LUISS

Finance

The Debt Maturity premium
in the Dutch stock market

N. Borri

SUPERVISOR

E. Barone

CORRELATOR

Vincenzo Cassone

CANDIDATE

Accademic year 2022/2023

Abstract

This thesis studies the asset pricing implications of firms' debt maturities within the Dutch stock market context. I find that a long-short portfolio constructed from firms with long versus short debt maturity generates an average monthly excess return of 0.53%. Despite this result, the analysis falls short of finding substantial statistical evidence in the data to establish the presence of a premium for debt maturity in the Dutch stock market. Additionally, the study explores the correlation between debt maturity and the Fama-French 5 factors (2015) to examine the nature of the debt maturity premium. The results suggest that this premium exhibits partially spanned characteristics, with positive exposure to some of these factors. Drawing on previous research by Dangl and Zechner (2021), DeMarzo and He, and Adamati et al. (2018), a plausible economic explanation for the existence of a debt maturity premium is offered. Overall, this thesis contributes to our understanding of the relationship linking debt maturities and stock returns in the Dutch stock market, shedding light on the presence and characteristics of the debt maturity premium.

Table of Contents

1. Introduction

Debt financing is a crucial avenue for companies to secure capital and support their operational endeavours. The maturity of debt exerts a significant effect on a companies' cost of capital, thus influencing their capacity to generate value and foster growth. Although there have been studies examining the correlation between debt maturities (DM) and equities' returns in the US stock market, there is a noticeable void in the academic literature regarding this relationship in the Dutch stock market. This thesis aims to bridge this gap by studying the link between debt maturities and excess returns in the Dutch context. By doing so, this study seeks to provide valuable insights that enhance the comprehension of the influence of debt maturities on equity returns in this market, and potentially identify a debt maturity premium.

The concept of a "debt maturity premium" pertains to the difference in expected returns between companies relying on long-term financing and those relying on short-term financing. The research questions guiding this thesis centre around the relation uniting debt maturity and equity returns, the presence of a debt maturity premium in the Dutch market, and the correlation betwixt debt maturity and other well-known companies' characteristics.

Through an examination of the research questions, the objective of this thesis is to offer valuable insights specific to the Dutch context, thereby contributing to the academic literature on debt maturity and stock returns, while providing valuable insights to investors, financial practitioners, and policymakers. By researching the correlation between debt maturities and stock returns in the Dutch market, a more comprehensive understanding of the capital structure dynamics can be achieved, and distinctive factors impacting debt maturities can be identified. The discoveries made with this study will empower stakeholders to make well-informed decisions and formulate strategies based on a nuanced comprehension of the relationship linking the maturity of debt and equities returns.

1.1 Methodology and results

The following analysis employs a range of methodologies to comprehensively investigate the correlation between debt maturity and stock returns within the Dutch context. These methodologies encompass factor-mimicking portfolio procedures, two-stage Fama-MacBeth regressions, and spanning regressions based on established benchmarks, including the CAPM (1964), the Fama-French 3-factor (1993), and 5-factor model (2015). To conduct this study, data sampled at a monthly frequency over the period 01/1990 – 12/2022 for 383 public Dutch firms are employed. This dataset includes various debt categories, including short- and long-term debt, and the portion of debt within current liabilities. Furthermore, in addition to debt-related variables, this study incorporates factors derived from renowned models in the asset pricing literature, encompassing variables like value, size, operating profitability, investment growth, and market beta. By adopting this comprehensive approach, various asset pricing tests will be performed and the relationship linking debt maturity and stock returns within the framework of these models will be assessed.

The analysis uncovers several significant findings. Firstly, the study reveals that Dutch firms with longer debt maturity levels tend to experience, on average, a monthly excess return that is 0.53% higher compared to firms with shorter debt maturity. This observation suggests that higher levels of debt maturity are associated with increased returns, emphasizing the importance of debt maturity in explaining variations in stock returns. Despite that, by conducting Fama-MacBeth regressions, it’s not possible to gather sufficient statistical evidence to establish the reality of a premium for debt maturity in the Dutch stock market. Furthermore, the obtained results also indicate that there’s a lack of enough statistical evidence to assert that the debt maturity premium is not a redundant factor. Nevertheless, the yielded results signal that the debt maturity premium is indeed spanned by certain factors contained in the FF5 model. This suggests that the debt maturity premium is partially accounted for by these factors. Additionally, when considering endogenous leverage and debt maturity choices, qualitatively analogous conclusions regarding the relationship between debt maturities and stock returns are obtained, utilizing a methodology inspired by Friedwald et al. (2022). This robustness analysis strengthens the validity and generalizability of the findings.

Based on these findings, many paths for future research can contribute to expanding the understanding of DM's implications. One potential direction involves exploring the asset pricing ramifications of debt maturity within a dynamic equilibrium model, considering firms' exposure to inflation risk connected with long-term (nominal) debt within a macro-finance framework. Additionally, conducting further studies in emerging economies, where short-maturity debt may hold greater significance and present unique dynamics and challenges, would offer valuable insights.

This research offers valuable insights into the pricing of debt maturity risks and their influence on excess returns within the Dutch stock market. However, it is crucial to acknowledge certain limitations. While some of the results attain statistical significance, others do not, indicating the potential presence of noise or unexplored firm characteristics that drive excess returns. Moreover, the relatively smaller sample size, in comparison to studies conducted in the US markets, may limit the generalizability of the findings, and hinder a comprehensive understanding of firm characteristics and market dynamics. In conclusion, this study contributes to our understanding of the risks associated with debt maturity and their impact on excess returns in the Dutch stock market. It is important for future research to address the identified limitations and explore new avenues to deepen our knowledge in this area, allowing for a more comprehensive understanding of the complexities surrounding debt maturities and their implications.

1.2 Literature

Despite the extensive research on short- and long-term financing decisions' impact on firms' capital structure, the effect of debt maturities on stock returns has received limited attention in the asset pricing literature. Chaderina et al. (2022) contribute to filling this lacuna by demonstrating that US stocks characterized by longer debt maturity exhibit a monthly premium of 0.21% compared to firms with a shorter maturity, even after controlling for market risk exposure. Their findings are supported by a theoretical model highlighting the stickiness of long-term debt, resulting in added countercyclical leverage dynamics for stocks with longer maturities. Consequently, companies with higher levels of long-term debt tend to have higher leverage levels during market downturns, leading to higher expected returns. Their model effectively characterizes the maturity premium in the existence of unconditional risk factors. Chaderina et al. (2022) build upon prior research by Adamati et al. (2018) and provide further justification for the presence of a debt maturity premium through the concept of "debt overhang". They attribute their findings to the reluctance of shareholders to repurchase debt during periods of financial distress. During those times, although repurchasing debt could potentially increase the firm's overall value, issuing new equity for debt repurchases would imply transferring wealth from shareholders to bondholders, creating a conflict of interest, and leading to the avoidance of leverage reductions. However, firms with prevailing shorter maturity debt can avoid the need to roll over maturing debt during economic downturns, allowing them to deleverage and navigate this conflict of interest successfully.

On the contrary, Friedwald et al. (2022) approach the topic from the perspective that firms determine their leverage and debt maturity levels simultaneously. They argue that highly leveraged firms may opt for shorter debt maturities to mitigate the conflict of interest highlighted by Adamati et al. (2018), thus considering it advantageous. Hence, they adopt a different approach by considering endogenous leverage and debt maturity choices to address the endogeneity of capital structure decisions. In the wake of controlling for size and leverage, they discover that, contrary to the findings of Chaderina et al. (2022), firms with a higher presence of short-maturity debt experience approximately 2% higher annual returns compared to firms with low refinancing intensity.

Their findings align with prior research by He and Xiong (2012), which suggests that short-maturity debt subjects shareholders to debt rollover risk, while long-maturity debt doesn't. This differential in risk exposure leads to unconditionally more elevated expected returns in the cross-section.

While the evidence presented by Chaderina et al. (2022) and Friedwald et al. (2022) based on the US markets is encouraging, it's crucial to scrutinize the applicability of the relationship among debt maturities and stock returns outside the US market. This is especially important, considering the significant variations in debt maturity choices across countries. Fan et al. (2012) emphasize the varying proportions of long-term debt among developed economies, which makes us wonder whether a premium for debt maturity exists outside the US, where maturity structures differ.

