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Bond Yield Discrepancies

A study of bond yield components and discrepancies for US and EU bonds from 2008 to 2017

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Abstract

This paper analyses the yield components of bonds for US and EU bonds from 2008 to 2017. We calculate the yield difference for bonds with different seniority, coupons and issuing region. Using these results, we analyse types of bonds that seem more beneficial to invest in. We find that senior unsecured bonds have the lowest average yield, EU issued bonds tend to have a lower yield and a higher coupon has a positive effect on the yield.

Keywords: Notching, Investment Grade, High Yield, Seniority

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Table of Contents

1 Introduction

The purpose of this paper is to examine the bond market from an investor perspective. As there are many categories of bonds, sometimes even different bonds from the same firm, this study aims to research risk to return discrepancies among different categories of bonds. Specifically, this study will focus on where in the capital structure the bond is issued, the seniority of the debt in case of a default. The following paragraphs structure the research question, as well as a short hypothesis as to why there may be risk to return discrepancies.

Research question: *Does the generalized nature of rating junior subordinated, subordinated,* and senior *secured bonds, create a risk to return discrepancy between bonds with different seniority?*

Rating firms is a very expensive process for rating agencies, but a crucial one none the less. Many studies have researched the usefulness of rating agencies and the value they provide and found that they do provide valuable information to market participants. (Ederington, Yawitz and Roberts, 1987; Kliger and Sarig, 2000). Bonds can be issued with different levels of seniority, which is the repayment priority in case of a default. Rating agencies will put a lot of money and resources to rate firms that want to issue their first securities, but they will rate the firm as if the debt that is issued is senior unsecured debt. The agencies then use this rating as a benchmark for other types of debt, for instance subordinate debt will be based of the firms rating of senior unsecured debt, the agencies often notch down the rating of the senior unsecured debt to reach the rating for the subordinate debt and junior subordinated debt, and vice versa for senior secured debt. The number of down (up) notching will often depend on the initial rating of the firm, and firms with a higher rating will often receive less (more) of a penalty (reward) for their subordinated (secured) debt than firms with a lower rating (Kose, Ravid, and Reisel, 2010). The rating agencies use this very generalized way of rating to save time, money and resources as the rating process is very expensive.

The theory is thus that, this standardized, low due diligent way of rating subordinated and secured debt leads to price discrepancies between firms' senior unsecured and other issued debt, and that the other issued debt, to avoid law suits, is on average rated too conservatively or not conservatively enough.

Furthermore, this effect may be higher in investment grade bonds compared to non-investment grade bonds as rating institutes spend more time to value the seniority of the bond in non-investment grade ratings (John, Lynch and Puri, 2002).

Lastly, this study will examine any other discrepancies found in the components of the bond yields.

1.1 Thesis outline and overview

The thesis starts with a short review of relevant literature in chapter two to give the reader a good background to understand the rest of the study as well as an understanding on how this thesis differs from current literature. Chapter three will discuss the methods used throughout the study and why they are used. Chapter four will cover the data used in the study. The result of the study and the main analysis will be presented in chapter five. Lastly, chapter six will summarize the findings of the study.

2 Literature Review

Despite being a large part of financing these days, debt studies are fewer than that of equities. Thus, the literature regarding bonds yields for different levels of the capital structure and rating grades is scarce. This section will summarize the existing literature relevant to these fields.

Many studies have been done on how debt collaterals impact the riskiness of loans. The hypothesis is often that riskier loans are more frequently collateralized as lenders want the extra security of collaterals for taking on the extra risk associated with these loans. For instance, Orgler (1970) regresses a bad/good dummy variable on a secured/unsecured dummy variable and other control variables, and a good loan is citied as loans that have not been criticized by the banks' loan officers. Orgler (1970) finds that secured loans tend to be riskier on average. Moreover, Berger and Udell (1990) regress the risk premium, as a proxy for the riskiness of the loan, on collateral size, and several control variables. They come to the same conclusion, that there is a positive relationship between the risk of the firm, the risk of the loan as well as the risk of the bank and collateral.

John et al (2002) study the effect of collateralized debt and bond yields. Collateralized debt makes up roughly 70 % of the US debt market (Berger and Udell, 1990), and hence the characteristics of collateralized debt is important. After controlling for credit rating John et al. (2002) find that there is a positive relationship between securitized debt and yield.

A study by John, Ravid and Reisel (2010) studies the effects of the notching rule for subordinated debt. They start off by measuring the yield difference between senior unsecured and subordinated debt for the different rating grades and find that there are statistically significant differences between the two. They go on to test whether the yield bias on average is higher for subordinated debt across all rating grades but conclude that it is not so. Lastly, they study whether the effect is positive for lower ratings grades but negative for higher rating grades, as rating institutions are more likely to be conservative with the ratings in lowers grades but also more optimistic with rating in higher rating graders. They find these relationships to be true, even after controlling for split ratings, time effects and bond callability. This indicates a systemic bias in the notching policies of rating agencies.

Amihud and Mendelson (1991) prove with their paper that liquidity matter for bond pricing. They measure the yield differences between treasury notes and treasure bills. As both securities are issued by the US government the default risk is the same. Treasury notes are generally less liquid than treasury bills because treasury bills are issued in larger amount, and over time notes often becomes a part of portfolios. Amihud and Mendelson (1991) match the treasury notes and bills with maturities less than six months, and as they have the same credit quality and maturity there is no need to control for other effects. They find robust results that liquidity matters in bond pricing and that the yield differences between treasury notes and bills decreases over time.

Using different models to estimate the default risk premia part of the credit spread, Huang and Huang (2003), find that for investment grade corporate bonds the default risk only accounts for roughly 20 % of the corporate – Treasury yield spread, while for lower rated bonds they conclude that the fraction of the spread that is attributable to default risk is higher. Moreover, they also find evidence that the fraction of the spread that is attributable to the default risk increases with maturity. These findings are consistent with work done previously, such as that of Delianedis and Geske (2001), who use Merton option model to estimate the part of the yield spread of investment grade bonds that is accounted for by the default risk. They find that the fraction of the spread that can be explained by default ranged from 5% for AAA rated firms to 22% for BBB rated firms. Instead they conclude that the main parts of the yield spreads are due to tax, liquidity, recovery, and market risk factors.

