differences across major industry sectors, which do not appear in the full sample regressions, explain the opposite results?

To explore the question, I divide the sample into four major industry super-categories based on the Fama&French industry identification described earlier in section 1.4. Figure 1 shows the relative number of floating rate issues by year for these major industry groups. We see what appears to be a rising trend in floating rate issuance for Consumer and Manufacturing

industries, while High-technology sector (which in this sample primary consists of issues by firms in the telecommunications sector) has a more erratic pattern of floating rate issuance. Table 7 presents truncated regression results for each industry super-category with the sample period split further into four equally long time-periods[17]. The model specification for column one in panel one is identical to column one in table 4. Regressions include all previously presented variables without industry or firm fixed effects. Each panel represents a separate industry super-category and columns II to V provide regressions for sub-periods of the sample. Some interesting results emerge.

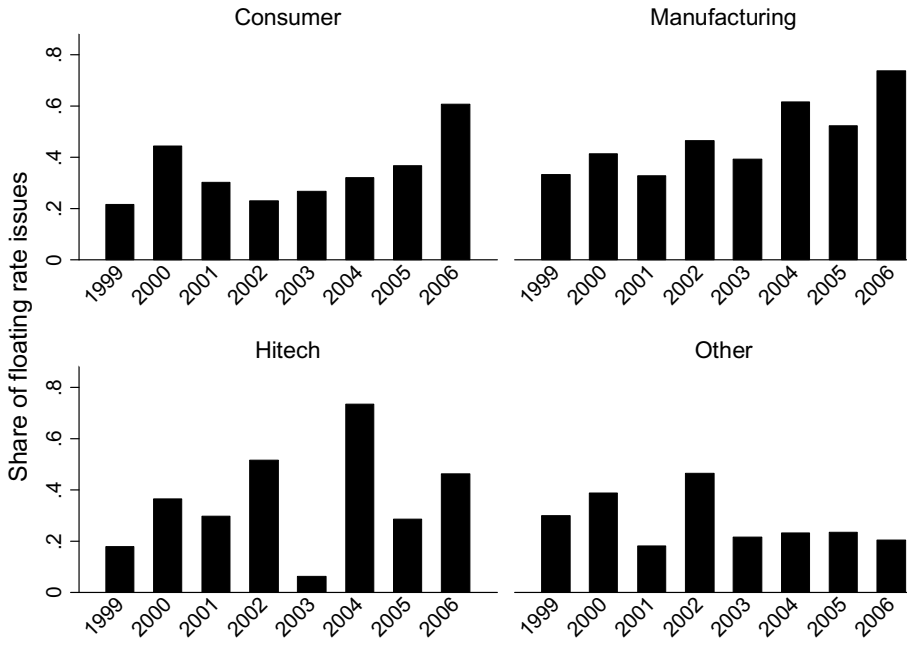

Figure 1 Share of floating rate issues by industry super-categories.

Focusing first on the full sample regressions in panel one, we notice that the significance of the estimated interest rate variables diminish during the different sub-periods and that the sign of the coefficients change also sporadically. The only sub-period with negative and significant Level and Slope coefficients are seen only in column IIII, comprising January 2003 to December 2004. By contrast, the interest rate variables appear with opposite signs in columns II and V, where coefficient for the interest rate level is positive and negative for the term structure variable. Positive and significant estimates for these coefficients are found in column III, similar to the positive relationship between interest rate exposure and yield spread reported by Faulkender (2005). Also, adjusted R-squared values fluctuate over the sub-periods, indicating that the explanatory power of the model varies over time.

Similarities with the full sample regressions are also apparent in the panels representing each industry super-category. Interest rate variables have negative correlations with the choice of debt type throughout column I, except for the Hitech sector, which has a positive Slope coefficient. All coefficients for the sub-period 2001-2002 in column III are, by contrast, positive and additionally highly significant in the third panel. Although not reported in the

[17] The last two-year period is only 23 months, since the sample does not include data for December 2006.

table, the maturity variable remains negative and significant at a 1% level for all modifications of the regression.

Linear probability model					
	Dichotomous dependent variable: Floating 0/1				
	Jan1999-Nov2006	Jan1999-Dec2000	Jan2001-Dec2002	Jan2003-Dec2004	Jan2005-Nov2006
Independent Variables	I	II	III	IIII	V
Full sample					
Level	-0.092***	0.059	0.313**	-0.485**	0.081
	[0.016]	[0.110]	[0.141]	[0.208]	[0.077]
Slope	-0.077***	-0.129*	0.278**	-0.200**	-0.015
	[0.022]	[0.077]	[0.116]	[0.080]	[0.102]
Obs.	1322	273	371	377	301
Adjusted R-squared	0.50	0.51	0.40	0.59	0.60
Consumer					
Level	-0.113***	-0.400	0.362	-1.151*	0.140
	[0.041]	[0.315]	[0.395]	[0.650]	[0.180]
Slope	-0.165***	-0.373**	0.290	-0.615**	-0.140
	[0.052]	[0.179]	[0.345]	[0.267]	[0.268]
Obs.	221	52	68	56	45
Adjusted R-squared	0.49	0.38	0.34	0.70	0.70
Manufacturing					
Level	-0.080***	-0.013	0.171	-0.296	0.128
	[0.027]	[0.197]	[0.245]	[0.326]	[0.113]
Slope	-0.089**	-0.154	0.081	-0.065	-0.049
	[0.035]	[0.135]	[0.195]	[0.114]	[0.163]
Obs.	550	89	133	189	139
Adjusted R-squared	0.53	0.55	0.43	0.59	0.52
Hitech					
Level	-0.085**	-0.294	0.758**	-1.553***	0.196
	[0.043]	[0.348]	[0.328]	[0.423]	[0.275]
Slope	0.009	-0.464	0.918***	-1.444***	0.068
	[0.067]	[0.279]	[0.292]	[0.224]	[0.305]
Obs.	205	45	67	46	47
Adjusted R-squared	0.42	0.62	0.21	0.78	0.58
Other					
Level	-0.059**	0.199	0.249	-0.509	-0.053
	[0.029]	[0.220]	[0.276]	[0.370]	[0.144]
Slope	-0.016	-0.021	0.278	-0.081	-0.175
	[0.042]	[0.136]	[0.217]	[0.182]	[0.176]
Obs.	346	87	103	86	70
Adjusted R-squared	0.49	0.47	0.54	0.43	0.54
Issue characteristics	Yes	Yes	Yes	Yes	Yes
Additional macro cntrls	Yes	Yes	Yes	Yes	Yes
Credit rating dummies	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	No	No	No	No	No
Robust standard errors (White(1980)) in brackets *** p<0.01, ** p<0.05, * p<0.1					

Table 7 **Truncated regression results by industry origin over split sample periods.** Issue characteristics and macroeconomic controls equal those presented in earlier tables.

One explanation may be the variation – or lack of it – in the interest rate variables during certain time periods. Especially the short end interest rate remained almost constant for more than two years in 2003-2005, as seen in table 2. Nevertheless, issuers do seem to time the market and the second and final sub-periods do indeed display mostly positive signs for the

macroeconomic variables, parallel to the findings by Faulkender (2005) and Vickery (2005). However, for the third period, 2003-2004, we observe negative estimates for the macroeconomic variables. This two-year period embraces both a historical low-point for European interest rates combined with the steepest in-sample yield curve. Additionally, 2003 saw a high ratio of fixed-to-floating issuance (125-to-54), while 2004 reversed this statistic for the first time in favour of floating rate debt (92-to-98). That is, while the short-term interest rates fell in 2003, the yield-curve kept still rising, but with historically low interest rates, fixed rate issuance was still the preferred choice in the market. However, as the yield curve steepness peaked, issuers turned away from longer term fixed debt to favour adjustable rate debt in 2004.

1.6. Discussion on the reversed signs obtained for interest rate variables

One of the prominent findings in this paper has been the negative and generally highly significant sign obtained for the primary macroeconomic coefficients. This is in sharp contrast to earlier empirical findings by Faulkender (2005) and Vickery (2005), who find a positive relationship between the macroeconomic variables and the likelihood of floating rate debt. At the same time, all results presented in this paper show that a negative relationship exists between the likelihood of issuing floating rate debt and the macroeconomic variables representing the slope of the yield curve and the level of short-end interest rates. The question remains, why are the results conflicting with previous findings? And why do the coefficients for the interest rate vary with time?