To address these research questions, this study investigates the cross-sectional relationship between equity returns and debt, specifically focusing on examining the existence and nature of a premium for debt maturity within the Dutch stock market. Similar to Custodio et al. (2013), debt maturity is measured using the amount of total debt maturing in one year or longer. To assess the extent of the debt maturity premium, factor-mimicking portfolio techniques, developed in the empirical asset pricing studies, and Fama-MacBeth regressions are implemented. Furthermore, to ascertain the observed maturity premium is not influenced by other firms' attributes or factor associations, the impact of portfolio returns on factors from CAPM (1964), Fama-French's 3-factor (1993), and the 5-factor model (2016) is evaluated.

1.3 Roadmap

The remaining part of the thesis is organized as explained below:

Section 2 introduces the data utilized in the analysis. It offers a comprehensive overview of the data sources and the specific variables used in the study. Section 3 delves into the methodology implemented in the study. It presents a detailed explanation of the analytical framework, including the statistical models and techniques employed to research the relationship between debt maturities and stock returns. In Section 4, the empirical analysis is presented, and the results obtained through the study are discussed. A thorough examination of the findings is provided, including significant correlations or patterns observed in the data. Finally, in Section 5, conclusions based on the findings are drawn, and a rationalization of the implications is provided. The implications of this research are discussed, highlighting the key insights derived from the analysis, and recommendations are offered for further exploration and future research.

2. Data

This thesis relies on data from publicly traded firms in the Dutch market to address its research questions. The selected sample includes 383 Dutch listed firms' returns and accounting data from January 1990 to December 2022. To obtain the necessary data, monthly stock prices from the Compustat Global – Security File and annual accounting fundamentals from the Compustat Global – Fundamentals Annual File are gathered. To ensure the reliability and relevance of the analysis, the data for all Dutch firms within the specified period is obtained. However, certain criteria are applied to exclude firms from the sample. Specifically, financial stocks (with SIC codes ranging from 6000 to 6999) are excluded from the sample, as well as stocks with a non-positive book value or market value of equity, or/and total assets.

To study the impact of DM on equity returns, this analysis relies on detailed data on debt maturity. Specifically, information on three distinct types of debt is employed: debt with an original maturity longer than one year (DLTT), debt that matures within the year (DD1), and debt within current liabilities (DLC). To ensure the accuracy and robustness of the analysis, specific constraints on the debt variables are imposed. It is required that all debt variables (DD1, DLC, and DLTT) for the firms in the sample must have non-negative values. To quantify a measure of DM, the total debt maturing in longer than one year is considered (see Appendix). This measure enables us to capture the maturity profile of companies' debt and examine its influence on equity returns. Furthermore, the analysis relies on the attainability of several key variables that play a crucial role in constructing the asset pricing models, namely the CAPM, FF3, and FF5 are considered. These variables include measures of value, size, operating profitability, investment growth, and market beta. By ensuring the availability of these variables, the multifaceted relationships between debt maturity and stock returns are captured, while controlling for other relevant factors.

Additionally, to provide a comprehensive perspective, a market-weighted index that includes all the stocks examined in the analysis over the interval from January 1990 to December 2022 is built. This approach has been preferred, as an index like the AEX 25 index alone may not provide a fair representation of the considered stock universe, which encompasses a much broader set of firms. Finally, the risk-free rate is computed by utilizing the yield on the Dutch Government Bond (10 years maturity). By incorporating these data selection criteria, a comprehensive analysis that provides valuable insights into the relationship linking debt maturities and stock returns in the Dutch stock market is conducted.

Name	Abbreviation	Construction
Price	PRC	PRCDD from COMPUSTAT
Shares outstanding	CSHO	CSHO from COMPUSTAT
BV of Equity	CEQ	CEQ from COMPUSTAT
Long-term Debt	DLTT	DLTT from COMPUSTAT
Short-term Debt	DLC	DLC from COMPUSTAT
< 1 year Debt	DD1	DD1 from COMPUSTAT
Total Assets	AT	AT from COMPUSTAT
EBIT	EBIT	EBIT from COMPUSTAT
MV of Equity	ME	$PRC_t \times CSHO_t$
Debt maturity	DM	$(DLTT_t - DD1_t)/(DLTT_t + DLC_t)$
Leverage	LEV	$(DLTT_t + DLC_t)/(DLTT_t + DLC_t + ME_t)$
Size	MCAP	$(PRC_t \times CSHO_t)/10.000$
Book-to-Market	BM	$(ME_t)/(CEQ_t)$
Opearating profitability	OP	$(EBIT_t)/(CEQ_t)$
Investment Growth	INV	$(AT_t)/(AT_{t-1})$

2.1 Summary statistics

Table 1

Panel A displays summary statistics for the sample data. I report summary statistics for monthly stocks' returns and annual Size (market capitalization/10.000), book-to-market ratio (BM), and debt maturity (DM) for the sample. I report in my table the time-series averages of cross-sectional statistics, including mean, standard deviation, as the 25%, 50%, and 75% quintiles. I also include summary statistics for the Market return, referrıng to the return on a Value weighted index containing the firms in the sample, and the risk-free rate, referring to the monthly yield of the 10-year maturity Dutch Government Bond. Panel B presents correlations among firms' characteristics. I report the correlation of the various characteristics (Size, BM, DM, LEV, OP, INV). The data are sampled at a monthly frequency and include 383 Dutch publicly traded firms from January 1990 to December 2022.

Panel A: Summary statistics

Var	Mean	SD	p25	p50	p75
Returns	**0,76%**	**5,54%**	**-1,69%**	**0,77%**	**3,18%**
Size	0.88	2.13	0.03	0.15	0.96
BM	0.89	1.89	0.28	0.50	0.96
DM	0.57	0.34	0.39	0.65	0.82
LEV	0.40	0.20	0.25	0.40	0.54
INV	1.09	0.27	0.97	1.04	1.16
OP	0.20	0.20	0.09	0.19	0.28
Risk-Free	**0.32%**	**0.21%**	**0.15%**	**0.34%**	**0.49%**
Market Return	**0.85%**	**6.12%**	**-2.71%**	**0.97%**	**4.80%**

Panel B: Correlations among firms' characteristics

Var	**Size**	**BM**	**DM**	**LEV**	**OP**	**INV**
Size	1.000					
BM	-0.128	1.000				
DM	0.150	-0.042	1.000			
LEV	0.030	-0.021	0.176	1.000		
OP	0.155	-0.149	0.061	0.280	1.000	
INV	0.036	-0.073	0.028	-0.042	0.093	1.000

Summary statistics and correlations for the sample data are presented in Table 1. Panel A provides an overview of the sample, which encompasses 99,346 firm-returns observations spanning from January 1990 to December 2022. The average maturity of firms in the sample, calculated over the time series, is 0.57. This indicates that, on average, approximately 57% of a company's total debt matures in one year or more. The time-series average monthly return for the sample data is 0.76%. Moving to Panel B, the correlations among the selected characteristics of the firms are examined, observing a positive but weak correlation between debt maturity and the other considered characteristics (besides BM). Among these, the correlation with leverage is the strongest, standing at 0.176. The correlations with other variables, such as firm size, profitability, and investment growth, exhibit weaker magnitudes, indicating less pronounced relationships.

