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Liquidity Premia in the Cross-Section of Corporate Bonds

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Abstract

The purpose of this research is to examine the excess returns in the cross section of corporate bonds for the time period of 4/11/11 until 04/06/13. Through a number of cross sectional regressions, the factors that affect the corporate bond premia are identified and the contribution of each factor to the returns of the corporate bonds is analyzed with statistical evidence. The systemic factors used in the analysis are market-wide liquidity and corporate-treasury yield spreads while in the regression model there are also bond- specific factors such as rating, maturity, security, coupon and a number of other bond characteristics. The results showed that the systemic factors of market-wide liquidity and corporate treasury yield-spreads are important determinants of the excess returns of corporate bonds. Besides, maturity and security are the bond-specific factors with the highest impact on corporate bonds' premia. In addition, the information incorporated in market-wide liquidity is also examined and the factors that have an influence on it are described explicitly.

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Introduction

According to financial theory, an asset which tends to be more sensitive to risk factors offers a higher return as a compensation for the greater risk. In efficient markets, where the prices of securities incorporate and reflect all the relevant information, returns in excess are not feasible since no investor can outperform the market. However, efficient market is just a simplification of the real world and it does not always hold. Actually, there are times when investors are able to gain returns from a portfolio that exceed a benchmark. These returns are called "excess returns". The existence of excess returns in financial securities has attracted the attention of many practitioners, policy makers and researchers. Through a number of studies, several conclusions have been made regarding the factors that affect the premia of the securities so that a number of reasons of this phenomenon to be isolated.

In this study, we concentrate on the excess returns of corporate bonds and we focus on investigating the information incorporated in them. More specifically, a number of factors are used in the study so that their relationship with excess returns to be examined and their influence towards these premia to be analyzed. One of these factors is the market-wide liquidity. Liquidity is thought to play a significant role in the returns of many securities and empirical findings approve the existence of liquidity premia. For this reason, it would be interesting to identify if liquidity affects corporate bonds' returns and if it does how significant is this influence. Moreover, in this study the factor of corporate treasury-spread was also included. This spread has become a subject of conversation of many researchers who have found that its amount is not only attributed to the greater credit risk of corporate bonds compared to the treasury bonds, but also to other factors. Taking this information into account, we are confident that the corporate-treasury yield spread will affect the premia of corporate bonds. Additionally, in the model of our research there were also included other variables their impact of which on bonds' realized excess returns we wanted to control. These variables were the coupon, the sector, the seniority, the rating, the maturity, the par outstanding and the security of each bond.

The sample used in the study is sourced by the JP Morgan's market data portal. It equipped us with all the necessary information that were needed in order the research to be performed. The liquidity measure that we used is an equally weighted average of the volume of bonds traded and their relevant bid ask spreads. Moreover, several variables of the study are qualitative (sector, maturity, rating, security, seniority) and the rest are numeric (liquidity measure, corporate-treasury spread, par outstanding, coupon). Those which are qualitative were transformed in dummy variables in order to be regressed on the dependent variable of our model.

During the empirical research, a number of regressions were performed so that the relationship of the corporate bonds' premia with the factors to be examined explicitly. The first step, is the execution of a Fixed Time Effects regression in order to investigate the impact of our variables through time. At a second level, we check the existence of omitted variables that may be constant over time but vary between cases, and others that may be fixed between cases but vary over time, by carrying out a Random Effects regression. Subsequently, we perform a Fama-Macbeth regression in order to discover the premium with which an investor should be rewarded for exposing himself to the risk factors of market-wide liquidity and corporate-treasury spread in the market. Eventually, we investigate if our liquidity measure is related to any of the factors and in case it is related, in which way they correlate with each other.

At the final part of the research, conclusions are drawn and proposals for further investigation are being offered to any interested party.

CHAPTER 1: THEORETICAL ANALYSIS OF THE TOPIC

1.1 Literature Review

As financial theory suggests, an investor who is more exposed to risk factors accepts a higher return as a compensation for the greater risk. For instance, we can think of the risk factor of market liquidity. Liquidity is a broad notion that generally denotes the ability to trade great quantities quickly with low cost and without moving the price of the asset. As it is most known, liquidation is costlier when liquidity is lower. Therefore, it seems logical that many investors may require a higher return on assets whose return is highly sensitive to market liquidity. Market participants have by far shown a great interest on investigating the common factors on which the returns of financial assets are affected in different markets.