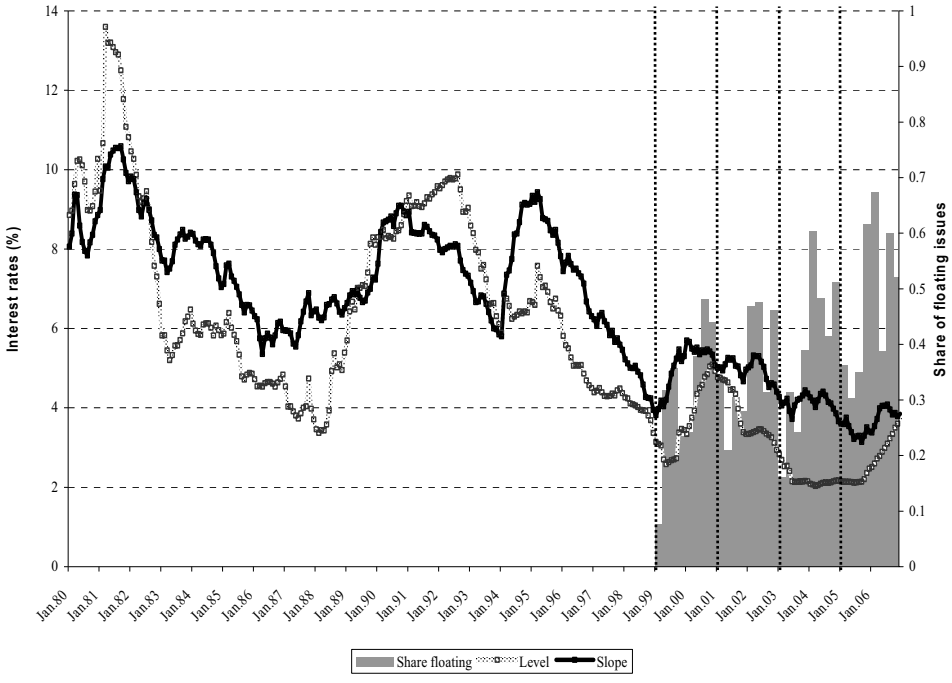

Figure 2 **Stacked movement of historical interest rates.** Historical movement of European interest rates. Level is represented by 3m Euribor. Slope is the difference between harmonized 10y government bonds weighted by GPD and 3m Euribor. (Before 1994, Level and Slope correspond to the German 3m Fibor and 10y German government bonds). Segments between the dotted vertical lines represent the decomposed samples in Table VII. Bar columns represent the relative share of floating rate issues to total issues in the sample.

My sample period starts at the introduction of the common European currency, which saw daylight on January 1st, 1999. Pagano and von Thadden (2004) show that the introduction of the Euro established the bond market as an important source of long-term funding. In addition, a wave of consolidation and restructuring was occurring in Europe at the same time, particularly in the telecom-sector, which led firms to finance acquisitions with long-term debt through public debt issuance.

Figure 2 presents stacked historic movement of European interest rates and the slope of the yield curve beyond the studied sample period. In isolation, the movement of the macroeconomic variables seem quite substantial within the sample period and, if theory would hold, we would expect a higher share of floating rate issuance especially at the beginning of the sample period during higher interest rates, which seems not to be case. We observe that although the post-1999 interest rate levels display considerable variation, they are dwarfed by the pre-Euro times, when yields hovered substantially higher. In relative terms to these historical yields, the within-sample interest rate levels are low and the observed high frequency of fixed-rate financing occurring at these yields conforms much better to theoretical predictions. In fact, we see that the risk-free funding cost of long-term debt is well below historical averages. In effect, I argue that the wide new debt capital market under the common currency and the by historical standards low interest rate environment may have led opportunistic firms to seek fixed rate and longer term debt, closely resembling model predictions by Longstaff and Schwartz (1995). In lack of data, I can only speculate about firms' issuance behaviour prior to the introduction of Euro, but the explanation provided above would seem at least plausible in light of the transition towards lower interest rates under the common currency.

1.7. Conclusions

This paper examines determinants for the original interest rate exposure of debt, whereby I have departed from a popular branch of research focused on derivatives and the final interest rate exposure of debt. My approach has allowed me to examine a far wider spectrum of issuers over a longer time period, whereas previous studies involving derivatives have been significantly restricted in either dimension – or both. Naturally, recognizing that bond issuers do not fund themselves solely through the public capital markets, the aim is to understand general determinants of debt type from an cost efficiency perspective that are characteristic for the European bond market, rather than explaining the drivers affecting the overall choice of debt and its interest rate exposure.

Studying incremental debt issues on the European debt capital markets after the inauguration of common currency, I find evidence of market timing, confirming results from the survey conducted by Graham and Harvey (2001) and the empirical work by Faulkender (2005) and Vickery (2005). The slope of the yield curve, considered a reliable indicator of macro economic conditions, appears in this study with an opposite sign to previously reported results. This finding is consistent through various robustness checks on the full sample. I postulate that the historically low interest rate environment have driven firms to primarily issue fixed rate debt, a results which aligns well with predictions by Longstaff and Schwartz (1995), who argue that fixed rate debt is preferred when interest rates are below long-term averages.

In addition, I show that the maturity of debt has, by far, the strongest predictive power for the type of debt firms' issue. I deal with potential endogeneity problems by employing an instrumental variable model. Long-term debt tends to be issued with fixed coupon payments, while average floating rate debt is significantly shorter in its term-to-maturity. The result is consistent with the general notion that bank originated debt is short in term and floating rate

(see e.g. Datta, Iskandar-Datta and Patel (2000) and Denis and Mihov (2003)). Thus, it would appears also that funding from the capital markets is used to some extent as a complement to the more maturity restricted, floating rate bank debt.

Increases in issue size are found to correlate negatively with the likelihood of floating rate debt. In fact, we have seen that the average size of debt issues with fixed interest rate payments are double that of floating rate notes. The intuition for such behaviour is easy to understand; large blocks of interest rate sensitive debt could have material effect on the financial stability of any firms if interest rates were to rapidly move in unfavourable direction. Even in cases where firm cash-flows are positively correlated with interest rate movements, operating income may not respond to such changes as fast as payable interest rate expenses, leaving a firm more exposed to financial distress. Bearing in mind that firms able to access the public capital markets have passed a certain threshold in terms of size, transparency and quality, as described by both Diamond (1991) and Covitz and Sharpe (2005), we should not forget that facing financial distress as a bond issuer may prove more costly than for firms depending solely on bank debt. Bank lending (and monitoring) builds by definition on the relationship between the lender and the borrower, who can jointly negotiate on the terms of debt contracts as financial distress is looming and before actual default occurs. By contrast, this ability is vastly limited for bond issuers, who usually are unable to renegotiate terms on such debt contracts with widespread groups of lender-investors and have to succumb to very public proceedings in the case of default. This is potentially leading firms to minimize their interest rate exposures on large issues, as the presented empirical results have shown.

Consequently, we have also seen that firms of credit qualities belonging to the speculative-grade category issue a lion's share of bonds with fixed coupon payments, while floating rate debt is more likely issued by firms of higher, investment-grade quality, parallel to signalling models by both Flannery (1986) and Titman (1992). However, having been assigned a credit rating usually indicates that the firm is at least to some extent more active in the public market domain and evidence shows that both speculative-grade as well as investment-grade firms time the market with respect to interest rate movement. By contrast, firms lacking a credit rating seem not to engage themselves in market timing. A low issue frequency added with a lack of transparency due to the absence of a credit rating suggests that unrated firms perform issues in isolated attempts to tap the capital to complement their mainly bank-originated debt structure.

Future research could well be focused to specifically track the drivers behind the issuance behaviour for infrequent issuers, such as speculative-grade and unrated issuers. Are these firms increasingly moving away from bank financing towards market-based debt? Do these firms sporadically seek to secure debt through bond issues when they require external funds or are only certain types of investments and projects funded with public debt? This is hard to establish based on the evidence and data at hands, but studying cash-flows and approved credit-lines in the banking sector could shed further light on the issue.

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COSTLY LEMMINGS IN THE BOND MARKET? AN EMPIRICAL ANALYSIS OF THE TERM STRUCTURE OF CREDIT SPREADS

Abstract

The paper examines the credit spread between government and corporate bonds at different maturities. Theoretical models assume that credit risk premiums for high quality firms are monotonously increasing with maturity. I find evidence suggesting that bonds issued at maturities attracting the highest issuance volumes tend to have credit risk premiums that are on average 10 to 15 basis points higher than issues at non-conventional maturities. These results seem to highlight a shortcoming of existing theoretical models and show that the credit yield curve is not smooth, but affected by the local supply of issues at various parts of the yield curve. In addition, the empirical evidence presented in this paper indicates that firms utilising the bond markets for funding could lower their funding costs by shifting the term of their debt away from the most commonly targeted maturities.

Keywords: Credit spreads, bonds, primary market, Eurobonds

JEL Classifications: G12, G14, G15

1.1. Introduction

This paper examines the credit yield curve for risky debt, or more specifically, the credit spread between government and corporate bonds at different maturities. Current literature has explored both theoretically and empirically the factors affecting the overall credit risk premium with the normal assumption of a smooth credit yield curve of increasing, decreasing or hump-shaped form[1]. That is, risky debt pays a premium over the Treasury yield curve that relates to the probability of default, the expected loss in case of default and a compensation of bearing systematic, non-diversifiable credit risk.