Table 2

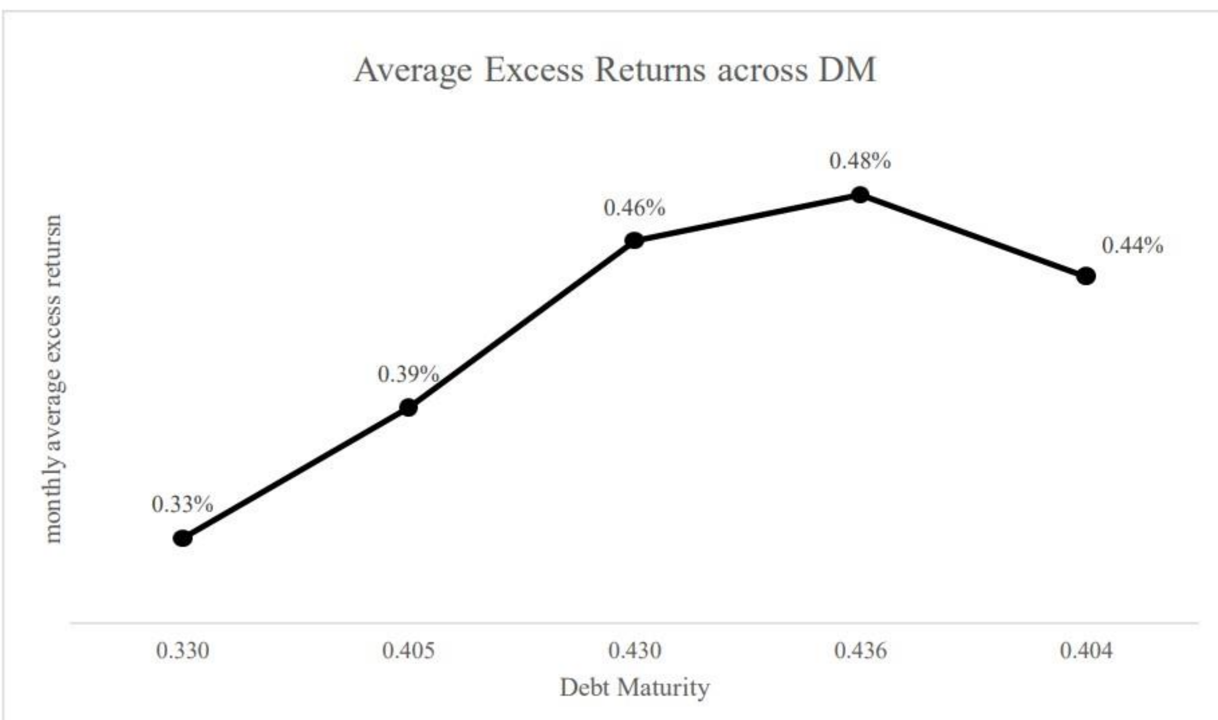
Firm characteristics across debt maturities (DM). I compute time-series averages for annual firms' characteristics and monthly excess returns across five debt maturity buckets. I sort firms into quintiles by DM for every month in my sample and present time-series averages within each DM bucket. For each debt maturity bucket, I reported monthly time-series averages of excess returns (Ex Ret), Market capitalization / 10.000 (Size), Book value to Market value of Equity ratio (BM), Debt maturity (DM) and Leverage (LEV), the excess return is the stock's monthly return in excess of the risk-free rate (monthly yield of 10Y Dutch Government Bond). The sample data covers 383 Dutch publicly traded firms from Jan 1990 to Dec 2022.

	Short DM	...	Medium DM	...	Long DM
Ex Ret	**0.33%**	**0.39%**	**0.46%**	**0.48%**	**0.44%**
DM	**10%**	**47%**	**65%**	**79%**	**92%**
Size	0.401	0.799	1.493	0.749	1.035
BM	1.253	0.894	0.823	0.854	1.120
LEV	0.330	0.405	0.430	0.436	0.404
OP	0.154	0.197	0.223	0.215	0.198
INV	1.070	1.097	1.082	1.072	1.110

Table 2 displays summary statistics of firms' characteristics and excess return, categorized into five debt maturity buckets. It’s possible to observe significant diversity across the maturity profiles in these buckets. On average, firms in the category with the lowest maturity have approximately 10% of their debt maturing in longer than one year, while firms in the category with the highest maturity experience over 92% of their debt reaching maturity in one year or more. The data also suggests that in the Dutch stock market, time-series average expected excess returns are increasing in average debt maturity: It’s possible to observe increasing average expected excess returns from the first to the fourth quintiles, and only decrease from the fourth to the fifth quintile. However, more statistical evidence is needed to conclude the link between DM and excess returns. The other firms’ characteristics don’t show any clear pattern across debt maturity buckets.

Graph 1

Time-series average excess returns across debt maturities (DM). I compute time-series averages for monthly excess returns across five debt maturity buckets. I sort firms into quintiles by debt maturity for every month in my sample and present time-series averages within each DM bucket. The sample data covers 383 Dutch publicly traded firms from January 1990 to December 2022.



3. Methodology

The objective of this study is to investigate the connection between debt maturities of firms and their equity returns in the Dutch equities market, with a specific emphasis on determining if there is a premium connected to debt maturity. Additionally, this study aims to explore if the debt maturity premium is correlated with other known characteristics of the firms. To achieve these objectives, several hypotheses are formulated, and several techniques are employed.

Firstly, using portfolio-sorting techniques the "Long Minus Short portfolio" (LMS) is created, a long-short portfolio based on debt maturities. Using this portfolio it is shown that companies with longer debt maturities exhibit higher risk premiums compared to firms with shorter maturities.

Secondly, within the framework of Fama-MacBeth regressions and using the LMS factor, the hypothesis that a one-unit increase in exposure to beta debt maturity (β_{DM}) will impact excess returns lambda times (λ_{DM}) is examined; alternatively, the possibility that it may not affect excess returns whatsoever is considered. Additionally, the potential scenario where there is insufficient statistical significance to draw any conclusive findings.

Thirdly, employing spanning regressions on the LMS portfolio, the study examines whether the debt maturity premium can be solely attributed to other known characteristics of firms, specifically the FF5 factors (2015). The hypothesis that the debt maturity premium is encompassed by these characteristics is examined, suggesting that their inclusion in the analysis explains the observed relationship; alternatively, the possibility that the debt maturity premium may not be entirely explained by these characteristics is considered. Furthermore, the scenario where there's no statistical significance to draw any conclusion it's taken into consideration.

Furthermore, the correlation between the LMS factor and the factors in FF5 (2015) is analyzed, employing Pearson correlation tests, to find significant correlations that bring forth awareness into the interplay among DM and other factors.

Lastly, these hypotheses are examined once again, while considering endogenous leverage and debt maturity choices, inspired by previous research by Friedwald et al. (2022). This additional analysis allows us to make conclusions in light of the endogeneity of capital structure decisions.

3.1 Long-short Portfolios

To study the relationship between returns and debt maturities, observations are sorted by their debt maturities into 5 quintiles, and time-series averages, standard deviations, median, 25% and 75% quintiles for excess returns, and firms' characteristics for each quintile are presented.

In addition, portfolio procedures inspired by the works of Friedwald et al. (2022) and Chaderina et al. (2022) are employed, to study the relevance and ramifications of the DM maturity structure on the cross-section of stock returns. The objective is twofold: first, to quantify the premium linked with debt maturity risk, and second, to investigate how it interacts with benchmark factors in asset pricing models. To isolate the impact of debt maturity from the effects of firm size, long-short portfolios based on conditional sorting of both size and debt maturity (DM) variables are built. This allows to separate the premium associated with size factors from the premium linked with debt maturity. Portfolio sorts based on Size ($i = 1, 2$) and debt maturity ($k = 1, 2, 3$) are operated, at the end of each month in year t (as in Chaderina et al., 2022). After that, a long-short portfolio based on debt maturity is built: the Long Minus Short portfolio (or DM factor). Additionally, long-short portfolios based on Size ($i = 1, 2$), BM ($j = 1, 2, 3$), INV ($l = 1, 2, 3$) and OP ($m = 1, 2, 3$) are also constructed, to replicate the FF5's factors that will be used afterwards in the analysis.

$$LMS_t = \frac{1}{2}\left(\sum_{i=1}^{2} R_t^{i,k=3} - \sum_{i=1}^{2} R_t^{i,k=1}\right)$$

$$SMB_t = \frac{1}{3}\left(\sum_{j=1}^{3} R_t^{i=1,j} - \sum_{j=1}^{3} R_t^{i=2,j}\right)$$

$$HML_t = \frac{1}{2}\left(\sum_{i=1}^{2} R_t^{i,j=3} - \sum_{i=1}^{2} R_t^{i,j=1}\right)$$

$$RMW_t = \frac{1}{2}\left(\sum_{i=1}^{2} R_t^{i,l=3} - \sum_{i=1}^{2} R_t^{i,l=1}\right)$$

$$CMA_t = \frac{1}{2}\left(\sum_{i=1}^{2} R_t^{i,m=3} - \sum_{i=1}^{2} R_t^{i,m=1}\right)$$

Table 3

Long Minus Short (LMS) and Fama-French factors' summary statistics. From my sample of 383 Dutch public firms from January 1990 to December 2022, I build five factors, focusing on monthly equally Weighted returns of long-short portfolios, sorted by Size ($i = 1, 2$), Debt maturity ($k = 1, 2, 3$), BM ($j = 1, 2, 3$),INV ($l = 1, 2, 3$) and OP ($m = 1, 2, 3$). I report in the table below the time series average monthly returns, standard deviations, median, 25% and 75% quintiles for each computed factor.