Unlike that of Delianedis and Geske (2001) and Huang and Huang (2003), Longstaff, Mithal and Neis (2005) find evidence that the default and recovery risk is a large part of the corporate – treasury yield spread. By using credit default swaps to estimate the default risk part of the yield spread Longstaff et al. (2005) find that even for the highest rated bonds, AAA, the default risk accounts for more than 50 % of the spread. Moreover, they also study the residual spread, the part of the spread not attributable to default risk. In support of previous studies, such as Delianedis and Geske (2001), they find that a large part of the residual spread is strongly correlated to illiquidity measure, in this case the issued amount and the bid – ask spread.

Elton, Gruber, Agrawal and Mann (2001) study the spread between corporate and government bonds and find that there are three components that explain large part of the spread, the expected default risk, state and local taxes, as government bonds are exempt from these, and systemic risk. The portion of the spread that can be explained by default risk is in line with what Delianedis and Geske (2001) and Huang and Huang (2003) find.

As shown by the studies above, liquidity matters in bonds spreads. The liquidity effect varies with time however, and is significantly lower during periods of financial stress, as proven by Friewald, Jankowitsch and Subrahmanyam (2010). Acharya, Amihud and Bharath (2013) also supports these findings and conclude that liquidity is more important in times of financial crises. Heck, Margaritis, and Muller (2016) further support this. Heck, et al. (2016) study how bonds with different rating and different maturity are affected by liquidity chocks. They find that there is a strong relationship between yield spreads and liquidity, and that it peaks in times of crisis. Moreover, they find that this effect is much stronger in lower rated bonds, indicating a larger sensitivity to liquidity risk in high yield bonds. Across maturity the relationship between liquidity and spreads is not monotone. The systemic effects of liquidity chocks only exist in bonds with longer maturities, while bonds with shorter maturities are only affected by bonds specific liquidity chocks.

Most of the bond trading is done over the counter and hence liquidity data is largely unavailable or unreliable (Houweling, Mentink and Vorst, 2005). This produces the issues of estimating the liquidity risk of bonds, which due to the fact that they are OTC traded can be very substantial. Houweling, et al (2005) study nine different proxies for estimating liquidity in investment grade bonds by creating bond portfolios, and then testing whether there is significant yield difference after controlling for other risk factors, such as credit risk. However, they find that none of the nine proxies they test are significantly better than the others at measuring bond liquidity.

Moreover, Fisher (1959) state that bonds with a higher issued amount will have a larger absolute value that is trading and hence more liquid, thus giving support for issued amount as a liquidity measurement. Another theory by both Sarig and Warge (1989) and Amihud and Mendelson (1991), is that bonds with a lower issued amount are more often absorbed in buy and hold type portfolios.

Fons (1994), studies the term structure of the credit risk of bonds. By measuring cumulative and marginal default risks, recovery rates, default rates, and credit spreads over time he finds results that for lower rated bonds the term structure of credit risk is declining, in line with the results of Johnson (1967). The conclusion is that this is largely due to the decreasing (increasing) marginal default rate for low (high) rated bonds.

3 Methodology

This chapter will go over the methods used in the study.

3.1 Debt seniority yield discrepancies

The methodology for this part of the thesis will largely be based of the study by Kose et al. (2010) but use a different data set to see if the risk discrepancies for subordinated debt holds for a different time-period and for European bonds, this study will also include senior secured debt as well as junior subordinated debt, which is excluded from the previously mentioned study. The focus of the study differs significantly, as Kose et al. (2010) are more focused on whether there are issues associated with the notching policy and whether it can be improved, this study on the other hand has an investor focus and aims to find favourable investing categories.

The first test is whether there are yield discrepancies between bonds of different seniority. The bonds will be sorted by rating and seniority, then the mean yield difference between the seniority classes for each rating bucket will be tested. Hence the first hypothesis is:

$$H1: Yield_{Notched} = Yield_{Unnotched}$$

This hypothesis is done to see if there is any difference in investing in bonds in different parts of the capital structure with the same rating. This will be done by using an unpaired t-test. If there are statistically significant differences in the yield of bonds in the different levels of seniority, we can move on to the next part, to see whether the yield difference is biased in same direction for all bond ratings. From the t-test used for the previous hypothesis we can study the sign of the yield difference across all rating grades. If the sign is the same across all ratings, where the difference is significant, we can conclude that the difference is biased in the same direction. If this does not hold, that is if the yield is not biased in the same direction for all bond ratings, we will test whether bias direction is the same among the higher rating grades, and the reverse for lower rating grades. The hypothesis here is that the rating companies are more likely to be conservative in the ratings among the lower rating grades as the risk of being sued could be higher, while they are more likely to be optimistic in the higher rating grades, as the risk of being sued is lower. Thus, in

the higher rating grades pleasing the rated firms, who also pay the fees for being rated, may be more beneficial than in the lower rating grades.

3.2 Regression

A multivariate regression analysis will be done to further test the theory of yield discrepancies among seniority, and test for other component discrepancies that significantly impact the yield after control for several factors. Moreover, this regression analysis will also focus on the effect of issuing bonds in the EU vs the US. The regressions are all adjusted for firm and time fixed effects, as a large part of the yield is expected to be firm specific and time specific. The standard errors are clustered on a firm level and heteroscedasticity robust.

$$Yield_i = Intercept + Maturity + Treasury + (10\ year\ term\ tresury - 2\ year\ term\ treasury\ ) + Seniority_i + Rating_i + EU + Coupon + Firm_i + Time_i$$

3.2.1 Control variables

The maturity variable is picked to control for the interest rate sensitivity of the bonds. Generally, all else the same, bonds with higher maturity will have a higher yield due to the increased risk. Hence it is important to control for maturity as it will be one of the factors impacting the yield. Because of this, the variable is expected to be significant and positive.

One variable that is expected to have a big impact on the yield of bonds is the current and the future risk-free rate. As with most assets, investors will require a higher return when the risk-free rate is higher, as they want to be compensated for the extra risk they take. Thus, controlling for the term structure of the risk-free rate is important, this will be done in two parts. Firstly, to control for the current risk-free rate, we will add the relevant short-term treasury rate. Secondly, to control for the longer rates, and the shape of the treasury term structure, we will add the variable of the relevant 10-year treasury rate minus the relevant 2-year treasury rate. The relevant treasury rate will be the US-treasury rate for American bonds and the ECB-treasury rate for European bonds. We expected both variables to be positive. The dummy variable EU will be added to see how bonds issued in the EU-zone compared to those issued in the US fare. The EU variable will test the difference in yield for firms that have issued bonds in both the EU and the US. Lastly, a coupon variable is added, to see how the coupon size affects bond yields. This is expected to be negative, as all else

the same investors are theorized to prefer getting their return as soon as possible, to minimize the loss given a future default. This variable is expected to be more significant in the lower rating grades when the risk of default is higher. The coupon will test the effect of different coupon yielding bonds issued by the same firm.