On the other hand, researchers have suggested that the credit yield curve may not conform to the assumption of a smooth credit curve; testing determinants for the choice of debt maturity on primary market data Guedes and Opler (1996) conclude that markets may systematically misprice bonds in parts of the yield curve. Meanwhile, Elton *et al.* (2001) make a vast contribution to the literature by examining the spot rate differences between corporate and government debt on the secondary market. By decomposing credit spreads into components, they are able to explain how the spread differential is allocated between these components. In adopting the Nelson and Siegel (1987) methodology for estimating the spot rates used in the analysis of credit spreads, Elton *et al.* (2001) exclude –by definition of the model– any irregularities in the pricing of credit risk over the term structure, since the model provides a smooth estimation of the spot yield curve. This approach has many advantages, namely that coupon-stripped zero-coupon corporate and government term structures provides more accurate estimates of credit spreads, since different coupon rates in the benchmark and corporate rates are not reflected in the yield differences.

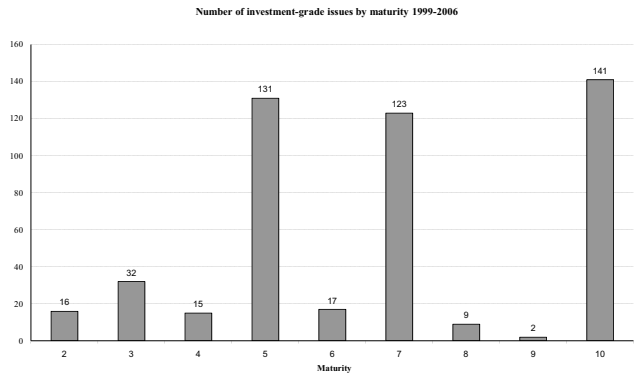

Figure 1 Issuance volumes by maturity

Figure 1 presents the number of Euro-denominated corporate bonds issued between 1999-2006 for the same maturity spectrum studied by Elton *et al.* (2001) and originating from within the EMU. We see a tremendous concentration of issues at five, seven and ten-year maturities, which receive some 82% of the total issuance volume. While these observations may stem from market practices on either the supply or demand side or reflect psychological

[1] See e.g. Edwin J. Elton, *et al* (2001), Pierre Collin-Dufresne, Robert S. Goldstein, and J. Spencer Martin (2001), G. Gabbi and A. Sironi (2005)

attachments to distinct figures, they do inevitably lead to the question of whether the pricing of credit at various maturities is as consistent as employed models assume. It is hardly surprising that corporate bonds are issued at maturities corresponding to common expiries of government benchmark bonds, but the question still remains whether debt issues at non-conventional maturities are priced with equal efficiency? In other words, is the term structure of credit risk for new issues as smoothly increasing as many theoretical models predict and various studies assume?

The empirical approach adopted in this study departs from previous studies in two essential ways; first, the objective is not to test existing theoretical models, but empirically explore the pricing of credit risk over the yield curve. Second, similar to Gabbi and Sironi (2005), the study is conducted on spreads observed at issuance in the primary market for corporate bonds, as opposed to traded securities on the secondary market, and reflects therefore the actual pricing of debt faced by firms seeking arm's length funding on the capital market. I find empirical evidence that appears to point to a shortcoming in existing theoretical models, where the credit yield curve is not smooth, but affected by the supply of issues at various parts of the yield curve. Bonds issued at high volume maturities have credit spreads that are 10 to 15 basis points *higher* than corresponding low volume maturities. On a fixed income market where median issue size is close to 500 million euros, the average maturity exceeds 6 years and total annual issuance volume exceeds 151 billion euros, the aggregate cost of such underpricing is significant.[2]

1.2. Theoretical and empirical framework

This section explores literature on the bond risk premium related to my study. I shortly introduce the main concept of structural- and reduced-form models and review a selection of empirical studies and their central results.

1.2.1. Estimating the term structure of credit risk

Structural-form models originate from the option-pricing framework by Black and Scholes (1973). Merton (1974) utilises this framework to model corporate liabilities as contingent claims on firm's assets.. The credit spread in Merton's (1974) model is essentially a function of two factors; i) the variance of firm operations (business risk) and ii) ratio of debt value to firm value (financial risk), where default is triggered when the firm value falls below some threshold level. That is, default threshold is a function of the amount of debt outstanding. Merton shows that debt by non-distressed firms has a positive relationship between the credit spread and maturity, while issuers closer to distress face a downward sloping or hump-shaped credit yield curve. Models augmenting the Merton approach for valuing risky debt based on asset values have been developed by, among others, Kim, Ramaswamy and Sundaresan (1993), Longstaff and Schwartz (1995), Leland and Toft (1996) and Collin-Dufresne and Goldstein (2001). Merton's model assumes non-stochastic interest rates, while Kim, Ramaswamy and Sundaresan (1993) and Longstaff and Schwartz (1995) allow interest rates to be stochastic. Leland and Toft (1996) provide a closed-form solution to estimate credit spread, which considers the optimal capital structure when firms are able to choose both the maturity and amount of debt it issues. In similar vein, Collin-Dufresne and Goldstein (2001) considers time-varying changes in firm value and debt capacity and show that speculative-grade firms can have an upward sloping term structure of credit spreads.

Structural-form models suffer from difficulty of empirical implementation, since the value of assets may not be known. As a result, they have been countered by another strand of

[2] Statistics are provided by the European Commission.

theoretical literature abstracting from the use of firm value to establish default. By contrast, reduced-form models assume that the default process is driven by an exogenous random variable; the probability of default and the recovery rate in case of default vary stochastically over time. For instance, Jarrow, Lando and Turnbull (1997) provide a model where the probability of default follows a Markov process. The authors fit the model to price data for bonds of various corporate credit ratings, resulting in similar credit yield curve shapes as the Merton model. That is, they show that investment grade bonds have upward-sloping credit yield curves, while speculative grade bonds have a downward-sloping credit curve. Other reduce-form models include e.g. Litterman and Iben (1991), Lando (1998) and Duffie and Singleton (1999). Litterman and Iben (1991) recognize that the term structure of credit risk is not flat.

1.2.2. Empirical studies on the determinants of credit risk premiums

Empirical tests on both structural- and reduced-form models argue that both models suffer from inaccuracy by underestimating the risk premiums for risky bonds when compared with the market observations and provide mixed results on the term structure of credit spreads (see e.g. Lyden and Saraniti (2000) or Eom, Helwege and Huang (2004) for tests on structural-form models and Duffee (1999) for reduced-form models.). Related empirical work finds evidence both supporting and to some extent conflicting the model prediction for the shape of credit curves (see. e.g. Sarig and Warga (1989), Helwege and Turner (1999), Collin-Dufresne and Goldstein (2001) and on European data van Landschoot (2003)). Nevertheless, consensus in the literature establishes that the credit yield curve for high-grade bonds is increasing with maturity, while disagreement prevails on its shape for lower quality firms. Further, empirical evidence on the determinants of credit risk premiums show that spreads are also affected by tax considerations, secondary market liquidity and non-diversifiable systematic risk (Elton *et al.* (2001)) , (Elton *et al.* (2004)), Collin-Dufresne, Goldstein and Martin (2001), Gabbi and Sironi (2005), Crabbe and Turner (1995))[3].

Graham and Harvey (2001) conduct a survey among chief financial officers and find that CFOs shift the maturity of issued debt to take relative advantage of low interest rate yields. In addition, Duffee (1998) show that there exists a negative correlation between Treasury yields and the credit risk premiums for corporate bonds. Studying the determinants of corporate debt maturity on primary market data, Guedes and Opler (1996) find evidence to suggest that managers of issuing firms may be responding to mispricing of bonds in part of the yield curve by altering the maturity of issued debt. As the total cost of debt for any given issue for not only comprise the level and term premium of interest rates, but also the credit risk spread, it would be expected that rational managers consider all aspects of the pricing of debt and respond to both the macroeconomic factors as well as mispricing no the market to secure the most attractive priced debt.

1.3. Data and empirical implementation

My objective is to investigate whether the pricing of credit risk is as monotonic as suggested by theoretical models, or more specifically, whether the distribution of issues in terms of volume affects pricing at different maturities. Following Gabbi and Sironi (2005), the focus of this study lies on the pricing of bonds in primary market, with no specific theoretical model assumed as the basis for the bond pricing. In essence, the approach taken here is to examine the pricing of credit risk at various maturities, rather than test a specific theoretical model in explaining the shape of the credit yield curve. In this section I discuss the data on

[3] Apart from Gabbi and Sironi (2005), all others conduct their studies on secondary market data.

which the study is conducted and the proxy variables used in the regressions for explaining the credit spreads.