Factor	Mean	SD	p25	p50	p75
Rm - Rf	0.53%	6.14%	-3.14%	0.71%	4.45%
LMS	0.54%	3.88%	-1.80%	0.47%	2.62%
SMB	1.14%	4.66%	-0.90%	1.20%	3.53%
HML	0.23%	5.22%	-2.35%	0.00%	2.07%
RMW	0.56%	5.09%	-1.59%	1.00%	3.38%
CMA	1.02%	4.33%	-0.95%	1.08%	3.48%

3.2 Fama-MacBeth regressions

Once the LMS and the factors have been built, the debt maturity-excess return relation is examined by implementing Fama-MacBeth regressions (1973), while controlling for a variety of firm characteristics. Using monthly returns for the factors, OLS regressions at the individual firm level are implemented, to test the hypotheses: H_0: $\lambda_{LMS,i} = 0$ vs H_1: $\lambda_{LMS,i} \neq 0$. The time-series average of $\lambda_{LMS,t}$ will represent an estimate of the expected risk premium per unit exposure to debt maturity risk ($\hat{\beta}_{LMS,i,t}$), hence, an estimate of the debt maturity premium. Firstly, the first stage regressions, for each firm i from 1 to N, is implemented in 3 specifications:

(1) $R_{i,t} - rf_t = \alpha_i + \beta_{LMS,i}(LMS_t) + \beta_{Mkt,i}(MRP_t) + u_{i,t}$

(2) $R_{i,t} - rf_t = \alpha_i + \beta_{LMS,i}(LMS_t) + \beta_{Mkt,i}(MRP_t) + \beta_{SMB,i}(SMB_t) + \beta_{HML,i}(HML_t) + u_{i,t}$

(3) $R_{i,t} - rf_t = \alpha_i + \beta_{LMS,i}(LMS_t) + \beta_{Mkt,i}(MRP_t) + \beta_{SMB,i}(SMB_t) + \beta_{HML,i}(HML_t) +$
$+ \beta_{RMW,i}(RMW_t) + \beta_{CMA,i}(CMA_t) + u_{i,t}$

Secondly, the second stage regressions, for each period t from 1 to T, are implemented in 3 specifications:

(1) $R_{i,t} - rf_t = \lambda_{0,t} + \lambda_{LMS,t}(\hat{\beta}_{LMS,i,t}) + \lambda_{Mkt,t}(\hat{\beta}_{Mk,i,t}) + \varepsilon_{i,t}$

(2) $R_{i,t} - rf_t = \lambda_{0,t} + \lambda_{LMS,t}(\hat{\beta}_{LMS,i,t}) + \lambda_{Mkt,t}(\hat{\beta}_{Mk,i,t}) + \lambda_{SMB,t}(\hat{\beta}_{SMB,i,t}) + \lambda_{HML,t}(\hat{\beta}_{HML,i,t}) + \varepsilon_{i,t}$

(3) $R_{i,t} - rf_t = \lambda_{0,t} + \lambda_{LMS,t}(\hat{\beta}_{LMS,i,t}) + \lambda_{Mkt,t}(\hat{\beta}_{Mk,i,t}) + \lambda_{SMB,t}(\hat{\beta}_{SMB,i,t}) + \lambda_{HML,t}(\hat{\beta}_{HML,i,t}) +$
$+ \lambda_{RMW,t}(\beta_{RMW,i,t}) + \lambda_{CMA,t}(\hat{\beta}_{CMA,i,t}) + \varepsilon_{i,t}$

A statistically different from zero coefficient for $\hat{\beta}_{LMS,}$ would imply that there is statistical evidence for a premium for debt maturity in the Dutch stock market.

3.3 Spanning regressions

Fama-French (2015) have demonstrated the redundancy of the HML factor, as its average return can be fully explained by its exposure to the Investment and Profitability factors. This study aims to conduct a similar analysis of the LMS factor. When a factor is deemed redundant, it implies that including it in the model does not provide any additional information or improvement, as its information is already captured by the other factors. To examine this, the returns of the DM factor are regressed on the returns of the other factors. This regression will be implemented in three specifications for each LMS portfolio formed within distinct Size buckets.

(1) $LMS_{i,t+1} = \alpha_i + \beta_{i,M}[MRP_{t+1}] + \varepsilon_{it}$

(2) $LMS_{i,t+1} = \alpha_i + \beta_{i,M}[MRP_{t+1}] + \beta_{i,SMB}[SMB_{t+1}] + \beta_{i,HML}[HML_{t+1}] + \varepsilon_{i,t}$

(3) $LMS_{i,t+1} = \alpha_i + \beta_{i,M}[MRP_{t+1}] + \beta_{i,SMB}[SMB_{t+1}] + \beta_{i,HML}[HML_{t+1}] +$
$+ \beta_{i,RMW}[RMW_{t+1}] + \beta_{i,CMA}[CMA_{t+1}] + \varepsilon_{i,t}$

To test whether the intercepts of the 3 Size-DM long-short portfolios are jointly significant or not ($H_0\!: \alpha_i = 0 \; \forall \; i$), a GRS test (1989) is implemented. If the jointly estimated alpha of the regression was statistically insignificant, it would not be possible to reject the hypothesis that the factor under consideration is redundant.

3.4 Pearson correlation test

To analyze the correlation between the DM factor and the factors in the FF5 model (2015 the Pearson correlation among the factors and the relative p-values for their test are computed.

3.5 Endogenous LEV and DM choice

To provide robustness to the study, the analysis is repeated considering the choice of debt maturity and leverage to be endogenous. To do so, Friedwald et al. (2022) portfolio sorts based on Size ($i = 1, 2$), LEV ($j = 1, 2, 3$) and DM ($k = 1, 2, 3$) are implemented. By employing this approach, It's possible to separate the premiums linked to leverage from those associated with debt maturity risk, while also accounting for size effects. Additionally, a Levered Minus Unlevered (LMU) long-short portfolio is constructed, in addition to the factors created in the previous analysis.

$$LMS_t = \frac{1}{4}\left(\sum_{j=1}^{2}\sum_{i=1}^{2} R_t^{ij3} - \sum_{j=1}^{2}\sum_{i=1}^{2} R_t^{ij1}\right)$$

$$LMU_t = \frac{1}{6}\left(\sum_{i=1}^{2}\sum_{k=1}^{3} R_t^{i2k} - \sum_{i=1}^{2}\sum_{k=1}^{3} R_t^{i1k}\right)$$

Table 4

Conditionally sorted portfolios' excess returns (triple sort). I report the excess returns from independent 2×2×3 sorts, for portfolios sorted on size (Size), Leverage (LEV), and Debt maturity (DM). I report the time-series average monthly return for the Long Minus Short (LMS) and the Levered minus Unlevered (LMU) portfolios. The LMS portfolio (LMU) is obtained as the monthly return differential between the long DM (high LEV) and short DM (low LEV) portfolios' return within each Size-Leverage bucket. The data are sampled at a monthly frequency and cover 383 public Dutch firms from Jan 1990 to Dec 2022.