4 Data

The data is collected from Bank of America Merrill Lynch Markets database and includes European and US bonds across all rating grades and sectors. The data will be quarterly due to the low day-to-day change of bonds. Moreover, the data set includes the time of maturity of the bonds, spreads over the relevant treasury rate, duration, the active sector of the bond as well as the seniority of the bond. The dataset covers the period of 2008 – 2017 and will also be divided into subsets to see if there are any differences between the European and US markets. The ratings from the dataset are the ratings set by the rating institute Moody's.

Data on risk free rates for the EU and US bonds alike is collected from the ECB and FED and contains monthly data that will be matched with the bonds.

4.1 Summary of mean statistic

Table 1: Mean statistic per grade

Rating	Nr observations	Spread	Coupon	Maturity (M)
Aaa	4433	0.96%	3.03%	126
Aa1	2435	1.03%	2.77%	100
Aa2	7583	1.24%	2.77%	106
Aa3	20576	1.16%	3.16%	102
A1	27541	1.23%	3.18%	100
A2	45085	1.35%	3.19%	110
A3	40615	1.56%	3.29%	115
Baa1	47577	1.73%	3.39%	115
Baa2	51879	2.09%	3.35%	109
Baa3	34924	2.64%	3.57%	105
Ba1	13436	3.65%	5.69%	81
Ba2	12855	4.24%	5.82%	79
Ba3	13239	4.71%	5.91%	77
B1	11900	5.32%	6.12%	77
B2	12316	6.47%	6.25%	74
B3	11735	7.97%	6.71%	72
Caa1	9524	10.07%	7.31%	72
Caa2	4934	14.87%	7.92%	72
Caa3	2094	24.16%	9.73%	64
Ca	1290	33.23%	11.19%	69
C	559	56.97%	16.04%	72
D	92	63.93%	16.63%	66
Total	***376622***	***3.14%***	***4.10%***	***101***

Table 2 – Region and firm statistics

Total number of firms	5070
Number of firms with bonds in EU and US	575
Firms with more than one bond issue	3148

Table 3: Mean statistics Seniority

Seniority	Nr Observations
Senior Secured	35956
Senior unsecured	324427
Subordinate	10963
Junior Subordinate	5276

Table 4: Mean statistics Sector

Industry Catagory	Nr Observations
Financial	78281
Industrials	257767
Utility	40574

Industry	Nr Observations
Financial Services	13323
Banking	45471
Energy	43413
Utility	40574
Automotive	11696
Healthcare	23290
Real Estate	11715
Insurance	19487
Telecommunications	18958
Media	16593
Basic Industry	33441
Retail	15892
Capital Goods	20377
Transportation	11996
Leisure	5707
Services	9106
Consumer Goods	21911
Technology & Electronics	13672

As can be seen in table 1 above, as expected, the yield spread increases with the lower rating grades. Interestingly this pattern does not hold when looking at coupons for the Aaa-rated bonds, which have a higher coupon on average than Aa1 and Aa2 rated bonds. Moreover, we see that the maturity decreases in the lower rating grades, especially in the HY-bonds rated Ba1 or lower. This is likely due to the fact that when the credit risk of the issuing firm increases the investors are less willing to commit to longer investment horizons.

5 Analysis

This section will be divided into the different methodology parts, where firstly the results of the study and then a discussion of the results follows.

5.1 Debt seniority yields discrepancies

5.1.1 Results

When testing the whole dataset for whether there are yield differences between senior unsecured and Subordinated debt for the same rating grade, we find that across all the rating grades Subordinated debt has on average a higher yield (varies between 0.4% and 5.13%) (*Table 5).* Interestingly, when looking at bonds issued in the EU-region we can see that between B1 and Caa3 rated bonds, senior unsecured debt has an on average a larger yield spread compared to subordinated debt *(Table 5)*. US bonds on the other hand, follow the same pattern as the complete dataset. For the complete dataset we can see that, the yield difference bias is the same across all rating grades, that the subordinated debt on average has a higher yield.

When comparing subordinated debt with junior subordinated debt, we achieve broadly the same results as when comparing the yields of senior unsecured and subordinated debt. We see that across the rating grades the more junior debt has an on average higher yield. (*Appendix A*)

However, when comparing senior secured debt with senior unsecured debt we find, interestingly, that for a lot of the rating grades senior secured debt has a higher average yield (*Table 6).* The results remain roughly the same when looking at the complete dataset as when looking at just US bonds. When looking at just EU bonds we see that the yield among

IG-bonds tends to be higher for senior secured debt while for the lower rating grades we see that senior unsecured has a higher yield. (*Table 6)*

Table 5 Subordinated and Senior unsecured Debt Yield Difference

AAA-rated bonds are excluded due to sample size, C and Ca rated bonds are excluded due to the equity like features, and low sample size.

Rating	***Subordinate Yield***	***Senior unsecured Yield***	***Yield difference***
Aa1	2.82%	1.01%	1.81%***
Aa2	1.95%	1.17%	0.78%***
Aa3	2.29%	1.10%	1.19%***
A1	3.12%	1.19%	1.93%***
A2	3.00%	1.31%	1.68%***
A3	3.58%	1.49%	2.09%***
Baa1	3.40%	1.66%	1.74%***
Baa2	3.56%	2.02%	1.54%***
Baa3	3.61%	2.58%	1.03%***
Ba1	4.26%	3.58%	0.69%***
Ba2	4.62%	4.19%	0.43%**
Ba3	5.92%	4.59%	1.33%**
B1	5.81%	5.13%	0.68%***
B2	6.83%	6.24%	0.59%***
B3	7.92%	7.51%	0.4%**
Caa1	10.29%	9.40%	0.88%***
Caa2	15.47%	14.14%	1.33%***
Caa3	28.74%	23.61%	5.13%***

AAA-rated bonds are excluded due to sample size, C and Ca rated bonds are excluded due to the equity like features, and low sample size.