1.3.1. Research methodology

The Euro and its capital market have enabled firms to tap into a large pool of investors to seek funding; chart 1 presents an overview of the maturities firms target when issuing bonds. We can observe a high concentration of issues at five-, seven- and ten-year maturities. Indeed, these issues account for more than 80 percent of the entire issuance volume and in excess of 86 percent of the size-weighted issuance in the final sample. In viewing chart 1, one inevitably lends a thought to whether the pricing of credit risk is equally efficient over the entire maturity spectrum. Meanwhile the assumption of common yield curve models is that the credit yield curve is monotonously increasing for good-quality issuers. With regards to these central themes, the aim of this study is to shed some light on the pricing of credit risk at different maturities and test whether pricing distortions exist between the high volume maturities and the rest of the credit yield curve.

The credit risk premium over the risk-free government bond yields reflect investors' perception of the risk of loss and bonds' primary and secondary market efficiency and liquidity. A vast number of prior studies have explicitly considered the secondary market credit spreads of traded fixed income securities, whereas I have chosen to depart from this convention and follow the approach adopted in Gabbi and Sironi (2005) by looking at the primary market spreads, which constitute the actual cost of borrowing firms face when issuing debt. No theoretical model is assumed as a basis for my study and the analysis attempts to capture factors affecting the bond issuance spreads and test for distortions over the yield curve. My model is to some extent influenced by the reduced-form model of Duffee (1998) with added variables to control for issue specific characteristics. In line with this reasoning, the analysis is conducted with a model of the following form:

$$SPRD_i = \alpha_i + \beta_1^{[+/-]} HIGHVOL_i + \beta_2^{[-]} LEVEL_t + \beta_3^{[-]} SLOPE_t + \beta_4^{[+]} BBBAAA_t + \beta_5^{[+]} MAT_i + \beta_6^{[-]} SIZE_i + \beta_7^{[+/-]} EFF_i + \beta_8^{[-]} CRED\_QUAL_i + \beta_9^{[+/-]} IND_i + \varepsilon_i$$

Where:

$SPRD_i$ = is the difference in basis points between the yield to maturity at launch of a given issue and the yield to maturity of the German Bund curve at a similar maturity.

$HIGHVOL_i$ = dummy variable with value 1 if the issue is performed at high volume maturities of five, seven or ten-year and zero otherwise.

$LEVEL_t$ = the level of 3 month Euribor rates

$SLOPE_t$ = the slope of the yield curve

$BBBAAA_t$ = secondary market risk premium defined as the difference between AAA and BBB rated corporate debt

MAT_i = Maturity of issue *i* in years at launch

$SIZE_i$ = Size of issue *i* in Euros at launch

EFF_i = primary market efficiency, which I proxy by the number of financial institutions involved in the sale of issue *i.*

$CRED\_QUAL_i$ = dummy variable for the credit quality of issue *i* as defined by credit ratings assigned by Moody's and Standard&Poor's

IND_i = dummy variable representing the industry sector of the issuing entity.

The expected sign of estimated coefficients is indicated in the model.

1.3.2. Data

My data set originates from the Dealogic database, containing issue-specific information on Euro-denominated bond issues made by EMU-country residents from January 1st, 1999 to November 31st, 2006. The study is restricted to include debt issued by non-financial firms.

Raw data comprises 14.902 observations. I eliminate issues by governments[4], supranationals, financial institutions and any linked category based on the issuer type and issuer industry coded in the database. I further exclude collateralized or covered bonds; bonds with various embedded option-features; subordinated bonds; currency-, inflation- or index-linked bonds; bonds with uneven payment schedules; tap-issues[5] and other irregular features as noted in the database. Unclear entries are cross-referenced with the Thomson ONE Banker database. Incomplete or missing records are subsequently excluded from the sample. I further restrict the analysis only to include bonds issued with a term to maturity of ten years or less and by firms of investment-grade credit quality. This choice is motivated by several factors; first, 90% of all issues in the entire sample are performed at maturities less than or equal to ten years[6]. Second, issues beyond ten years are highly dispersed making the spread analysis at longer maturities increasingly inaccurate. Third, the credit risk premiums of speculative-grade and unrated issuers may vastly differ from that of investment-grade firms due to increased likelihood of distress. Fourth, these restrictions follow those adopted by Elton *et al.* (2001), which makes comparison between the studies easier. Thus, the final sample consists of 486 plain vanilla bond-issues by 206 individual non-financial corporate EMU-residents[7].

The credit spreads for each bond issue is computed using the German Bund yield curve as a basis for risk-free interest rate yield. In other words, the credit spread is the difference between the yield to maturity at launch of a given issue and the yield to maturity of the German Bund curve at a similar maturity. Daily data on the German Bund yield curve is obtained from the Deutsche Bundesbank (DB).

Interest rate data used in the regressions to quantify macroeconomic conditions in the Euro-area is gathered from the European Central Bank (ECB). Interest rates representing the yield curve are monthly averages and weighted by the nominal outstanding amounts of national government bonds in each maturity band. The slope of the yield curve is defined as the

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[4] Debt issues, which have been granted a state-guarantee of repayment, are also excluded.

[5] Tap-issues are re-issues of a bond, executed in varying amounts and at different times, usually in response to investor demand. The main terms of the bond (issuing conditions, coupon and maturity) remain unchanged, but the issue price can vary according to market conditions. Tap-issues on bonds are thus left outside the sample, since they would induce a bias as the same bond appears multiple times in the sample.

[6] Specifically, applying a 365 days / year convention, I include issues with a term to maturity of less than 10 years and 182 days or 10.499 years.

[7] All non-financial corporate issuer residing within the EMU-area are considered; Austria, Belgium, Finland, France, Germany, Greece (2001), Ireland, Italy, Luxembourg, Netherlands, Portugal, and Spain. However, issuers in related colonies or territories to EMU countries, such as the French Polynesia or the Netherlands Antilles are omitted. On the other hand, issues by subsidiaries to other than EMU-residents are left in the sample; e.g., Toyota's European arm, Toyota Motor Finance BV located in the Netherlands belongs to the final sample.

difference between 10-year government bonds and the 3-month Euribor rate. International Index Company produces iBoxx bond-indices, which I use for calculation of the credit risk premium between AAA- and BBB-category investment-grade bonds. iBoxx-data is available from April 1st 1999 onwards.

Credit ratings by both Moody's and Standard&Poor's have been assigned to 237 of the 486 bonds in the final sample, while the remaining 249 bond issues have a single rating assigned by only one of the credit rating agencies. I recode the rating categories with integer numbers in ascending order, where the highest AAA/Aaa-rating is coded as "1" and the lowest BBB–/Baa3 is coded as "10". For issues with split ratings, a composite rating is calculated corresponding to an average of the values of the separate ratings assigned by the rating agencies. The rating scales, corresponding values and issue frequencies are shown in table 1.

Rating agency				Composite		
Moody's	Standard & Poor's	Value	Obs.	categories	Value	Obs.
Aaa	AAA	1	42	AAA	1	42
Aa1	AA+	2	14			
Aa2	AA	3	21	AA	2	81
Aa3	AA-	4	46			
A1	A+	5	69			
A2	A	6	55	A	3	194
A3	A-	7	70			
Baa1	BBB+	8	90			
Baa2	BBB	9	49	BBB	4	169
Baa3	BBB-	10	30			
		Total	486			486

Table 1 Credit ratings by Moody's and Standard&Poor's

1.4. Empirical tests and results

In this section I review the results obtained from empirical tests. I begin by examining aggregate spreads over the maturity spectrum and dividing them into broad credit rating categories. I extend the analysis by performing regressions on the presented model to control for theoretically motivated factors affecting credit spreads.

1.4.1. Observing the credit yield curve

Panel 1 of table 2 shows primary market credit spreads and standard deviations by maturity and credit rating categories for the sample firms. Maturities with high issuance volume (5, 7 and 10 year) are indicated as anchor points. Assuming that these high volume maturities are more efficiently priced than maturities attracting lower issuance volumes, I generate indicative credit spreads for the low volume maturities by interpolating credit spreads between the defined anchor points. For example, the indicative credit spread value for the full sample at a six-year maturity is 88.73bps, interpolated between anchor points of five and seven years (85.79bps and 91.67bps, respectively). To generate indicative values for the low end of the yield curve, the three year maturity has also been chosen as an anchor point. In addition, indicative credit spread values for issues of two-year maturity have thus been extrapolated from anchor points at three and five years. Chart 2 provides a graphical interpretation of the methodology; in the example the credit yield curve is representing all bonds issues in the final sample. Panel 2 of table 2 shows indicative credit spread values and results from *t*-tests for the differences between market spreads and indicative values at low volume maturities.