In recent years, the literature has provided a lot of studies performed on this topic. These studies refer to different equity markets and reveal a number of important factors that correlate with stock returns.

Researches in equity market have showed that liquidity plays an vital role on stock pricing and as a result on stock returns. Their conclusion is that shocks to the liquidity of individual stocks incorporate a common component and that the systematic risk, associated with this common component is priced in the cross-section of expected equity returns. Therefore, investors who invest their money on stocks whose returns are more sensitive to liquidity should earn higher returns than those investors who invest on stocks whose returns are less sensitive to liquidity.

There is a wide range of articles in literature that prove this connection of liquidity and stock returns upon various stock markets. In 2003, **Pastor and Stambaugh** examine the role of "liquidity betas" of stocks on pricing stocks. Liquidity betas, reflect the sensitivity of stocks to innovations in aggregate liquidity. Their conclusion is that the expected stock returns are cross-sectionally and positively affected by the sensitivities of stock returns to innovations in aggregate liquidity. In addition, according to their findings smaller stocks are less liquid and the smallest stocks are highly sensitive to aggregate liquidity.

Two years later, in 2005, **Acharya and Pedersen** develop a simple equilibrium model of liquidity risk. Their model shows that CAPM can be applied only for returns that are net of illiquidity costs. More specifically, a investor should worry about the performance and tradability of his asset both when market is blooming and when market faces a downturn. According to the liquidity-adjusted asset pricing model of Acharya and Pedersen the required return of a security depends on its expected liquidity as well as on the covariances of its own return and liquidity with the market return and market liquidity. In addition, they highlight that a positive and persistent shock to illiquidity is strongly followed by low returns in the same period and high expected future returns.

It is clear that these two studies provide much information about the factors that affect equity pricing. However, neither of them investigates the role of liquidity in the cross section of corporate bonds. Pastor and Stambaugh pose a direction for future research by refering to the exploration of the dependence of systematic liquidity risk on other financial markets. Acharya and Pedersen also recognize that their research does not include illiquid assets such as corporate bonds although assets of this kind constitute a large part of aggregate wealth.

Corporate bonds are considered to be much less liquid than stocks since most of them do not trade regularly. They seem to provide a fertile ground for studying the effect of liquidity risk on asset prices and returns since risk factors are easier to be identified. It is also true that there are very few studies examining the cross-section bonds returns empirically in the asset pricing literature although corporate bonds demonstrate a significant trading activity at a global level. For instance, US corporate bond market consists of 23.9% of the size of US bond market and its daily trading volume is estimated at $16.3 billion. It has long been and continues to be an important source of capital for issuers. Therefore, it is significant, the factors on which the returns of corporate yield spreads depend, to be explored.

Recently, the credit spread puzzle, that has been observed on corporate bonds, rendered the focus of the researchers on the link of corporate bonds with liquidity. More specifically, it was noticed that the yield spreads of corporate bonds are greater than what can be explained by their risk of default. Due to this fact several researches followed that attributed this gap between the expected spreads and the real spreads, on the existence of illiquidity in the market.

One of the first approaches on this topic was made by **Elton, Gruber, Agrawal and Mann** in 2001.They investigated the difference between spot rates of corporate and governments bonds. The results of their research showed that the spread between these two kinds of bonds is affected by three factors: the loss that an investor may face in case of default, the state and local taxes that are paid only on corporate bonds and not on treasury bonds, and the premium required from the investor for undertaking the systematic risk of the corporate bond. According to their findings, only a very small part of the corporate-treasury spread can be attributed to the expected default loss. In contrast, taxes have a more significant impact on spreads. For instance, for A-rated bonds that mature in 10 years, taxes account for 36.1 percent of the difference in yield spreads while loss from default accounts for only 17.8 percent of this difference. State and local taxes are very significant factors in explaining the "distance" of treasury-yield spread due to the fact that they are paid on the entire coupon of a corporate bond and not on the difference of the coupons of corporate and treasury bonds. Although taxes are recognized to play an important role in explaining the differences in returns of corporate and government bonds, their influence has not been taken into account before the study of Elton, Gruber, Agrawal and Mann. Additionally, the researchers remarked that the 85 percent of the part of corporate-treasury spread that remained unexplained by the two previous factors is attributed to the systematic risk of the investment in corporate bonds.