Factor	Mean	SD	p25	p50	p75
LMS	0.53%	3.49%	-1.74%	0.53%	2.64%
LMU	0.34%	2.66%	-1.29%	0.40%	1.80%

Once again, the debt maturity-excess return relationship is examined, by implementing Fama-MacBeth regressions while controlling for a variety of firm characteristics, including Leverage this time. Using monthly returns, OLS regressions at the individual firm level are implemented, to test the hypotheses: H_0: $\lambda_{LMS,i} = 0$ vs H_1: $\lambda_{LMS,i} \neq 0$. Firstly, the first stage regressions are executed, for each firm i from 1 to N, and in 3 specifications:

(1) $R_{i,t} - rf_t = \alpha_i + \beta_{LMS,i}(LMS_t) + \beta_{LMU,i}(LMU_t) + \beta_{Mkt,i}(MRP_t) + u_{i,t}$

(2) $R_{i,t} - rf_t = \alpha_i + \beta_{LMS,i}(LMS_t) + \beta_{LMU,i}(LMU_t) + \beta_{Mkt,i}(MRP_t) + \beta_{SMB,i}(SMB_t) + \beta_{HML,i}(HML_t) + u_{i,t}$

(3) $R_{i,t} - rf_t = \alpha_i + \beta_{LMS,i}(LMS_t) + \beta_{LMU,i}(LMU_t) + \beta_{Mkt,i}(MRP_t) + \beta_{SMB,i}(SMB_t) + \beta_{HML,i}(HML_t) +$
$+ \beta_{RMW,i}(RMW_t) + \beta_{CMA,i}(CMA_t) + u_{i,t}$

Secondly, the second stage regressions are runt, for each period t from 1 to T, in 3 specifications:

(1) $R_{i,t} - rf_t = \lambda_{0,t} + \lambda_{LMS,t}(\hat{\beta}_{LMS,i,t}) + \lambda_{LMU,t}(\hat{\beta}_{LMU,i,t}) + \lambda_{Mkt,t}(\hat{\beta}_{Mk,i,t}) + \varepsilon_{i,t}$

(2) $R_{i,t} - rf_t = \lambda_{0,t} + \lambda_{LMS,t}(\hat{\beta}_{LMS,i,t}) + \lambda_{LMU,t}(\hat{\beta}_{LMU,i,t}) + \lambda_{Mkt,t}(\hat{\beta}_{Mk,i,t}) + \lambda_{SMB,t}(\hat{\beta}_{SMB,i,t}) + \lambda_{HML,t}(\hat{\beta}_{HML,i,t}) +$

(3) $R_{i,t} - rf_t = \lambda_{0,t} + \lambda_{LMS,t}(\hat{\beta}_{LMS,i,t}) + \lambda_{LMU,t}(\hat{\beta}_{LMU,i,t}) + \lambda_{Mkt,t}(\hat{\beta}_{Mk,i,t}) + \lambda_{SMB,t}(\hat{\beta}_{SMB,i,t}) + \lambda_{HML,t}(\hat{\beta}_{HML,i,t}) +$
$+ \lambda_{RMW,t}(\beta_{RMW,i,t}) + \lambda_{CMA,t}(\hat{\beta}_{CMA,i,t}) + \varepsilon_{i,t}$

Finally, to understand if that premium formerly studied is spanned by exposure to other known firms' characteristics, spanning regressions for the DM factor are implemented, this time also including the LMU factor. To understand if the DM factor is redundant, the following regression will be implemented in three specifications and for each LMS portfolio formed in a different Size-Leverage bucket:

(1) $LMS_{i,t+1} = \alpha_i + \beta_{i,M}[MRP_{t+1}] + \beta_{i,LMU}[LMU_{t+1}] + \varepsilon_{i,t}$

(2) $LMS_{i,t+1} = \alpha_i + \beta_{i,M}[MRP_{t+1}] + \beta_{i,LMU}[LMU_{t+1}] + \beta_{i,SMB}[SMB_{t+1}] + \beta_{i,HML}[HML_{t+1}] + \varepsilon_{i,t}$

(3) $LMS_{i,t+1} = \alpha_i + \beta_{i,M}[MRP_{t+1}] + \beta_{i,LMU}[LMU_{t+1}] + \beta_{i,SMB}[SMB_{t+1}] + \beta_{i,HML}[HML_{t+1}] +$
$+ \beta_{i,RMW}[RMW_{t+1}] + \beta_{i,CMA}[CMA_{t+1}] + \varepsilon_{i,t}$

For each i from 1 to 9, where 1 represents small unlevered firms and 9 represents big-levered ones. Finally, to verify whether the intercepts (9 per model specification) obtained from the spanning regression on the LMS portfolios within each Size-Leverage bucket are jointly statistically significant (H_0: $\alpha_i = 0 \ \forall \ i$), once again a GRS test is implemented. Similar to previous findings, if the alpha of the regression was statistically indistinguishable from zero, it indicates that no portion of the regressand's return remains unexplained. Consequently, It would not be possible to reject the hypothesis that DM is a redundant factor.

4. Results

In this section, the evidence obtained from the previous analysis, which follows the methodology outlined above, is presented. By applying the described techniques and employing the sample data, the findings that contribute to the comprehension of the association among DM and equity returns in the context of the study are explored. The first step will be presenting the results obtained from portfolios that are sorted based on size and debt maturity, following the approach of Chaderina et al. (2022). Additionally, as a robustness check, in Chapter 4.4 the results from portfolios that are sorted based on size, leverage, and debt maturity, as suggested by Friedwald et al. (2022) are provided.

4.1 Portfolio Sorts

Table 5

In Panel A, I report summary statistics for the LMS factor, focusing on monthly equally weighted excess returns of triple-sorted portfolios, sorted by size ($i = 1, 2$) and debt maturity ($k = 1, 2, 3$). I report the time series average excess returns, standard deviations, median, 25%, and 75% quintiles. In Panel B, I report the time-series average excess returns from independent 2×3 sorts, for portfolios sorted on size (Size) and debt maturity (DM). I also report the time-series average excess return for the Long Minus Short portfolios, obtained as the monthly return differential between the Long and Short Debt maturity portfolios' excess returns within each Size bucket. The data are sampled monthly and cover 383 Dutch publicly traded firms from January 1990 to December 2022.

Panel A: Long Minus Short (LMS) portfolio

Factor	Mean	SD	p25	p50	p75
LMS	0.53%	3.49%	-1.74%	0.53%	2.64%

Panel B: Conditionally sorted portfolios' excess returns

		Size	
		Small	Big
Debt maturity	Short	-0.09%	0.81%
	Medium	0.38%	0.59%
	Long	0.41%	0.86%
LMS		0.50%	0.04%

To construct the portfolios, a double-sorting approach based on debt maturity and size as in Chaderina et al. (2022) is adopted. For each month, stocks are divided into quintiles according to their size and further divide them into conditional quintiles based on their debt maturities. Conditional sorting is necessary as debt maturity tends to vary across firm sizes. For each size quintile, a long-short portfolio is formed, where a long position in the long-maturity bucket and a short position in the short-maturity bucket is taken (referred to as the Long Minus Short or LMS portfolio). Their time-series average monthly excess returns and other summary statistics are presented in Table 5. As in Chaderina et al.'s (2022) analysis, it's possible to observe that the LMS portfolio displays positive time-series average monthly excess returns of 0.53%. This suggests that on average, companies with longer maturity of debt earn a premium of 0.53% (monthly) compared to firms with shorter maturity. From the time-series average monthly excess returns on the conditionally sorted portfolios reported in Panel B, it's possible to observe that there's some heterogeneity in the relationship between excess returns and debt maturities based on firms' size. The different LMS portfolios within each Size bucket (as in Chaderina) present positive time-series average excess returns for small firms (0.50%), and positive but closer to zero average excess returns for big firms (0.04%). This initial evidence suggests that the relationship between debt maturities and firms' size may vary depending on firms' size.

4.2 Fama-MacBeth Regressions

Table 6

Fama Macbeth regressions with portfolios double sorted by size, and debt maturity. I present the estimated results of the 2nd stage regressions as in Fama Macbeth, including the LMS factor. I present estimates for 3 model specifications, in which I include a different number of factors (CAPM, FF3 and FF5). The data are sampled at a monthly frequency and cover 383 Dutch public firms from January 1990 to December 2022.