RATING US BONDS	*SUBORDINATE*	*SENIOR UNSECURED*	*YIELD DIFFERENCE*	*EU BONDS RATING*	*SUBORDINATE*	*SENIOR UNSECURED*	*YIELD DIFFERENCE*
Aa1	3.14%	0.99%	2.16%**	***AA1***	2.37%	1.03%	1.34%
Aa2	1.95%	1.17%	0.79%***	***AA2***	N/A	N/A	N/A
Aa3	2.28%	1.08%	1.2%***	***AA3***	2.55%	1.14%	1.41%***
A1	3.48%	1.17%	2.31%***	***A1***	2.32%	1.22%	1.1%***
A2	3.42%	1.32%	2.1%***	***A2***	2.58%	1.28%	1.3%***
A3	3.56%	1.55%	2.01%***	***A3***	3.61%	1.33%	2.28%***
Baa1	4.19%	1.73%	2.46%***	***BAA1***	2.79%	1.41%	1.38%***
Baa2	3.95%	2.12%	1.83%***	***BAA2***	3.32%	1.60%	1.72%***
Baa3	4.13%	2.66%	1.47%***	***BAA3***	3.37%	2.09%	1.28%***
Ba1	4.21%	3.72%	0.49%**	***BA1***	4.32%	3.16%	1.16%***
Ba2	4.71%	4.27%	0.45%**	***BA2***	4.35%	3.78%	0.57%**
Ba3	5.65%	4.58%	1.07%***	***BA3***	9.14%	4.68%	4.46%
B1	5.82%	5.08%	0.74%***	***B1***	5.59%	5.69%	-0.1%
B2	6.88%	6.06%	0.81%***	***B2***	6.26%	8.04%	-1.78%
B3	8.05%	7.36%	0.69%***	***B3***	6.03%	9.09%	-3.06%***
Caa1	10.31%	9.31%	1%***	***CAA1***	9.73%	10.36%	-0.63%
Caa2	15.71%	13.80%	1.9%***	***CAA2***	8.90%	20.72%	-11.81%***
Caa3	29.03%	23.54%	5.49%***	***CAA3***	8.81%	24.83%	-16.03%***

Table 6 Senior unsecured and senior Secured Debt Yield Difference

AAA-rated bonds are excluded due to sample size, C and Ca rated bonds are excluded due to the equity like features, and low sample size.

Rating	***Senior unsecured***	***Senior secured***	***Yield difference***
Aa1	1.01%	0.97%	0.04%
Aa2	1.17%	2.25%	-1.08%***
Aa3	1.49%	1.60%	-0.11%***
A1	1.19%	1.21%	-0.01%
A2	1.31%	1.25%	0.06%***
A3	1.49%	1.60%	-0.11%***
Baa1	1.66%	2.43%	-0.77%***
Baa2	2.02%	2.77%	-0.75%***
Baa3	2.58%	2.92%	-0.34%***
Ba1	3.58%	3.73%	-0.15%**
Ba2	4.19%	4.38%	-0.2%***
Ba3	4.59%	4.75%	-0.16%*
B1	5.13%	5.71%	-0.58%***
B2	6.24%	6.88%	-0.65%***
B3	7.51%	8.93%	-1.42%***
Caa1	9.40%	12.03%	-2.62%***
Caa2	9.40%	12.03%	-2.62%***
Caa3	23.61%	23.95%	-0.34%

AAA-rated bonds are excluded due to sample size, C and Ca rated bonds are excluded due to the equity like features, and low sample size.

Rating US Bonds	*Senior unsecured*	*Senior Secured*	*Yield difference*	*Rating EU Bonds*	*Senior unsecured*	*Senior Secured*	*Yield difference*
Aa1	0.99%	0.91%	0.07%	***AA1***	1.03%	1.37%	-0.34%**
Aa2	1.17%	2.16%	-1%***	***AA2***	1.18%	2.60%	-1.43%***
Aa3	1.08%	1.32%	-0.24%***	***AA3***	1.14%	2.12%	-0.98%***
A1	1.17%	1.19%	-0.02%	***A1***	1.22%	2.26%	-1.04%**
A2	1.32%	1.24%	0.09%***	***A2***	1.28%	3.20%	-1.92%***
A3	1.55%	1.57%	-0.02%	***A3***	1.33%	2.21%	-0.88%***
Baa1	1.73%	2.32%	-0.59%***	***BAA1***	1.41%	3.51%	-2.1%***
Baa2	2.12%	2.84%	-0.71%***	***BAA2***	1.60%	2.50%	-0.9%***
Baa3	2.66%	2.99%	-0.33%***	***BAA3***	2.09%	2.18%	-0.09%
Ba1	3.72%	3.79%	-0.07%	***BA1***	3.16%	2.96%	0.2%
Ba2	4.27%	4.56%	-0.29%***	***BA2***	3.78%	3.68%	0.09%
Ba3	4.58%	5.07%	-0.48%***	***BA3***	4.68%	4.00%	0.68%***
B1	5.08%	5.67%	-0.59%***	***B1***	5.69%	5.83%	-0.15%
B2	6.06%	7.04%	-0.98%***	***B2***	8.04%	6.53%	1.52%***
B3	7.36%	9.11%	-1.75%***	***B3***	9.09%	8.15%	0.94%**
Caa1	9.31%	12.34%	-3.03%***	***CAA1***	10.36%	10.42%	-0.06%
Caa2	13.80%	17.12%	-3.31%***	***CAA2***	20.72%	17.69%	3.03%
Caa3	23.54%	23.38%	0.16%	***CAA3***	24.83%	29.63%	-4.79%

5.1.2 Analysis

From Table 5 we can clearly see a discrepancy where subordinate debt has a higher yield than senior unsecured debt, for the same rating grade, and thus we can reject the hypothesis $Yield_{Notched} = Yield_{Unnotched}$. This is inconsistent with the results found by John et al. (2010), whose study showed a lower yield for senior unsecured debt in the higher rating grades, but a higher yield in the lower rating grades.

If the ratings were done to perfectly regard credit risk and expected loss, the discrepancy should not exist. As the bias of higher yield is towards the subordinate debt, we can conclude that the rating agencies tend to not down-notch subordinate debt enough. This may be an example of agency problems as the rating agencies are payed by the issuing firm, who wants as cheap financing as possible and thus want the rating agencies to set the highest possible rating. John et al. (2010) state that rating agencies may be more inclined to do this in the higher rating grades where probability of default is lower, but for lower rating grades it may be that the risk of law suit/reputational damage if they rate bonds too high may have a bigger pull.

The EU sample results (Table 5) match the findings by John et al. (2010). In the EU sample we find that subordinate debt has a lower average yield compared with senior unsecured debt in the lower rating grades, but the reverse relationship for the higher rating grades. These findings are consistent with the theory that for the higher rating grades rating agencies tend to not down-notch enough, in favour of the debt issuer, while for the lower rating grades the rating agencies tend to down-notch too much, as to be conservative and minimize the risk of law suits and reputational damage. Moreover, it could also be an issue of liquidity. As rating agencies do not include the liquidity of the bonds they rate as a measurement, it is unclear whether the causality is due to bias from the rating agencies or liquidity premia. In the US only sample, however, it follows the complete dataset.