In the same year, **Collin-Dufresne, Goldstein, and Martin** examined the variations of credit spreads on individual bond returns. Commenting the traditional models of default risk they figured out that they can explain only the one-quarter of the changes in credit spreads. Besides, they find that aggregate factors determine much more credit spread variations than firm specific factors. This aggregate factor is common to all corporate bonds. However, the conclusion of the three researchers comes in contradiction with the predictions of existing structural models of default risk which support that it is firm-specific factors that drive credit spreads.

Two years after, in 2003, **Jing-zhi Huang and Ming Huang** set more light to this topic. In their research, they accept the fact that corporate bonds typically trade at higher yields than Treasury bonds, due to the existence of much greater credit risk to the formers. However, on their point of view, the yield spread between these two kinds of bonds does not only depend on their different credit risks. There are also other factors that affect the corporate-treasury yield spread and make it larger than the expected. One of these factors is illiquidity. Finally, through an implementation of structural models, they reached similar conclusions with Elton, Gruber, Agrawal and Mann. They find that for investment grade bonds, independently of their maturity, credit risk accounts only for almost 20% of the observed yield spread. Moreover, the corresponding percentage for Baa bonds is 30%. Taking all the above into account they highlight that credit risk accounts for only a small fraction of the observed corporate-treasury yield spreads.

The clear association between corporate bond yield spreads and liquidity comes with the study of **Chen, Lesmond and Wei** in 2007. Using a sample of 4000 corporate bonds of varying rating categories (both investment grade and speculative grade bonds) they test the relationship between the levels of yield spreads and liquidity as well as between yield spread changes and liquidity changes. According to their estimations liquidity is a key determinant of yield spreads since it accounts for as much as half of the cross-sectional changes in yield spreads. They clarify that liquidity is priced in yield spreads regardless of the potential existence of issuer fixed effects or bias between yield spreads, liquidity and credit ratings. This effect of liquidity on yield spreads is apparent both in investment grade and speculative bonds.
Fama and French in 1993 are the first who distinguish default and term premia as significant factors for corporate bond pricing. Their study initiates by examining the joint roles of market β, size, earnings to price ratio, leverage and book to market equity in the cross section of average stock returns. One of their findings is that when these variables are used isolated, they have explanatory power. When used in various

combinations, size and book to market equity appear to absorb the roles of leverage and earnings to price ratio in the average returns. As a result, they conclude that these two empirically determined variables can explain the cross-section of corporate average returns efficiently. By performing time-series regressions on the explanatory variables they find interesting results. Firstly, according to the regressions' results size and book to market factors can explain the differences in average returns on stocks. However, these factors can not justify the large difference between the average returns across between and one month bills. This is feasible by the use of the market factor. In the regressions that the size and book to market factors are included thy found that their stock portfolios have slopes on the market factor which approach 1. This means that the risk premium for the market factor links the average returns on stocks and bills. The same methodology was also used in bonds. Finally, they found that the relevant factors which capture the greatest portion of variation in the returns of government and corporate bond portfolios are the term premia and the default premia. These term-structure factors also explain the average returns of bonds.

A few years later, in 2005, **Gebhardt, Hvidkjaer, and Swaminathan** approve this finding. They study the cross section of corporate bond returns and assess how a number of factor loadings and bond-specific characteristics can explain the cross-section. As bond risk characteristics the researchers used ratings and duration. This choice of variables was made because ratings are proxies of bonds' default risk and duration is a proxy of the term or maturity risk of bonds. Moreover, the factor loadings used in their study are default and term risk factors. Their findings showed that default betas are more important determinants of expected bond returns than bond ratings. Additionally, the Fama MacBeth regressions that were performed in the cross-sections of corporate bonds demonstrated that term betas explain the average bond returns more powerfully than duration. As a result, default and term betas showed to be more important than bond- specific characteristics such as ratings and duration.