	λ_0	λ ($\hat{\beta}$ MKT)	λ ($\hat{\beta}$ SMB)	λ ($\hat{\beta}$ HML)	λ ($\hat{\beta}$ RMW)	λ ($\hat{\beta}$ CMA)	**λ ($\hat{\beta}$ LMS)**
(i)	**0.002**	**0.002**					**0.001**
p-value	*0.471*	*0.000*					*0.593*
(ii)	**0.003**	**0.003**	**0.001**	**0.004**			**-0.001**
p-value	*0.141*	*0.024*	*0.381*	*0.004*			*0.736*
(iii)	**0.003**	**0.003**	**0.003**	**0.003**	**-0.003**	**0.005**	**0.000**
p-value	*0.088*	*0.098*	*0.023*	*0.031*	*0.013*	*0.000*	*0.964*

To thoroughly examine the impact of debt maturities on equity returns, Fama-MacBeth's (1973) cross-sectional regressions are employed. This analysis involves conducting regressions at the individual stock level, using monthly excess returns. In Table 6 the results from the second-stage regression are presented in three different model specifications . In model (i) OLS regressions of excess returns on the Market and the DM factor are implemented, in model (ii) the SMB and HML factors are added to the regression, and in model (iii) the RMW and CMA factors are also incorporated.

The reported results don't provide enough statistical evidence to confirm the presence of a Debt maturity premium in the Dutch Stock market: in each of the three model specifications, a λ ($\hat{\beta}_{LMS}$) is obtained, which is close to zero and statistically insignificant. This outcome doesn't allow us to make any conclusion about the presence of a premium for debt maturity in the Dutch stock market.

4.3 Spanning Regressions

Table 7

Spanning regressions with portfolios double sorted by size and debt maturity. I present the results for the spanning regressions of the LMS portfolios within each size bucket (LMS1 for small, LMS2 for large firms, LMS including all the firms in the sample) on the CAPM, FF3 and FF5 factors. The LMS portfolios are characterized by their alpha estimates from CAPM regressions (αCAPM), the 3-factor model by Fama and French (αFF3), and the 5-factor model by Fama and French (αFF5). Factor loadings are displayed as well. Data are sampled at a monthly frequency and cover 383 Dutch publicly traded firms from January 1990 to December 2022.

	LMS1 (small firms)		**LMS2** (big firms)		**LMS**	
	Coefficient	*p-value*	Coefficient	*p-value*	Coefficient	*p-value*
β MKT	**-0.069**	*0.229*	**-0.075**	*0.168*	**0.003**	*0.950*
α CAPM	**0.001**	*0.090*	**0.000**	*0.972*	**0.003**	*0.241*
β MKT	**-0.133**	*0.023*	**-0.094**	*0.086*	**-0.020**	*0.655*
β SMB	**0.410**	*0.000*	**0.146**	*0.081*	**0.132**	*0.048*
β HML	**0.084**	*0.250*	**0.296**	*0.001*	**-0.106**	*0.053*
α FF3	**0.003**	*0.385*	**-0.004**	*0.213*	**0.004**	*0.175*
β MKT	**-0.187**	*0.001*	**-0.083**	*0.139*	**-0.052**	*0.239*
β SMB	**0.301**	*0.001*	**0.185**	*0.031*	**0.058**	*0.383*
β HML	**0.229**	*0.003*	**0.255**	*0.001*	**-0.013**	*0.825*
β RMW	**-0.385**	*0.001*	**0.132**	*0.074*	**-0.258**	*0.001*
β CMA	**0.186**	*0.019*	**-0.147**	*0.053*	**0.167**	*0.005*
α **FF5**	**0.003**	*0.425*	**-0.003**	*0.346*	**0.003**	*0.257*

Table 8

GRS test with portfolios double sorted by size and debt maturity. I run a GRS test on the ability of CAPM, FF3, and FF5 factors to explain monthly excess returns on the three LMS portfolios within each size bucket (relating to Table 7 regressions). The data are sampled at a monthly frequency and cover 383 Dutch publicly traded firms from January 1990 to December 2022.

GRS	Mean alpha	Mean abs alpha	Test static	P-value	Mean adj R2
CAPM	0.0029	0.0030	2.9423	0.4006	0.0003
FF3	0.0008	0.0035	1.9754	0.5775	0.0360
FF5	0.0009	0.0030	1.3193	0.7246	0.0740

To examine the potential redundancy of the debt maturity premium (monthly), spanning regression tests are conducted. These tests involve regressing the LMS factor onto factors from the CAPM (1964) in scenario (i), the FF3 (1993) in scenario (ii), and the FF5 (2015) in scenario (iii), which are widely recognized benchmarks in empirical asset pricing. The outcome of the spanning regressions for the three LMS portfolios on the factors is presented in Table 7. In model specification (i), for the sample of small firms (LMS1), some statistical evidence suggesting that the LMS factor is not redundant (α CAPM is 0.001, at the 10% level) is found. However, this is not also true for the sample of big firms (LMS2), and for the whole sample (LMS).

In model specification (ii), among all samples, enough statistical evidence to conclude that the LMS factor is not redundant is not found. Moreover, amongst the three samples, some statistical evidence that the LMS factor is positively spanned by the Size factor is found.

In model specification (iii) as well, among all samples enough statistical evidence to conclude that the LMS factor is not redundant is not found. Moreover, amongst the three samples, some statistical evidence is found, suggesting that the LMS factor is positively spanned by the Size, Value, Investment, and Profitability factor (although negative for the small firms' sample).

In addition to analyzing the individual debt maturity premia, it's also relevant to assess their joint significance across the different size buckets implementing the GRS (1989) test. The former allows us to evaluate whether the alphas obtained before (debt maturity premia) premia are jointly statistically significant or not. Table 8 displays the results of the GRS test applied to the three model specifications. As of course expected, the joint null hypothesis, which assumes that all the individual alphas are zero ($\alpha_i = 0 \ \forall i$), cannot be rejected for any of the three proposed model specifications as sufficient statistical significance lacks. Based on these findings, as expected, it is not possible to confirm that the LMS factor is not redundant. It is important to consider the limitations of the study and the potential influence of other factors that may affect the observed results.

4.4 Endogenous Leverage and DM choice

Table 9

In Panel A, I report summary statistics for the LMS factor, focusing on monthly equally weighted excess returns of triple sorted portfolios, sorted by Size ($i = 1, 2$), Leverage ($j = 1, 2$) and Debt maturity ($k = 1, 2, 3$). I report the monthly time series average excess returns, standard deviations, median, 25%, and 75% quintiles. In Panel B, I report the time-series average excess returns from independent 2×2×3 sorts, for portfolios sorted on Size, Leverage, and Debt maturity. I report the time-series average excess return of each one of the 12 portfolios. I also report the time-series average excess return for the Long Minus Short portfolios, obtained as the monthly return differential between the Long and Short Debt maturity portfolios' return within each Size-Leverage bucket. The data are sampled at a monthly frequency and cover 383 Dutch publicly traded firms from January 1990 to December 2022.

Panel A: Long Minus Short (LMS) portfolio

Factor	Mean	SD	p25	p50	p75
LMS	0.54%	3.88%	-1.80%	0.47%	2.62%

Panel B: Conditionally sorted portfolios' excess returns

	Small Size		Large Size	
Debt maturity	Low LEV	High LEV	Low LEV	High LEV
Short	-0.16%	-0.07%	0.58%	0.55%
Medium	0.41%	-0.02%	0.89%	0.59%
Long	0.29%	0.41%	0.99%	0.72%
LMS	0.45%	0.48%	0.41%	0.17%

To further validate the findings, a robustness analysis is performed by incorporating considerations of endogenous leverage and debt maturity choices, following the approach of Friedwald et al. (2022). This involves constructing portfolios that are triple-sorted through size, leverage, and debt maturity. At the end of each month, firms are ranked into quintiles depending on their size, followed by conditional quintiles based on their leverage, and once again into conditional quintiles depending on their DM. Within each size-leverage bucket, long-short portfolios (LMS) are created, that are long the long-maturity bucket and short the short-maturity bucket. The time-series average excess returns and summary statistics of these portfolios are presented in Table 9.