PANEL 1		Maturity									
		2	3 Anchor	4	5 Anchor	6	7 Anchor	8	9	10 Anchor	Mean Obs
FULL	Mean	68.92	61.66	31.05	85.79	46.98	91.67	78.77	62.61	69.41	77.11
	St.dev.	77.58	57.78	63.00	70.52	54.22	56.62	25.47	22.68	49.76	60.70
	Obs	16	32	15	131	17	123	9	2	141	486
AAA	Mean	8.38	-12.23	-18.55	-14.47	-31.15	27.92	.	.	17.41	0.99
	St.dev.	0.06	38.44	36.13	24.80	35.72	15.87	.	.	23.14	31.59
	Obs	2	4	6	7	3	3	0	0	17	42
AA	Mean	.	1.46	15.09	34.85	24.95	38.19	33.01	.	48.07	38.57
	St.dev.	.	37.37	17.10	32.57	24.55	32.59	0.00	.	24.54	30.19
	Obs	0	4	2	23	3	13	1	0	35	81
A	Mean	41.25	61.99	30.54	71.25	57.03	70.98	80.37	46.57	74.15	68.97
	St.dev.	39.72	31.30	9.01	47.47	24.06	37.28	27.21	0.00	36.13	39.54
	Obs	10	14	2	54	7	44	4	1	58	194
BBB	Mean	168.36	114.83	97.17	142.36	104.50	120.19	88.61	78.65	113.15	123.84
	St.dev.	84.73	44.15	53.72	67.26	45.06	56.61	12.64	0.00	63.43	61.04
	Obs	4	10	5	47	4	63	4	1	31	169

Table 2 continues on next page

Table 2 **Sample t-tests by maturity and credit ratings** Maturities 3, 5, 7 and 10 act as anchor points for the pricing of credit spreads. In panel two, indicative spreads are calculated for maturities 4, 6, 8 and 9 by interpolating spreads between the anchor points. Corresponding value for 2 year maturity has been extrapolated from anchor points 3 and 5 years. Panel 2 details results from tests on the difference in means between observed and indicative credit spreads.

PANEL 2		Maturity									
		2	3	4	5	6	7	8	9	10	Mean
		Extrapolated		Interpolated		Interpolated		Interpolated	Interpolated		total
FULL	Mean	49.60	.	73.72	.	88.73	.	84.25	76.83	.	
	Difference	19.32	.	-42.67	.	-41.75	.	-5.48	-14.22	.	-16.96
	t-statistic	1.00	.	-2.62**	.	-3.17***	.	-0.65	-0.89	.	
AAA	Mean	-11.11	.	-13.35	.	6.73	.	.	.	.	
	Difference	19.49	.	-5.20	.	-37.88	.	.	.	.	-7.86
	t-statistic	487.34***	.	-0.35	.	-1.84	.	.	.	.	
AA	Mean			18.16		36.52		41.49			
	Difference	.	.	-3.07	.	-11.57	.	-8.48	.	.	-7.71
	t-statistic			-0.25		-0.82		.			
A	Mean	57.36		66.62		71.11		72.04	73.10		
	Difference	-16.11	.	-36.08	.	-14.08	.	8.33	-26.53	.	-16.89
	t-statistic	-1.28		-5.66		-1.55		0.61	.		
BBB	Mean	101.07		128.59		131.28		117.85	115.50		
	Difference	67.29	.	-31.43	.	-26.78	.	-29.24	-36.85	.	-11.40
	t-statistic	1.59		-1.31		-1.19		-4.62**			
Mean total		23.56		-18.94		-22.58		-9.79	-31.69	.	.

Table 2 continued **Sample t-tests by maturity and credit ratings** Maturities 3, 5, 7 and 10 act as anchor points for the pricing of credit spreads. In panel two, indicative spreads are calculated for maturities 4, 6, 8 and 9 by interpolating spreads between the anchor points. Corresponding value for 2 year maturity has been extrapolated from anchor points 3 and 5 years. Panel 2 details results from tests on the difference in means between observed and indicative credit spreads.

For most part of table 2, differences between indicative values and observed values appear insignificant. Mean differences at low volume maturities are, however, mostly negative, suggesting that the actual credit spreads are lower than the indicative spreads derived from the high-volume maturity spreads. The finding is somewhat surprising, since it suggests that the unconventional maturities offer more favourable funding from a corporate perspective.

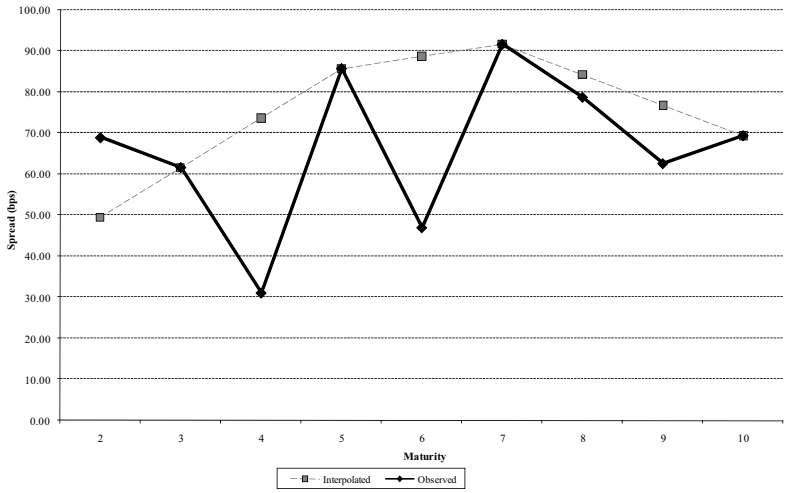

Figure 2 Illustration of interpolation technique

The analysis suffers from a number of drawbacks; first, the pricing *within* the broad credit rating categories can be wide and a more detailed analysis would be necessary. However, increasing the precision would further dilute the number of observations in each category and make the analysis unfeasible. Second, the time-varying risk-appetite of the market is not taken into account. Third, issue specific differences, pricing differentials between various industry sectors and macroeconomic factors all attribute to the level of credit spreads. I therefore continue the analysis by performing a series of regression analysis to gain further insight into the effects that issuance volume has on the pricing of credit risk.

1.4.2. Multivariate analysis

Utilising the model presented earlier, I perform a series of regressions with the primary market credit spreads over the risk-free rate as my dependent variable. Table 3 details the results; some interesting details emerge.

First, the dummy variable representing issues at high volume maturities is consistently positive and significant with obtained estimates varying between 12.824 and 26.204. The results indicate that issues at commonly utilised maturities are priced lower –that is, with higher credit risk premiums– than corresponding issues targeting non conventional. Second, the regressions in columns two to seven include a maturity variable to control for the term premium of the credit yield curve described by Litterman and Iben (1991). Similar to previous studies, the estimated maturity coefficient is found significant and positive, except in the last column which does not include controls for credit ratings. Third, a deteriorating credit quality increases the spread monotonically, parallel to predictions and previous findings on primary market spreads by Gabbi and Sironi (2005). Fourth, time-varying affects are captured in column two by month-year dummies, whereas these dummies are replaced in

	Dependent variable: Spread						
	I	II	III	IIII	V	VI	VII
Independent Variables							
HIGHVOL	24.914***	14.017**	15.529***	13.050***	.	12.824**	26.159***
	[7.390]	[5.475]	[4.707]	[4.528]	.	[5.709]	[7.483]
MAT (LN)	.	24.238***	22.851***	18.931***	27.751***	18.139**	11.834
	.	[8.072]	[6.221]	[6.122]	[5.107]	[7.710]	[7.991]
LEVEL	.		12.348***	12.174***	12.526***	.	14.700***
	.	.	[2.773]	[3.074]	[3.050]	.	[3.611]
SLOPE	.	.	-8.195**	-8.000**	-7.771**	.	-2.436
	.	.	[3.511]	[3.686]	[3.651]	.	[4.499]
BBBAAA	.	.	60.280***	59.497***	59.053***	.	63.581***
	.	.	[8.819]	[8.903]	[8.912]	.	[10.920]
SIZE (LN)	.	.	.	4.206	5.198*	5.255**	-1.421
	.	.	.	[2.851]	[2.856]	[2.568]	[3.914]
EFF	.	.	.	0.952	0.424	-0.164	7.384**
	.	.	.	[2.394]	[2.369]	[2.706]	[3.317]
CRED_QUAL dummies							
Rating difference	.	.	.	9.460**	10.335**	6.653	.
	.	.	.	[3.959]	[4.055]	[4.690]	.
AA+	.	26.801	23.602*	20.734	22.979	22.286	.
	.	[18.937]	[12.957]	[13.689]	[13.987]	[16.442]	.
AA	.	33.140*	23.580**	19.641**	20.203**	27.074*	.
	.	[18.070]	[10.488]	[9.838]	[9.777]	[14.160]	.
AA-	.	48.072***	35.314***	34.692***	37.077***	45.278***	.
	.	[15.023]	[11.620]	[10.494]	[10.596]	[10.992]	.
A+	.	57.817***	51.399***	48.103***	49.558***	55.108***	.
	.	[15.744]	[11.143]	[10.697]	[10.834]	[12.576]	.
A	.	66.903***	61.067***	59.721***	62.005***	69.839***	.
	.	[14.670]	[11.251]	[10.552]	[10.724]	[11.571]	.
A-	.	88.962***	72.388***	71.992***	73.491***	80.990***	.
	.	[16.241]	[12.288]	[11.689]	[11.953]	[13.137]	.
BBB+	.	112.341***	99.930***	98.514***	99.907***	110.361***	.
	.	[16.019]	[11.886]	[11.505]	[11.804]	[12.778]	.
BBB	.	131.236***	110.093***	111.370***	115.297***	120.237***	.
	.	[18.303]	[14.092]	[13.679]	[13.926]	[14.478]	.
BBB-	.	154.702***	158.907***	158.912***	161.590***	160.892***	.
	.	[20.451]	[17.608]	[17.716]	[18.008]	[19.401]	.
Constant	56.861***	-79.430***	-149.241***	-171.359***	-183.827***	-95.510***	-99.756***
	[9.091]	[27.131]	[26.919]	[27.857]	[28.688]	[31.720]	[31.494]
Month-year dummies	No	Yes	No	No	No	Yes	No
Industry fixed effects	No	No	Yes	Yes	Yes	Yes	Yes
Observations	486	486	468	468	468	486	468
Adjusted R-squared	0.024	0.665	0.687	0.693	0.689	0.719	0.416
Robust standard errors clustered by issuer in brackets *** p<0.01, ** p<0.05, * p<0.1							