Lastly, for the yield difference between the subordinate debt and senior unsecured debt an analysis over time was done to see if rating agencies tended to be more conservative right after a financial crisis, in this case 2009-2010, and to see if they got less conservative as time since last crisis increased, but no such relationship was found.

When comparing the yield of senior secured debt and senior unsecured debt we can see that the results for the complete data set and the US sub dataset is inconsistent with what John et al. (2010), they found that rating agencies tend to not down-notch enough in the higher rating grades and down-notch the lower rating grades too much. However, in our dataset we see that the bias remains the same throughout the rating grades, and that senior debt on average has a lower yield than senior secured debt. What is interesting when comparing the senior secured debt and senior unsecured debt for the EU sub dataset we see that rating agencies tend too down-notch to much in the higher rating grades, and down-notch to little in the lower rating grades. One reason for this could be that investors are more concerned with the credit quality of the debtor rather than the seniority of the bond. As investors prefer to avoid default altogether, and issuers with two bonds with the same rating but different seniority will have vastly different default rates as the recovery rate is factored into the rating of the bond. Thus, the bond with the lower seniority but same rating will have a lower probability of default. If investors preferred the lower secured bonds given the same rating, this could drive up the price and thus reduce the yields. Another reason for this discrepancy could be liquidity. Senior unsecured bonds may be more liquid than senior secured bonds for two reasons, firstly, it is a more common type issue (324427 senior unsecured bonds in the sample vs 35956 senior secured bonds) and thus could be more desirable from an investor perspective, and secondly if the issued amount is higher (could be as better firms, i.e. higher rated, may not have to use collateral to the same extent) the liquidity in the bond will be better. Liquidity would affect the yield as investor may have a harder time to exit and may face larger losses if they do exit before maturity. Further studies would have to be conducted to conclude as to why we see this relationship between senior unsecured and senior secured bonds issued in the EU.

Table 7 – Full regression

Variable	Estimate	Standard Error
Senior Secure	-0.821***	0.190
Senior unsecure	-0.924***	0.140
Subordinate	-0.272	0.180
AAA	0.095*	0.050
AA1	0.354***	0.090
AA2	-1.012***	0.150
AA3	-0.464***	0.110
A2	-0.261***	0.080
A3	-1.245***	0.160
BBB1	3.094***	0.360
BBB2	3.797***	0.440
BBB3	4.909***	0.470
BB1	1.543***	0.210
BB2	2.195***	0.250
BB3	2.57***	0.360
B1	0.51***	0.080
B2	0.797***	0.100
B3	1.263***	0.140
CCC1	47.37***	2.500
CCC2	26.26***	2.240
CCC3	7.522***	0.560
CC	11.74***	0.860
C	17.73***	1.230
D	51.97***	6.120
Maturity (m)	0.002***	0.000
Treasury 10y- 2y	-0.193***	0.020
Utility	-0.172***	0.030
Coupon	0.221***	0.020
EU	-0.083*	0.050
***p<0.1; **p<0.05; ***p<0.01*		
Nr observations 376622		

The dependent variable is the corporate bond yield spread over the relevant treasury rate.

A1 is the omitted rating grade.

Junior subordinate is the omitted seniority.

EU is a dummy variable set to 1 if the bond is issued in the EU region, otherwise 0.

The short-term rate is the US treasury rate if EU is 0 and if EU is 1 then it is the ECB treasury rate.

The treasury yield shape is the relevant 10-year rate minus the relevant 2-year rate.

Maturity variable is time left till maturity, as measured in months

Coupon is measured in percentage units

From the regression above we see that the results from previous analysis confirmed, there seems to be a bias of lower yields towards the senior unsecured bonds, and we can also see that junior subordinate is the least favoured seniority.

Moreover, the rating variables and maturity are in line with what is expected, and the average yield increases when the rating gets worse and for longer maturing bonds, as is consistent with existing theories.

Interestingly, the coupon variables have a reverse relationship to the yield than we would expect. We see that for one percentage unit change in the bond coupon, on average it increases the bond yield by 0.22%. We would have expected the coupon to have reverse relationship to the yield, as investors tend to prefer to get their investments back as soon as possible, as this could reduce the potential credit loss. We will further test this when looking at the difference between HY and IG bonds. The expectancy here is that we will see a larger effect for the coupon in the HY bonds and that we will see a reverse relationship

Lastly, we have to EU variable, which in this dataset indicates that EU bonds on average have a lower yield. One reason for this may be the large bond buying programs the ECB initiated in 2015. To further test this as well as the effect that times of distress has on the results the dataset will be split into two time periods below.

Table 8 – All rating grades 2008 – 2012

Variable	Estimate	Standard Error
Senior Secure	-1.388***	0.34
Senior unsecure	-0.914***	0.22
Subordinate	-0.097	0.28
AAA	-1.229***	0.22
AA1	-0.933***	0.20
AA2	-0.577***	0.17
AA3	-0.409**	0.17
A2	0.221	0.15
A3	0.906***	0.25
BBB1	0.977***	0.19
BBB2	1.46***	0.26
BBB3	2.082***	0.27
BB1	2.496***	0.30
BB2	3.268***	0.50
BB3	3.711***	0.63
B1	4.117***	0.69
B2	4.932***	0.79
B3	5.756***	0.84
CCC1	8.319***	0.93
CCC2	11.08***	1.19
CCC3	15.33***	1.86
CC	21***	2.07
C	42.95***	3.25
D	43.82***	8.26
Maturity (m)	0	0.00
Treasury 10y- 2y	-0.166***	0.01
Treasury short term	-0.46***	0.07
Coupon	0.086***	0.02
EU	0.306***	0.10
***p<0.1; **p<0.05; ***p<0.01**		
Nr observations 150491		

Table 9 – All rating grades 2013 – 2017

Variable	Estimate	Standard Error
Senior Secure	-0.097	0.16
Senior unsecure	-0.24***	0.09
Subordinate	-0.216**	0.10
AAA	-0.268	0.41
AA1	-0.124	0.33
AA2	-0.672**	0.26
AA3	-0.212	0.14
A2	-0.126	0.17
A3	0.063	0.15
BBB1	0.303**	0.15
BBB2	0.396**	0.16
BBB3	0.525***	0.17
BB1	0.821***	0.19
BB2	1.047***	0.21
BB3	1.05***	0.23
B1	1.207***	0.26
B2	1.351***	0.31
B3	1.708***	0.34
CCC1	3***	0.45
CCC2	5.621***	0.59
CCC3	9.563***	0.87
CC	16.593***	2.05
C	27.025***	2.13
D	30.224***	3.81
Maturity (m)	0.001***	0.00
Treasury 10y- 2y	-0.013	0.07
Treasury short term	-0.001	0.05
Coupon	1.66***	0.08
EU	0.731***	0.08
***p<0.1; **p<0.05; ***p<0.01*		
Nr observations 226131		