In Panel A, the results obtained from the LMS portfolios constructed through triple sorting based on Size, LEV, and DM are presented. The time-series averages of the portfolios demonstrate positive excess returns, indicating a positive relationship between debt maturity and stock returns, even when considering endogenous leverage and debt maturity choices. On average, It’s possible to observe that firms with longer maturity debt outperform stocks with shorter maturity debt by approximately 0.54% per month (0.53% before), after controlling for differences in size and leverage effects. This finding aligns with the previous results when controlling for size effects only. Additionally, in Panel B, the heterogeneity in the relationship between excess returns and debt maturities based on firms' size and leverage is displayed. It’s possible to observe that the time-series averages of the LMS portfolios for each size-leverage bucket remain consistent. Specifically, the LMS factor consistently exhibits positive values across every size-leverage bucket.

Table 10

Fama Macbeth regressions with portfolios double sorted by size, leverage, and debt maturity. I present the estimated results of the 2nd stage regressions as in Fama Macbeth, including the LMS and LMU factors. I present estimates for 3 model specifications, in which I include a different number of factors (CAPM, FF3, FF5). The data are sampled at a monthly frequency and cover 383 Dutch firms from Jan 1990 to Dec 2022.

	λ_0	λ ($\hat{\beta}$ MKT)	λ ($\hat{\beta}$ SMB)	λ ($\hat{\beta}$ HML)	λ ($\hat{\beta}$ RMW)	λ ($\hat{\beta}$ CMA)	**λ ($\hat{\beta}$ LMS)**	λ ($\hat{\beta}$ LMU)
(i)	**0.000**	**0.006**					**-0.001**	**0.004**
p-value	*0.829*	*0.001*					*0.532*	*0.030*
(ii)	**0.001**	**0.005**	**0.002**	**0.004**			**-0.001**	**0.003**
p-value	*0.489*	*0.002*	*0.077*	*0.001*			*0.317*	*0.010*
(iii)	**0.001**	**0.006**	**0.003**	**0.001**	**-0.002**	**0.000**	**0.001**	**0.004**
p-value	*0.680*	*0.003*	*0.001*	*0.204*	*0.078*	*0.734*	*0.604*	*0.010*

To account for the endogeneity in debt maturity and leverage choices, the analysis is extended by running Fama-MacBeth regressions on LMS portfolios that are triple-sorted by size, leverage, and debt maturity, following the approach of Friedwald et al. (2022). Additionally, the leveraged minus unleveraged (LMU) factor is included, which captures the returns of a portfolio going long on highly-levered and short on low-levered stocks. Table 10 presents the results from the first and second stage Fama-MacBeth regressions. In model (i), OLS regressions of firms' excess returns on the Market, LMU, and LMS factors are performed. In model (ii), the SMB and HML factors are incorporated into the regression, and in model (iii), the RMW and CMA factors are included as well.

Once again, the reported results don't provide any statistical evidence for the presence of a premium for debt maturity in the Dutch Stock market: in each of the three model specifications, obtain a λ ($\hat{\beta}_{LMS}$) is obtained, which is close to zero and not statistically significant. These results don't allow us to make any conclusion about the presence of a premium for debt maturity in the Dutch stock market.

Table 11

Spanning regressions with portfolios triple sorted by size, leverage, and debt maturity. I present the results for the LMS portfolios within each size bucket (LMS11 for small-unlevered to LMS22 for big-levered firms), and in the last column, I present the LMS portfolio containing firms of all sizes. The portfolios are characterized by their alpha estimates from CAPM-regressions (αCAPM), the 3-factor model by Fama and French (αFF3), and the 5-factor model by Fama and French (αFF5). Moreover, factor loadings for FF5 are shown. The data are sampled monthly and cover 383 Dutch public firms from Jan 1990 to Dec 2022.

	LMS11		**LMS12**		**LMS21**		**LMS22**		**LMS**	
	Coefficient	p-val	**Coefficient**	p-val	**Coefficient**	p-val	**Coefficient**	p-val	**Coefficient**	p-val
β CAPM	**-0.107**	*0.069*	**-0.070**	*0.220*	**-0.094**	*0.090*	**0.196**	*0.001*	**0.063**	*0.044*
β LMU	**0.037**	*0.788*	**0.422**	*0.001*	**0.202**	*0.113*	**-0.092**	*0.481*	**-0.170**	*0.019*
α CAPM	**0.005**	*0.100*	**0.005**	*0.184*	**0.000**	*0.948*	**0.000**	*0.986*	**0.000**	*0.854*
β MKT	**-0.143**	*0.019*	**0.671**	*0.037*	**-0.100**	*0.090*	**0.235**	*0.000*	**0.081**	*0.013*
β SMB	**0.214**	*0.040*	**3.800**	*0.000*	**0.189**	*0.061*	**-0.241**	*0.017*	**-0.112**	*0.045*
β HML	**0.143**	*0.114*	**-0.534**	*0.102*	**-0.017**	*0.842*	**-0.036**	*0.678*	**-0.006**	*0.901*
β LMU	**0.008**	*0.956*	**-2.118**	*0.002*	**0.431**	*0.001*	**-0.089**	*0.500*	**-0.171**	*0.019*
α FF3	**0.004**	*0.320*	**0.028**	*0.221*	**0.004**	*0.276*	**0.001**	*0.691*	**0.001**	*0.644*
β MKT	**0.092**	*0.149*	**0.047**	*0.444*	**0.173**	*0.004*	**0.257**	*0.000*	**0.096**	*0.005*
β SMB	**0.222**	*0.032*	**0.207**	*0.039*	**0.230**	*0.018*	**0.232**	*0.022*	**0.112**	*0.045*
β HML	**0.029**	*0.771*	**-0.131**	*0.174*	**0.241**	*0.010*	**-0.082**	*0.400*	**-0.041**	*0.447*
β RMW	**0.240**	*0.029*	**0.328**	*0.002*	**-0.126**	*0.221*	**0.148**	*0.163*	**0.047**	*0.426*
β CMA	**0.060**	*0.558*	**0.069**	*0.486*	**-0.150**	*0.123*	**-0.053**	*0.597*	**0.057**	*0.306*
β LMU	**0.133**	*0.361*	**0.593**	*0.000*	**0.099**	*0.468*	**-0.017**	*0.905*	**-0.144**	*0.066*
α FF5	**0.002**	*0.672*	**0.002**	*0.543*	**0.000**	*0.897*	**0.001**	*0.823*	**0.000**	*0.935*

Table 12

GRS test with portfolios double sorted by size and debt maturity. I run a GRS test on the ability of CAPM, FF3, and FF5 factors to explain monthly excess returns on the three LMS portfolios sorted by Size and Leverage (relating to Table 11 regressions). The data are sampled at a monthly frequency and cover 383 Dutch publicly traded firms from January 1990 to December 2022.

GRS	Mean alpha	Mean abs alpha	Test static	P-value	Mean adj R2
CAPM	0.0022	0.002	5.2134	0.3904	0.0148
FF3	0.0015	0.002	2.8884	0.7172	0.0240
FF5	0.0009	0.001	0.7006	0.9829	0.0326

The spanning tests are repeated, regressing the LMS factor on factors from three different models: the CAPM (1964) in (i), FF3 (1993) in (ii), and FF5 (2015) in (iii). In each model specification, LMS portfolios that are triple-sorted on size, leverage, and debt maturity are used. Additionally, the LMU factor is included as part of each model.

In Table 11, the outcome of the spanning regressions is presented, which investigates the time-series average monthly excess returns of the five LMS portfolios using the specified model specifications. In the analysis, sufficient statistical evidence to conclude that the LMS factor is not redundant (α) across all model specifications is not found. However, statistically significant coefficients with the Market, Size, and LMU factors in certain size-leverage buckets and specifications are observed.

As expected, Table 12 confirms once again that It’s not possible to conclude that LMS is not a redundant factor, employing a GRS test. The test suggests that there isn’t sufficient evidence to deduce that the DM premia in the Dutch stock market is not a redundant factor. Based on these findings, once again, It’s not possible to confirm the presence of a significant Debt maturity premium in the Dutch stock market based on the analyzed data. It is important to acknowledge the limitations of the study and consider the potential influence of other factors that may affect the observed results.

4.6 Pearson Correlation

Table 13

Pearson correlations among factors. I report the Pearson correlation coefficient among the factors included in the FF5 model (MRP, SMB, HML, RMW, CMA, LMS), the LMU and LMS factors and their relative p-values. The data are sampled monthly and cover 383 Dutch public firms from Jan 1990 to Dec 2022.