Table 3 **Multivariate analysis.** Table shows OLS regression on the credit spreads over the risk-free rate. *HIGHVOL* has value 1 if the issue is of 5, 7 or 10 year maturity, zero otherwise. *MAT* is the natural log of term to maturity in years of a given issue. *LEVEL* is the monthly average of the 3m Euribor, *SLOPE* is the difference between 10-year government bonds and the 3-month Euribor rate. *BBBAAA* is the credit spread between AAA and BBB rated corporate bonds in the market. *SIZE* is the natural log of the size in Euros of a given issue. *EFF* measures the marketing efficiency of an issue, defined by the number of financial institutions involved in the sale of the bond. Rating difference takes the variable 1 if the rating agencies have assigned different credit ratings, zero otherwise.

column three by macroeconomic variables, which reflect the overall economic conditions; an increasing market credit risk premium[8] and rising interest rate level increase the spreads of newly issued debt, while a steeper slope on the yield curve of interest rates appears to have a decreasing effect on credit spreads. A negative coefficient was expected for the short-term interest rates, suggesting that the obtained result is somewhat counterintuitive. Indeed, the positive sign also contradicts findings by Duffee (1998), who found a negative relationship

[8] I lose 18 observations when the market credit risk premium variable *Bbbaaa* is included, since this data is available only from April 1st, 1999 onwards.

between credit spreads and short term interest rates. I will explore this issue further in section 1.4.3.

Issue specific variables are included in columns four through six. I do not find consistent significance in any of the variables. The *Size* variable is found mostly positive, but appears significant only in column three, where the regression model is fully specified. Thus, it seems that secondary market liquidity is not a relevant pricing argument.[9] Obtained results follow those reported by both Gabbi and Sironi (2005) and Crabbe and Turner (1995), the latter of whom analyse yield differences between corporate bonds and medium-term notes.

Disagreement of opinion between the rating agencies regarding an issuer's credit quality increases the spread, indicating that uncertainty about the firms "true" credit worthiness is priced at the market. The variable does not, however, allow us to draw conclusions about how substantial the difference in assigned credit ratings is, nor does it tell if the two rating agencies have placed the credit worthiness of an issuer in entirely different categories.[10] Nevertheless, we note that the coefficient is positive and significant in the full model regression, which is sufficient for the current analysis.

Finally, reported adjusted R^2 -values suggest that the full model specification in column three explains some 69% of the variation in credit spreads. In all specifications of the model to control for various factors affecting the credit spreads, we find that the dummy variable representing the high volume maturities is both positive and highly significant, suggesting that these maturities bear a premium on issued debt. In addition, the variable has economic significance as the magnitude of the estimated coefficients is in excess of 10 basis points. Thus, the results would indicate a pricing distortion over the term structure of credit spreads in favour of maturities that do not attract the highest volume of issuance.

1.4.3. Regressions on split samples

The European capital market has endured tremendous transition from being distinguished by a myriad of national currencies to a having a common currency spanning all EMU-member countries. Although the transition to a new currency was immediate[11], one could expect some lag in the market's ability to adapt to the new environment, which is an argument worth investigating further. Moreover, results in table 3 raised a question about the relationship between short-term rates and spreads, which was expected to be negative, while the obtained regression results showed a positive relationship between the two. Therefore I continue my analysis of the term structure of credit spreads by splitting the sample in equally long time-periods[12] –1999 to 2002 and 2003 to 2006– in order to gain insight into possible

[9] The same positive relationship between the spread at launch and the size of an issue is also apparent in regressions where I exclude jumbo-sized deals exceeding 1 billion Euros (not shown here). Further, the *maturity* of a bond is generally also assumed to affect a bond's market liquidity. This measure rests on the belief that newly issued bonds are more liquid than bonds that have been in the market for a longer period of time (Elton et al, 2004). However, my sample consists entirely of newly issued bonds as the empirical analysis is based on spreads observed at issuance.

[10] A difference of one notch may be interpreted differently depending on whether the difference is e.g. BBB+ vs. BBB or A– vs. BBB+. In the latter case the difference in credit ratings exceeds boundaries for broad rating categories.

[11] The national currencies of the member states officially ceased to exist on the 31st of December 1998 and the Euro became de facto currency on January 1st, 1999.

[12] The latter time-period is in fact one month shorter, since the sample period ends on November 31st, 2006. However, I have deemed it unnecessary to account for this small difference in the split sub-samples and find it more practical to split the sample at year-end 2002, instead of splitting the sample in mid-December of that same year.

effects imposed by a maturing capital market under the Euro-currency. Table 4 details these results.

Independent Variables	Dependent variable: Spread	
	I	II
	1999-2002	2003-2006
HIGHVOL	14.358**	8.233
	[6.653]	[7.042]
MAT (LN)	18.838**	29.542***
	[9.262]	[8.453]
LEVEL	-3.841	21.971**
	[8.153]	[9.535]
SLOPE	-30.836***	6.400
	[9.349]	[6.328]
BBBAAA	56.101***	58.510***
	[9.227]	[10.515]
SIZE (LN)	4.293	2.705
	[3.301]	[3.221]
EFF	1.958	1.479
	[3.363]	[2.993]
CRED_QUAL dummies		
Rating difference	16.942***	4.705
	[5.568]	[6.391]
AA+	2.900	20.916
	[23.920]	[15.147]
AA	30.459**	27.555
	[12.121]	[22.361]
AA-	46.548***	23.929
	[11.406]	[15.509]
A+	48.784***	38.519**
	[13.311]	[15.926]
A	56.076***	60.017***
	[13.637]	[15.532]
A-	81.669***	66.046***
	[13.192]	[16.658]
BBB+	109.579***	88.629***
	[14.199]	[17.283]
BBB	126.252***	106.091***
	[16.311]	[20.855]
BBB-	157.205***	172.640***
	[17.848]	[28.836]
Constant	-82.365*	-229.304***
	[46.826]	[48.159]
Industry fixed effects	Yes	Yes
Observations	255	213
Adjusted R-squared	0.703	0.710

Robust standard errors clustered by issuer in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table 4 **Regressions with split sample.** Table shows OLS regression on the credit spreads over the risk-free rate. *HIGHVOL* has value 1 if the issue is of 5, 7 or 10 year maturity, zero otherwise. *MAT* is the natural log of term to maturity in years of a given issue. *LEVEL* is the monthly average of the 3m Euribor, *SLOPE* is the difference between 10-year government bonds and the 3-month Euribor rate. *BBBAAA* is the credit spread between AAA and BBB rated corporate bonds in the market. *SIZE* is the natural log of the size in Euros of a given issue. *EFF* measures the marketing efficiency of an issue, defined by the number of financial institutions involved in the sale of the bond. Rating difference takes the variable 1 if the rating agencies have assigned different credit ratings, zero otherwise.

Beginning with the variable representing the short-term interest rates, we see that it appears negative, albeit insignificant at the first part of the sample period, while it is positive and highly significant during the latter sub-sample. I argue that these results are strongly associated with the exceptional interest rate environment that endured after the inauguration of the common currency. The general interest rate environment has been historically low over both periods, with an extended period of record low interest rates during the latter sub-sample, during which the European Central Bank kept its key lending rate at two percent for

2.5 years. These extraordinary interest rate levels broke the general convention of a negative relationship between the short-end rates and credit spreads, thus yielding the positive and significant coefficient for the latter part of the sample period.

Next, we observe the high-volume dummy variable. The estimated coefficients are positive for both sub-samples, but found significant only for the sample spanning 1999-2002. Why would there be a significant credit spread premium during the first part of the sample period, but not the latter? There is no obvious difference in the concentration of issues to high volume maturities (1st half; 80.22%, 2nd half; 82.63%) and the general issuance activity during each sub-period does not differ remarkably from one another, as can be seen from table 5.