When splitting the dataset into the two time periods, we see that the impact of issuing bonds in EU is higher in the later years (0.731 for 2013-2017 compared to 0.306 for 2008-2012) to the same thus concluding that the time period is not the cause for the yield bias. Moreover, we can still see that the EU bonds impact the yield positively for both time periods. However, the ECB bond buying programs only included investment grade bonds, so to further test the effect of this we split the period 2013-2017 into IG and HY bonds (Appendix B - D). When comparing the IG and HY bond regression for the 2013-2017 time period we can see that the EU variable changes sign for the IG bonds. However, when comparing the two time periods for IG bonds only, we see that the impact, which is not statistically significant for either, becomes less, thus concluding that the ECB bond buying program is not the cause for this.

Table 10 – Investment grade

Variable	Estimate	Standard Error
Senior Secure	-1.142***	0.150
Senior unsecure	-1.222***	0.160
Subordinate	-0.396***	0.130
AAA	0.073	0.050
AA1	0.272***	0.100
AA2	-0.748***	0.120
AA3	-0.367***	0.090
A2	-0.194***	0.060
A3	-0.899***	0.210
BBB1	0.46***	0.060
BBB2	0.672***	0.100
BBB3	1.107***	0.130
Maturity (m)	0.002***	0.000
Treasury 10y- 2y	-0.17***	0.020
Treasury short term	-0.169***	0.020
Coupon	0.111	0.090
EU	-0.224***	0.060
***p<0.1; **p<0.05; ***p<0.01*		
Nr observations 282648		

Table 11 – High Yield

Variable	Estimate	Standard Error
Senior Secure	0.804	1.07
Senior unsecure	0.488	1.03
Subordinate	0.894	1.1
BB1	0.662***	0.21
BB2	1.658***	0.28
BB3	-1.376***	0.31
B2	-0.78***	0.22
B3	-0.522***	0.17
CCC1	42.797***	2.44
CCC2	22.437***	2.27
CCC3	4.233***	0.41
CC	8.535***	0.77
C	14.506***	1.18
D	44.321***	5.44
Maturity (m)	0	0
Treasury 10y- 2y	-0.08	0.06
Treasury short term	0.338**	0.14
Coupon	0.191***	0.02
EU	0.798***	0.22
***p<0.1; **p<0.05; ***p<0.01*		
Nr observations 93974		

The results from the IG only regressions (Table 10) show both differences and similarities to that of the full regression. We can from the results conclude that the effect of the seniority of the bonds is the same as in the full regression. However, we can note that the EU variable has the reverse relationship as the full regression. We can see that the economic effect of the EU variable decreases, the average yield for EU bonds increases, in the later years of the dataset, despite the ECB bond buying program for IG bonds. The actual causation for this, remains unclear, as we would have expected the US bonds to have a lower average yield spread due to the US bond market being bigger, thus indicating a more liquid market (292155 US bond observation and 84467 EU bond observations in the dataset). Moreover, after finding that EU bonds have a lower average yield, we expected the causation to be the ECB bond buying program, but as proven above, this was not the case.

The two other interesting results from the IG regression is firstly, we see that the coupon is no longer significant. As the expected default rate is much lower for investment grade firms it stands to reason that when the investors get their investments back will matter less. The

investors may not be as concerned with the cumulative default rate in the IG segment. Thus, investor may be more indifferent, if they are getting a time value adjusted return that is fair, to the coupon payments size.

The results from the HY only regression (Table 11) show significant difference to that of IG bonds. Firstly, we can see that the seniority of the bond is no long significant. This may be because HY are too equity like and the bonds are invested more based on the individual firms' ability to repay the bonds rather than broad investments that are more common in IG bonds. It could also be that the rating agencies are more concerned with the risk of being sued in the lower rating grades and thus spend more time and resources to notch the bonds in the lower rating grades.

Moreover, we see that the coupon is significant, yet the sign of the coefficient is still positive, which is reverse of what we hypothesised. The cause of this may be that the marginal default rate for firms issuing HY bonds is inverted (Fons, 1994). The investors would then get most of the yield that is due to the bond trading at a discount in the first year rather than later over the lifetime of the bond. Investor may thus prefer a high coupon bond as they would continue to get a higher return if the firm was to survive.

Lastly, we note that the maturity is no longer significant. The reasoning applied for the coupon may apply here as well. Due to the inverted marginal default rate most of the default risk happens early in the remaining life time of the bond. This in turn may mean that the effect that maturity has in IG bonds, that investor require a higher premium due to credit duration risk, gets cancelled out due to the lower marginal default rate further in the life time of the bond. To further validate this, and the coupon causation theory we will split the HY bonds into a more granular level to see if the effect differs between the ratings in HY section.

Table 12 – Ba (1,2 and 3) rated bonds

Variable	Estimate	Standard Error
Senior Secure	-0.41	1.55
Senior unsecure	-0.44	1.5
Subordinate	0.309	1.91
Ba2	0.541***	0.19
Ba3	0.833***	0.2
Maturity (m)	0.003***	0
Treasury 10y- 2y	-0.075	0.07
Treasury short term	0.196	0.2
Coupon	0.012	0.01
EU	0.171	0.31
***p<0.1; **p<0.05; ***p<0.01*		
Nr observations 39530		

Table 13 – B (1,2 and 3) rated bonds

Variable	Estimate	Standard Error
Senior Secure	-0.033	1.13
Senior unsecure	0.025	1.09
Subordinate	-0.012	1.12
B2	0.701***	0.14
B3	1.899***	0.22
Maturity (m)	0	0
Treasury 10y- 2y	-0.215***	0.08
Treasury short term	0.159	0.12
Coupon	0.071***	0.01
EU	0.519***	0.19
***p<0.1; **p<0.05; ***p<0.01*		
Nr observations 35951		

Table 14 – Caa (1, 2 and 3) rated bonds

Variable	Estimate	Standard Error
Senior Secure	7.302***	1.26
Senior unsecure	8.271***	0.95
Subordinate	8.478***	1.08
Caa2	3.663***	0.44
Caa3	10.158***	0.8
Maturity (m)	-0.006***	0
Treasury 10y- 2y	-0.216	0.16
Treasury short term	0.713**	0.34
Coupon	0.269***	0.04
EU	1.575***	0.5
***p<0.1; **p<0.05; ***p<0.01*		
Nr observations 16552		