Var	MRP	SMB	HML	RMW	CMA	LMS	LMU
MRP	**1.000**						
p-value							
SMB	**0.277**	**1.000**					
p-value	0.001						
HML	**0.036**	**-0.012**	**1.000**				
p-value	0.478	0.808					
RMW	**-0.288**	**-0.124**	**0.339**	**1.000**			
p-value	0.001	0.013	0.001				
CMA	**-0.160**	**-0.016**	**0.274**	**0.433**	**1.000**		
p-value	0.001	0.748	0.000	0.000			
LMS	**0.072**	**-0.070**	**-0.054**	**-0.036**	**0.032**	**1.000**	
p-value	0.149	0.166	0.285	0.477	0.521		
LMU	**0.111**	**0.014**	**0.160**	**-0.293**	**-0.016**	**-0.107**	**1.000**

To examine the correlation between the debt maturity premium and the other factors, the Pearson correlation coefficient (1964) is employed. Table 13 displays the results of the correlation analysis, revealing significant findings. It’s possible to observe a negative correlation (at the 5% level) between the LMS factor and the LMU factor, with a coefficient of -0.107. As predicted by Friedwald et al. (2022), it is not surprising to observe this outcome, where firms with higher leverage typically opt for shorter debt maturities to mitigate the conflict of interest discussed by Adamati et al. (2018).

It is important to note that the Pearson correlation test encounters a two-step estimation problem. The test assumes the availability of observed variables for correlation; however, in this case, the Debt maturity premium is not directly observable but rather estimated. Considering this limitation, the significant correlations observed between the LMS factor and other factors could be biased in providing valuable insights into the relationship between DM premium and other characteristics.

4.7 Summary of Empirical Evidence and Implications

Based on the showcased analysis, insufficient statistical evidence to support the presence of a debt maturity premium in the Dutch stock market is found. Out of the 24 regression specifications examined, only one regression (Fama-MacBeth regressions including Market and LMS factors for the small firms' sample) showed a weak and statistically significant (at the 10% level) debt maturity premium of approximately 0.001 per month. Furthermore, the findings do not provide enough support to conclude that the debt maturity premium is not a redundant factor, as sufficient statistical evidence to draw such a conclusion is lacking. Although It's not possible to confirm the redundancy of the LMS factor, the analysis suggests that a premium for debt maturity can be explained by certain factors in the Fama-French models. Specifically, the debt maturity premium exhibits positive factor exposures to SMB, HML, and CMA. Notably, the SMB factor plays a significant role in explaining the maturity premium, as the estimated size exposure consistently yields the most elevated t-statistic compared to other model specifications. Moreover, the findings remain consistent even when considering the endogeneity of debt maturity and leverage choices.

The presence of a debt maturity premium, as documented in previous research in the US market by Chaderina et al. (2021) and Friedwald et al. (2021), suggests that shareholders demand a more elevated return for stocks with longer debt maturity compared to stocks with shorter debt maturity. This premium could potentially be explained by channels of debt overhang and flexibility, drawing upon research by Dangl and Zechner (2021), DeMarzo and He (2020), Adamati et al. (2018), and Chaderina et al. (2022). These studies indicate that companies financed with long-term debt tend to have higher leverage during economic crises when the market price of risk is elevated. This higher leverage would lead to more elevated expected returns in the cross-section. Additionally, shareholders may be reluctant to repurchase debt when profitability declines, as it would result in a wealth transfer from shareholders to remaining bondholders. Without prior commitments, the needed reductions in leverage would be unlikely to occur, creating a conflict of interest between debtholders and shareholders, as described by Adamati et al. (2018). Oppositely, firms with shorter-term debt would be less inclined to roll over maturing debt during economic downturns. Consequently, companies' leverage with shorter debt maturities exhibits less countercyclicality, as it can avoid the conflict of interest mentioned above.

While the presented empirical findings do not provide direct insights into the specific mechanisms through which debt overhang and flexibility affect equity returns across different debt maturity profiles, they still have important implications for key aspects of corporate finance. These implications include decisions related to capital structure and the estimation of the cost of equity capital.

6. Conclusion

This thesis explores the function of debt maturity in the cross-section of equity returns in the Dutch stock market. Through the use of portfolio sorting techniques, Fama-MacBeth regressions, spanning regression tests, and Pearson correlation tests, a comprehensive analysis to investigate the link among debt maturity and risk premiums is conducted.

The empirical analysis presented above, reveals a premium differential of approximately 0.53% per month (0.54% when accounting for leverage) between firms with longer debt maturity and those with shorter debt maturity in the Dutch stock market, after controlling for firm size. However, differently from recent findings by Chaderina et al. (2022), the analysis does not provide sufficient statistical evidence to support the existence of a debt maturity premium in the considered market. The extent to which the debt maturity premium is spanned by the CAPM and Fama-French models is also examined. However, the study does not yield enough statistical evidence to definitively assert whether the debt maturity premium is a redundant factor or not. Additionally, the findings suggest that the debt maturity premium is partially explained by certain factors proposed by Fama and French, with a particularly strong positive correlation observed with the Small Minus Big factor. This suggests that these factors play a role in explaining the debt maturity premium, highlighting the importance of considering multiple risk factors when analysing equity returns. Importantly, the results remain consistent when considering the endogeneity of debt maturities and leverage choices, as observed in Friedwald et al. (2022).

Overall, this thesis adds on to the existing literature by supplying specific discernment into the relation between debt maturity and stock returns within the Dutch context. The implications of the findings extend to investors, financial practitioners, and policymakers, offering a nuanced understanding that can inform investment decisions, capital structure choices, and the estimation of the cost of equity capital. However, it is important to acknowledge the inherent limitations of the research. By recognizing these limitations, intriguing avenues for future research are identified, promoting further exploration of this important topic.

References

Adamati, A.R., DeMarzo, P.M., Hellwig, M.F., Pfleiderer (2018). The leverage ratchet effect. *Journal of Finance*, 145-198

Dangl, T., Zechner, J. (2021). Debt maturity and the dynamics of leverage. *Review of Financial Studies*, 5796–5840.

DeMarzo, P.M. and He, Z. (2021), Leverage Dynamics without Commitment. *The Journal of Finance*, 1195-1250.

He, Z., Milbradt, K. (2016). Dynamic Debt maturity. *The Review of Financial Studies*, 2677–2736.

Chaderina, M., Weiss, P., Zechner, J. (2022). The maturity premium, *Journal of Financial Economics*, 660–694

Custódio, C., Ferreira, M., Laureano, L. (2013). Why are US firms using more short-term debt? *Journal of Financial Economics*, 182-212.

Fama, E. F., and French, K. R. (1993). Common risk factors in the returns on stocks and bonds, *Journal of Financial Economics*, 3–56.

Fama, E. F., MacBeth, J.D. (1973). Risk, return, and equilibrium: Empirical tests, *Journal of Political Econothe*,607–636.

Fama, E.F., French, K.R. (2015). A five-factor asset pricing model. *Journal of Financial Economics*, 1–22.

Friewald, N., Nagler, F., Wagner, C. (2022). Debt Refinancing and Equity Returns. *The Journal of Finance*,2287-2329.

Gibbons, M. R., Ross, S. A., & Shanken, J. (1989). A Test of the Efficiency of a Given Portfolio. *Econometrica*, 1121–1152.

Modigliani, F., Merton H. M. (1958). The cost of capital, corporation finance and the theory of investment, *American Economic Review*, 261–297.

Sharpe, W. F. (1964). Capital asset prices: a theory of market equilibrium under conditions of risk. *The Journal of Finance*, 425-442.

Appendix

- Leverage is computed as: $LVG_t = \frac{DLC_t + DLTT_t}{DLC_t + DLT_t + ME_t}$

- Operating Profitability is computed as: $OP_t = \frac{EBIT_t}{CEQ_t}$

- Investment Growth is computed as: $INV_t = \frac{AT_t}{AT_{t-1}}$

- Size is computed as: $Size = \frac{PRC_t \times CHSO_t}{10.000}$

- BM ratio is computed as: $BM_t = \frac{Size \times 10.000}{CEQ_t}$

- DM is computed as: $DM_t = \frac{DLTT_t - DD1_t}{DLTT_t + DLC_t}$