	# of Obs.		
Maturity	1999-2002	2003-2006	Total
High volume	80.22%	82.63%	81.28%
Low volume	19.78%	17.37%	18.72%
2	11	5	16
3	24	8	32
4	9	6	15
5	**92**	**39**	**131**
6	8	9	17
7	**59**	**64**	**123**
8	1	8	9
9	1	1	2
10	**68**	**73**	**141**
Total	273	213	486

Table 5 Issuance volume by sub-samples

1.4.4. Different benchmark

In so far I have assumed that the pricing of corporate bond issues is related to the credit risk premium over the risk-free rate defined by the German Bund yield curve. While the government bonds are generally considered as the risk-free and thus the theoretically true choice, whether or not this benchmark is the accurate base measure for the pricing of credit risk is not entirely clear. Due to the lack of a coherent benchmark government yield curve on the Euro capital markets, the European bond markets often price bonds against interest rate swaps; the swap yield curve presents a more liquid benchmark and has, over time, been accepted as a standardized method for pricing corporate bonds[13]. Could an ill-chosen benchmark be a cause of the obtained results?

Table 6 provides results from regression analysis, where the dependent variable is not the credit spread over a government benchmark, but the credit spread of interest rate swaps. Again, we find that the high volume maturity dummy appears significant and positive during the first part of the sample period, while a pricing distortion is not present during the latter, although we still observe a positive sign for the estimated coefficient. What has changed? Although the proof is beyond the scope of this paper, one could speculate that the shift from pricing against benchmark bonds, to pricing bonds against a more liquid and coherent swap yield curve resulted in lower credit pricing differentials between the low and high volume maturities. Clearly, the market practice of issuing bonds primarily at maturities of five–, seven– and ten-year terms, corresponding to common expiries of government bonds, has not eroded during the sample period, but the pricing seems to have converged towards more consistent term structure of credit risk.

[13] See e.g. G. R. Duffee (1996), Danthine, Giavazz, and Thadden (2000), John Hull, Mirela Predescu, and Alan White (2004) and J. P. Casey and K. Lannoo (2005).

Independent Variables	Dependent variable: Swap Spread		
	I	II	III
		1999-2002	2003-2006
HIGHVOL	10.660**	11.412*	8.369
	[4.433]	[6.772]	[6.954]
MAT (LN)	20.181***	17.760*	33.883***
	[6.055]	[9.290]	[8.380]
LEVEL	2.601	-9.544	15.475
	[3.178]	[8.116]	[9.573]
SLOPE	-8.700**	-27.262***	8.064
	[3.740]	[9.306]	[6.319]
BBBAAA	66.065***	65.820***	62.224***
	[8.793]	[9.134]	[10.635]
SIZE (LN)	4.434	4.816	2.521
	[2.827]	[3.210]	[3.325]
EFF	0.940	1.541	1.404
	[2.438]	[3.318]	[3.096]
CRED_QUAL dummies			
Rating difference	8.510**	15.644***	5.203
	[4.061]	[5.619]	[6.451]
AA+	20.719	2.949	19.113
	[13.989]	[25.176]	[14.234]
AA	20.772**	30.818**	28.639
	[10.310]	[12.919]	[21.378]
AA-	35.422***	46.188***	25.348*
	[10.671]	[12.098]	[15.287]
A+	48.720***	47.963***	39.173**
	[10.964]	[13.978]	[15.471]
A	59.140***	50.241***	61.070***
	[11.110]	[14.644]	[15.053]
A-	74.269***	83.435***	66.906***
	[11.712]	[13.509]	[16.374]
BBB+	99.739***	108.469***	90.011***
	[11.656]	[14.703]	[16.983]
BBB	113.626***	126.669***	107.521***
	[13.951]	[16.881]	[20.583]
BBB-	158.641***	153.638***	174.452***
	[17.403]	[17.805]	[28.545]
Constant	-171.098***	-98.728**	-247.114***
	[28.868]	[46.456]	[48.877]
Industry fixed effects	Yes	Yes	Yes
Observations	468	255	213
Adjusted R-squared	0.69	0.71	0.71
Robust standard errors clustered by issuer in brackets *** p<0.01, ** p<0.05, * p<0.1			

Table 6 **Regressions on swap spreads.** Table shows OLS regression on the credit spreads over interest rate swaps. *HIGHVOL* has value 1 if the issue is of 5, 7 or 10 year maturity, zero otherwise. *MAT* is the natural log of term to maturity in years of a given issue. *LEVEL* is the monthly average of the 3m Euribor, *SLOPE* is the difference between 10-year government bonds and the 3-month Euribor rate. *BBBAAA* is the credit spread between AAA and BBB rated corporate bonds in the market. *SIZE* is the natural log of the size in Euros of a given issue. *EFF* measures the marketing efficiency of an issue, defined by the number of financial institutions involved in the sale of the bond. Rating difference takes the variable 1 if the rating agencies have assigned different credit ratings, zero otherwise.

1.4.5. Further robustness checks

In so far, the target maturities have been represented by a single dummy variable. Also, the whole range of investment-grade issuers has been pooled together in a single regression. Table 7 presents a final set of regression, which not only details the high volume maturities separately, but also performs individual regressions for each main rating category.

First, we notice that each high volume dummy bears statistical significance with positive signs in column one, again indicating a premium in the pricing of issues at these maturities.

	Dependent variable: Spread				
	I	II	III	IIII	V
Independent Variables	Full sample	AAA	AA	A	BBB
HIGHVOL dummies					
5 years	13.494***	19.527	-6.238	2.449	24.025**
	[4.694]	[12.566]	[8.791]	[8.383]	[9.298]
7 years	15.570**	39.683**	3.529	1.621	18.195
	[7.725]	[13.933]	[15.914]	[10.388]	[15.187]
10 years	18.150*	47.814**	-8.037	-4.296	15.283
	[9.335]	[18.407]	[19.186]	[13.919]	[18.893]
MAT (LN)	13.811	-26.977	27.420	41.547***	36.623**
	[9.353]	[20.012]	[22.265]	[13.841]	[18.290]
LEVEL	12.213***	13.389	11.052**	10.474**	9.412
	[3.084]	[9.798]	[4.464]	[4.328]	[6.388]
SLOPE	-7.980**	-5.784	-8.429	-15.670**	-4.016
	[3.705]	[10.849]	[5.987]	[6.914]	[7.455]
BBBAAA	59.501***	18.192**	8.075	40.010***	121.944***
	[8.917]	[6.371]	[8.920]	[8.186]	[14.194]
SIZE (LN)	4.229	2.560	-0.470	5.152	5.972
	[2.853]	[4.763]	[2.707]	[4.176]	[5.115]
EFF	1.013	0.368	4.807*	-3.835	-5.051
	[2.369]	[5.615]	[2.426]	[2.489]	[4.093]
CRED_QUAL dummies					
Rating difference	9.552**	9.156	28.049***	13.792***	23.809**
	[3.914]	[16.589]	[4.117]	[4.986]	[9.119]
AA+	20.770	.	-20.556*	.	.
	[13.677]	.	[11.730]	.	.
AA	19.824**	.	-	.	.
	[9.848]	.	-	.	.
AA-	34.813***	.	5.148	.	.
	[10.480]	.	[7.133]	.	.
A+	48.094***	.	.	-8.501	.
	[10.648]	.	.	[5.642]	.
A	59.806***	.	.	-	.
	[10.534]	.	.	-	.
A-	71.874***	.	.	13.408*	.
	[11.785]	.	.	[7.525]	.
BBB+	98.579***	.	.	.	-11.939
	[11.533]	.	.	.	[8.934]
BBB	111.518***	.	.	.	-
	[13.911]	.	.	.	-
BBB-	159.122***	.	.	.	47.392***
	[17.476]	.	.	.	[17.347]
Constant	-163.442***	-34.846	-59.540	-99.677***	-220.517***
	[27.124]	[32.815]	[54.607]	[34.136]	[57.679]
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
Wald *F*-statistic for the joint significance of the maturity dummies	2.81**	2.79*	0.79	0.40	2.97**
Observations	468	41	73	188	166
Adjusted R-squared	0.69	0.76	0.65	0.52	0.66
Robust standard errors clustered by issuer in brackets *** p<0.01, ** p<0.05, * p<0.1					

Table 7 **Additional regressions for robustness.** Table shows OLS regression on the credit spreads over the risk-free rate. Individual *HIGHVOL* dummies have the value 1 if the issue is of either 5, 7 or 10 year maturity, zero otherwise. *MAT* is the natural log of term to maturity in years of a given issue. *LEVEL* is the monthly average of the 3m Euribor, SLOPE is the difference between 10-year government bonds and the 3-month Euribor rate. *BBBAAA* is the credit spread between AAA and BBB rated corporate bonds in the market. *SIZE* is the natural log of the size in Euros of a given issue. *EFF* measures the marketing efficiency of an issue, defined by the number of financial institutions involved in the sale of the bond. Rating difference takes the variable 1 if the rating agencies have assigned different credit ratings, zero otherwise.