Table 15 – Ca, C, D rated bonds

Variable	Estimate	Standard Error
Senior Secure	4.99	9.55
Senior unsecure	8.013	10.03
Subordinate	8.448	10.34
Ca	-13.014***	3.25
D	8.255	6.18
Maturity (m)	-0.002	0.01
Treasury 10y- 2y	0.202	1.01
Treasury short term	-0.63	1.74
Coupon	0.367***	0.13
EU	5.393	5.57
***p<0.1; **p<0.05; ***p<0.01*		
Nr observations 1941		

From the regressions featured above (table 12 – 15) we see evidence of the theory that the impact of the coupon on the bond yield could be due to the inverted yield curve and marginal default rate. We see that when moving down the rating grades the statistical significance of the coupon goes from not significant at a 10% level for the Ba rated bonds to significant on a 1% level for the other ratings in the HY segment. Moreover, we see that the economic significance of the coupon increases as well the further down the rating grades. However, while this does support the theory that the coupon effect is due to the inverted yield curve and decreasing marginal default rate it may not be the definitive causation. From the study by Fons (1994) we know that in the lower rating grades the marginal default rate decrease with

time, as would be expected, but to further validate the theory behind the coupon effect we need to extract the yield curve for the relevant rating grades for the dataset.

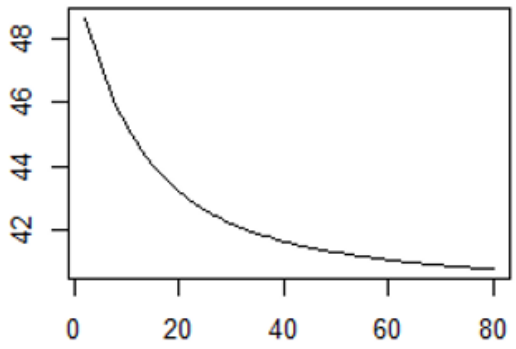
Using the Nelson-Siegel model to estimate the yield curve of the different rated bonds in the HY segment we find that the yield curve for B, Caa, Ca, C and D rated bonds is inverted, but normal for the Ba rated bonds (Graph 1-4). This is in line with the expected results and further validates the theory the coupon effect.

While this may be one reason of the coupon effect, another one could be that if institutional investors, such as insurance companies, prefer high coupon bonds, these bonds would get absorbed into portfolios. Bonds issues which have a larger share absorbed into buy-and-hold type portfolios will have a smaller share being traded and consequently they will be less liquidity. Thus, this increase in yield for high yield bonds may also be due to liquidity. There is evidence of this theory as the yield of IG bonds, which are more liquid, are not significantly impacted by a different coupon, while the lower rated HY bonds are, which are less liquid. However, further testing, such as including a liquidity proxy in the regression would have to be conducted.

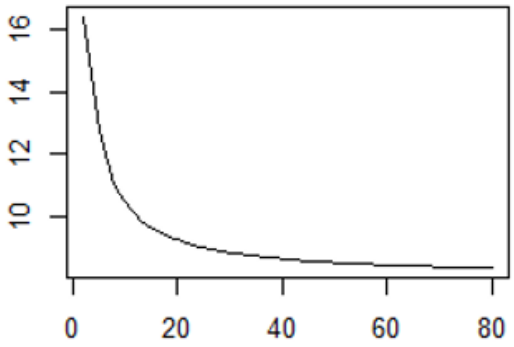
Graph 1 – 4 Yield curve HY bonds

Y-axis represents the yield in % and the x-axis time to maturity in months

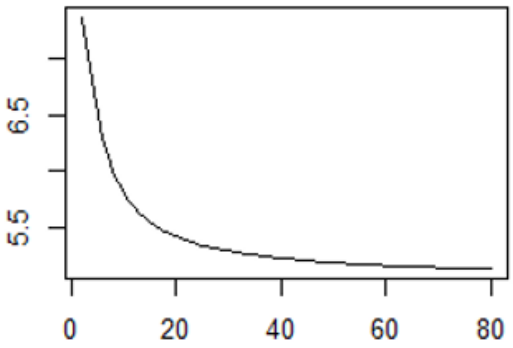
Ca, C, D rated bonds



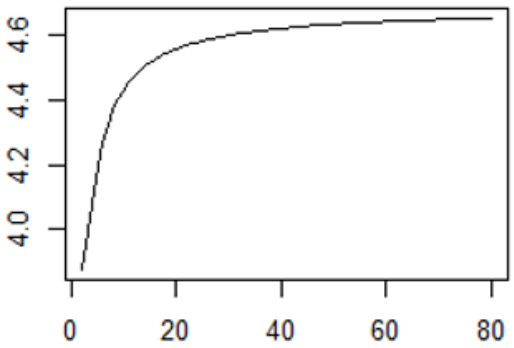
Caa rated bonds



B rated bonds



Ba rated bonds



6 Conclusion

This study set out to find discrepancies in bond yields, mainly looking at the seniority between. Looking at the results put forth in chapter 5 we found that there is indeed a discrepancy in yield for different seniority of bonds with the same rating. We find a clear statistical and economical significance in yield difference for the different seniorities (senior secured, senior unsecured, subordinate and junior subordinate). It seems that the rating agencies standardized way of rating bonds of different seniorities do not fully account for the increased or decreased risks associated with the bonds, thus the yield difference is significant depending on where in the capital structure the bond is issued. Furthermore, this effect seems to be more persistent in the higher rating grades, with only the segment in the HY bonds consistently showing the same results being Caa-rated bonds. This may be due to HY bonds being more equity like and the investors in HY bonds may take the seniority more into account when buying the bonds, rather than buying widely across a whole rating segment. Moreover, as John et al. (2010) state, rating agencies may take a different approach to rating HY bonds, using more time and resources, to be more conservative to avoid lawsuits.

This thesis included data of both EU and US bonds, and assessments have been made to see if there is any difference in the EU bond market and the US bond market. While in general it does seem that the markets are affected closely the same way, we do see some differences. Overall, we saw that investors tend to prefer more senior bonds and that the junior subordinate bonds tend to have a higher yield given the same rating. Furthermore, we see that the direction of this bias remains in the same direction throughout the time period in the dataset but vary slightly in how large the difference is. We can also see that the bias direction is constant throughout the rating grades when looking at the whole dataset and when isolating the US bonds. However, looking at the EU bonds we see that the bias shifts as we move down the rating grades. We can see that comparing both senior secured and subordinate debt to senior unsecured debt that the senior unsecured debt has a lower average yield for the higher rating grades but a higher average yield in the lower rating grades. It seems for EU bonds that rating agencies do not down notch enough in the higher rating grades, while in the lower rating grades they down notch too much for subordinate

debt, and for senior secured debt they tend to up notch too much in the higher rating grades and not enough in the lower rating grades. The results for the EU market are in line with what John et al. (2010) found.

We found that the EU market has had a lower average yield across the rating grades and across time. This is the opposite from what was hypothesised. The EU market is generally less mature and with lower liquidity, thus the expected effect was that EU bonds would have a higher average yield than US bonds, which turns out is not to be the case. The exact causation for this discrepancy remains unclear, as the ECB bond buying program is not the cause, and further studies would need to be conducted in order to study what causes this.

As for investors looking to benefit from the results found in the study, it would mainly be beneficial for investors looking to invest broadly in investment grade bonds. However, as the exact causations are not found in this study investors would have to test strategies involving investing more in the less senior bonds and US bonds, in the IG segment. Moreover, investors looking to use these results for strategies would benefit from finding the causation behind these yield discrepancies is caused by factors not account for in this thesis.

6.1 Limitations of the study

This study does contain some limitations, and in this section, we will examine them further

Firstly, the data in this study lacks a proxy for liquidity. As Friewald, Jankowitsch and Subrahmanyam (2014) and Acharya et al (2013) find, liquidity is one of the major components of the yield of bonds, while it has not been established how much of the yield it makes up, some studies find that it is more important than credit risk in the higher rating grades. Thus, the impact controlling for the liquidity of the bonds would have on these results may be significant.

Moreover, the data only contains the rating from one agency. Rating agencies do not always rate bonds the same, thus it may be the case that Moody's, as is used here, is more or less accurate in measuring the expected credit loss of bonds than other rating agencies such as S&P and Fitch. The bias in the seniority of the bonds may differ across the different rating agencies, and as such controlling for cross sectional difference between the agencies would be beneficial to see if all rating agencies exhibit the same biases.

Lastly, it may be the case that some of the yield discrepancy found is due to rating lag. Rating bonds is a time-consuming process; thus, the current rating of a bond may not accurately reflect the most current information, unlike the market, which reacts to information in real time. Thus, further studies may want to control for factors such as time since last re-rating, or test and see if there is a difference in the discrepancies depending on how long it was since the bond was issued or re-rated.

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Appendix

Appendix A – Subordinate yield vs Junior subordinate yield

Rating	*Subordinate*	*Junior subordinate*	*Yield difference*	*P-value*
Aa1	2.82%	3.68%	-0.86%	29%
Aa2	1.95%	4.52%	-2.57%	2%**
Aa3	2.29%	5.71%	-3.42%	0%***
A1	3.12%	4.03%	-0.91%	0%***
A2	3.00%	3.61%	-0.62%	0%***
A3	3.58%	3.36%	0.21%	31%***
Baa1	3.40%	4.06%	-0.66%	0%***
Baa2	3.56%	3.43%	0.14%	28%
Baa3	3.61%	3.59%	0.02%	87%
Ba1	4.26%	4.44%	-0.18%	46%
Ba2	4.62%	4.64%	-0.02%	94%
Ba3	5.92%	7.95%	-2.03%	17%
B1	5.81%	6.21%	-0.40%	40%
B2	6.83%	10.22%	-3.40%	1%***
B3	7.92%	14.71%	-6.79%	11%
Caa1	10.29%	32.65%	-22.37%	24%
Caa2	15.47%	12.53%	2.94%	60%
Caa3	28.74%	6.85%	21.90%	0%***

Appendix B – 2013 – 2017 Investment grade

Variable	Estimate	Standard Error
Senior Secure	-1.1***	0.08
Senior unsecure	-1.045***	0.07
Subordinate	-0.287***	0.08
AAA	0.065***	0.02
AA1	0.157***	0.03
AA2	0.157	0.15
AA3	-0.085*	0.05
A2	-0.058*	0.03
A3	0.173	0.14
BBB1	0.344***	0.03
BBB2	0.454***	0.04
BBB3	0.823***	0.07
Maturity (m)	0.003***	0
Treasury 10y- 2y	-0.028	0.02
Treasury short term	-0.021*	0.01
Coupon	0.113***	0.02
EU	-0.025	0.02

Appendix C – 2013 – 2017 High yield

Variable	Estimate	Standard Error
Senior Secure	0.454	0.36
Senior unsecure	0.505*	0.3
Subordinate	0.813***	0.31
BB2	0	0.17
BB3	0.062	0.19
B1	-0.09	0.21
B2	0.057	0.18
B3	0.06	0.13
CCC1	13.757***	2.05
CCC2	6.96***	1.04
CCC3	0.57**	0.25
CC	1.747***	0.32
C	3.592***	0.48
D	15.317***	2.88
Maturity (m)	0	0
Treasury 10y- 2y	0.014	0.19
Treasury short term	0.008	0.12
Coupon	2.522***	0.05
EU	0.88***	0.18

Appendix D 2008-2012 Investment Grade

Variable	Estimate	Standard Error
Senior Secure	-0.982***	0.32
Senior unsecure	-1.191***	0.32
Subordinate	-0.465*	0.25
AAA	0.28*	0.16
AA1	0.92***	0.31
AA2	-0.71***	0.14
AA3	-0.582***	0.16
A2	-0.377***	0.11
A3	-1.034***	0.22
BBB1	1.131***	0.22
BBB2	1.625***	0.37
BBB3	2.164***	0.42
Maturity (m)	0	0
Treasury 10y- 2y	-0.133***	0.02
Treasury short term	-0.327***	0.06
Coupon	0.106	0.1
EU	-0.069	0.05

Appendix E 2008-2012 High Yield

Variable	**Estimate**	**Standard Error**
Senior Secure	-0.233	1.81
Senior unsecure	0.709	1.75
Subordinate	1.748	1.89
BB2	0.661**	0.31
BB3	1.126***	0.43
B1	-1.399***	0.48
B2	-0.598*	0.33
B3	-0.47	0.32
CCC1	35.572***	3.2
CCC2	15.076***	1.86
CCC3	3.457***	0.58
CC	6.224***	0.99
C	10.315***	1.68
D	32.453***	7
Maturity (m)	-0.001	0
Treasury 10y- 2y	-0.052	0.05
Treasury short term	0.165	0.29
Coupon	-0.001	0.01
EU	1.15***	0.4