In addition, each column in table 7 reports a joint test of significance for the dummy variables. Columns two to five report separate regression results by credit quality. We observe positive and significant maturity dummies for firms of AAA and BBB quality, confirmed also by the *F*-statistic.

Furthermore, we are able to measure the pricing difference within each broad credit rating category. The dropped quality dummy variable in each regression is the middle rating category.[14] As expected, in each category, the higher rating has lower spreads and vice versa.

1.5. Additional investigation of differences between maturity segments.

Evidence presented in this paper suggests a pricing anomaly in the primary bond market favouring maturities deviating from the norm; issues targeting non-conventional maturities bear a lower credit risk premium, which appears both statistically and economically significant. A reasonable question is to ask why these differences exist when theoretically justified controls are incorporated in the regression model. Are there unobserved sample differences between the issues at conventional and non-conventional maturities?

An intuitive argument for the observed phenomenon is that sophisticated investors may be more willing to extend funding at non-conventional maturities. It is reasonable to assume that these issues would be of a private-placement nature, where the appetite for corporate risk is investor driven and debt is directly placed to the institutional investors. Arak and Corcoran (1996) note that yield spreads private placement issues are sometimes lower than public issues and that the state of the economy drives the direction of the difference. Similarly, Blackwell and Kidwell (1988) study the yields spreads adjusted for transaction costs and find that the average yield for public issues exceeds those of private issues mainly since public issues involve higher flotation costs. By contrast, Zwick (1980) find that yields on private placements are higher than on public issues due to illiquidity. Thus, the status of a bond – whether it is of private or public nature – may explain the observed anomaly if issues of non-conventional maturities are placed directly to investors willing to grant at spreads lower than what can be obtain through widely auctioned debt issues.

Unfortunately, reliable data on the debt type is not available for bond issued in the Euro bond market[15], but statistical properties related to private placement issues may shed some light on the private-public status of a bond. Previous studies have shown that a number of factors appear to typify a private placement; the size of an average private placement issue is smaller than public issues (e.g. Carey *et al.* (1993) and Kwan and Carleton (2004)) and private placements have generally a shorter term to maturity (e.g. Datta, Iskandar-Datta and Patel (2000), Szewczyk and Varma (1991) and Carey *et al.* (1993)).

Table 8 presents summary statistics on maturity, size and the primary market efficiency[16] for bonds issued at high and low volume maturities. Panel 1 presents statistics on an annual basis while panel 2 divides the sample depending on whether a bond was issued under a debt programme or as a stand-alone issue. Issues at non-conventional maturities are generally of shorter term, smaller in size, and are placed less efficiently in the market than issues targeted to high-volume maturities. In addition, panel 2 shows that the proportion of stand-alone issues is higher within non-conventional maturities, suggesting that these bonds are more often issued uniquely outside normal debt programmes. This may suggest that stand-alone issues are made to meet a specific demand from debt investors. Alternatively, as debt

[14] The rating categories are, e.g.: A+, A and A–. Note that the highest, AAA rating category does not have plus or minus sub-categories within itself.

[15] The utilised database includes a dichotomous variable identifying issues as public or private. However, the information contained in this variable is both highly inaccurate and inconsistent. Further, the value in the variable is not reliably based on the true status of a bond, but rather on secondary measures defined by the data provider. Of the 486 issues included in the final sample, only 5 were identified as private placements by the database variable and 13 lacked the information entirely. Consequently, I have determined that the use of this variable is not suitable in the analysis.

[16] Recall that the efficiency was measured as the number of financial institutions – book runners – involved in the sale of a bond issue.

programmes are generally utilised by established capital market participants, a higher share of stand-alone issues could also indicate issues by new entrants in the market. In this case, a lower credit spread for these issuers would appear to suggest that investors are willing to lend at lower spreads with the intention of diversifying their debt holdings further.

PANEL 1		Debt issues				Maturity			Size			Efficiency	
		Low	High	Total		Low	High		Low	High		Low	High
1999	# obs.	6	47	53	Mean	3.98	7.85	Mean	525.40	637.32	Mean	2.33	2.09
	Share	11.3%	88.7%	100.0%	St.dev.	2.75	2.18	St.dev.	425.95	564.44	St.dev.	1.51	0.88
2000		8	52	60		3.51	7.00		446.25	591.35		2.00	2.17
		13.3%	86.7%	100.0%		0.92	2.13		486.50	301.46		1.07	0.73
2001		26	71	97		3.19	6.64		691.92	957.54		1.88	2.31
		26.8%	73.2%	100.0%		1.30	2.01		906.88	871.82		1.14	1.05
2002		14	49	63		3.93	7.16		477.57	786.22		1.64	2.45
		22.2%	77.8%	100.0%		1.81	2.09		618.63	760.47		0.93	1.00
2003		15	63	78		4.26	7.71		451.67	764.29		2.27	2.90
		19.2%	80.8%	100.0%		2.01	2.11		526.48	537.08		1.49	1.21
2004		7	37	44		5.16	8.15		398.86	605.22		2.57	3.11
		15.9%	84.1%	100.0%		2.33	1.75		273.80	444.66		1.51	1.39
2005		6	31	37		4.77	7.31		333.33	674.11		2.33	2.84
		16.2%	83.8%	100.0%		2.47	2.11		240.14	395.79		1.37	1.21
2006		9	45	54		5.89	8.02		505.56	766.67		3.00	3.09
		16.7%	83.3%	100.0%		1.97	2.04		199.13	398.58		1.12	1.02
Total		91	395	486		4.08	7.42		522.15	742.16		2.14	2.58
		18.7%	81.3%	100.0%		1.95	2.11		616.95	602.30		1.25	1.12

PANEL 2		Debt issues				Maturity			Size			Efficiency	
		Low	High	Total		Low	High		Low	High		Low	High
Standalone	# obs.	33	61	94	Mean	3.58	7.32	Mean	418.73	806.20	Mean	1.64	2.39
issue	Share	36.3%	15.4%	19.3%	St.dev.	1.45	2.19	St.dev.	546.13	609.64	St.dev.	0.99	1.08
Issue under		58	334	392		4.37	7.44		580.99	730.47		2.43	2.62
programme		63.7%	84.6%	80.7%		2.15	2.09		651.03	601.13		1.30	1.13
Total		91	395	486		4.08	7.42		522.15	742.16		2.14	2.58
		100.0%	100.0%	100.0%		1.95	2.11		616.95	602.30		1.25	1.12

Table 8 Descriptive statistics of differences between maturity segments.

Thus, descriptive statistics appear to highlight differences in the nature of issues targeted at either high or low volume maturities; a larger portion of debt issues at non-conventional maturities fit the characteristics described in previous studies of private placements type debt. While the lack data to accurately identify the actual public-private status of each bond issue diminishes our ability to draw clear conclusions regarding the pricing differences, the presented statistics appear signify that issues at non-conventional maturities meet more the characteristics of private placements, which are placed directly to investors willing to grant funding at spreads lower than what can be obtain through widely auctioned debt issues.[17]

1.6. Conclusions

This paper analyses pricing distortions over the credit yield curve. Theoretical models predict that credit risk premiums are monotonously increasing with maturity for high quality

[17] The scarcity of bonds issued at non-conventional maturities may also undermine the robustness of the results. Unfortunately, additional data is not available from the Euro bond market to augment the study in this respect.

firms. These models and related empirical research have usually focused their attention on credit spreads observed on traded, secondary market fixed income securities and fail therefore to embrace the initial costs of debt occurred at a firm level. In addition, the models do not consider supply and demand factors affecting the pricing of credit risk.

I contribute specifically to the literature by focusing my study on the primary bond market, where the observed spreads constitute actual funding costs for firms seeking funding on the capital markets. I find that bonds issued at maturities attracting the highest issuance volumes tend to have higher credit risk premiums compared with bonds of non-conventional maturity. These results seem to highlight a shortcoming of existing theoretical models, where the term structure of credit spreads is not smooth, but affected by the local supply of issues at various parts of the yield curve. Bonds issued at common maturities have 10-15 bps higher credit spreads than corresponding low volume maturities, even after controls for issue specific variations, macro economic changes, issuer's credit quality and industry differences are taken into consideration.

Precisely why issuance volumes remain focused on certain maturities is not immediately clear and goes beyond the scope of this paper, but it would seem odd that firms target maturities which lead to higher capital costs of funding in the long run. The initial benchmarking of issues over government risk-free rates may be argued as a source for the distinct focus on certain maturities, as the benchmark bonds and as well as credit default swaps have traditionally been primarily available at these conventional maturities. In light of these findings, one would expect issuers to adjust their targeted maturity dates to decrease funding costs.

Indirect evidence indicates that debt issues at non-conventional maturities are more often of private nature. Sophisticated debt investors are willing to extend directly placed funding at maturities deviating from the norm and at lower spreads, resulting in the non-monotonic term structure of credit spreads. The lack of robust data leaves, however, this explanation somewhat inconclusive, but invites further research to be conducted on the behaviour of European credit spreads.

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