1.2 Aim and Contribution of the Study

It can easily be realised that our work is differentiated from the previous researches. It complements them since it examines the sensitivities of corporate bond returns to two systematic risk variables: the market-wide liquidity and the corporate-treasury yield spread. In the study we also use a number of bond characteristics. These are the coupon, the par outstanding, ratings, maturity, sector, security and seniority. More specifically, in this research, we focus on the liquidity premia that US corporate bonds offer over the period of 4 November of 2011 until 4 June of 2013. It is reasonable, the liquidity premia to vary through time. We expect them to be high in days of illiquidity in the market and low in days when the market is considered to be liquid. Furthermore, our liquidity measure does not focus only in the systematic part of liquidity but represents the sum of systematic and unsystematic part of liquidity. Our approach is based on regression analysis. We regress the liquidity of US corporate bonds as wells as their ratings, maturity, sector and spreads, on the bonds' yields. Statistically significant regression coefficients prove the existence of liquidity premia in corporate bonds.

The primary goal of the study is to broaden the awareness of both the investors and researchers about the significant role that not only some bond specific but also some non bond specific factors play in the premia of corporate bonds. It is an extension of the previous researches that have been made in the previous years since it captures the effect of two important systematic risk factors, the market-wide liquidity and corporate-treasury spreads. Furthermore, the use of the bond characteristics is going to play an important role in the formulation of the conclusions of the study.

The results of the particular study are considered to be very significant and are expected to enrich the existing knowledge of investors, researchers and market practitioners. Particularly, by making use of the results of the research, portfolio managers and investors can have the opportunity to plan the future behaviour and pursue available investment opportunities. Furthermore, the study facilitates the identification of investment approaches and decreases the possibility of high value losses.

1.3 Data Description

The data of the research were drawn by JP Morgan's market data portal. It provided us with data of everyday transactions of corporate bonds and filled us with information about their liquidity scores as well as about their ratings, coupons, returns and other important data. The corporate bonds selected where those with the highest trading activity and as a result the highest liquidity. It also should be added that the study refers to trades that happened between 4/11/11 and 4/06/13.

Initially, our source of data provided us with daily data that started from 12/03/10 and expanded until 28/06/13. However, there were certain bonds on which our source of data lacked information about liquidity. These bonds were finally extracted from the dataset. In addition, we have excluded callable, convertible, puttable and sinking fund bonds in order to prevent the confounding effect of embedded options. As a result, our sample contains 955.323 observations of corporate bonds. These corporate bonds are of various ratings, maturities, sectors and coupons since the aim of the research is to investigate the factors that affect the liquidity premia of corporate bonds independently of their time to maturity, coupons or ratings. Therefore, there is a diversity of corporate bonds in the sample so that the research will enclose all the possible combinations.

In our study we use a liquidity measure for each individual bond by estimating an equally weighted average of the volume of bonds traded and their relevant bid ask spreads. The bonds of the sample are those traded on the New York Stock Exchange (NYSE) and the London Stock Exchange. It is should also be referred that the data of marketwide liquidity used in the research are weekly. This measure is thought to be reliable and approach the real liquidity of the corporate bonds.

1.3.1 Panel Data

It is crucial to refer to the form that the dataset used in the study has since this will help the comprehension of the analysis that follows.

Panel data, also called longitudinal data or cross-sectional time series data, allows the examination of different entities across time. It is important that every entity is observed in more than one points in time. The symbol i (i = 1,.....,n) indicates a specific entity such as a specific corporate bond of the sample and the symbol t (t = 1,.....,T) indicates a specific point in time, for instance, a specific date.

In our research we have a panel dataset considering that the same bonds can be traded at different points in time (t) and at the same point of time many different bonds are traded (i). Therefore, this kind of data gives us the opportunity to study a variety of bonds issued by the same or different issuers through time.

Our panel is considered to be balanced since the time periods (t=1,...,T) of the sample are equal for each of the cross-sections. It is extremely useful to work on a dataset of such kind because it offers the opportunity to have a large number of data points (T*N) in the research, increasing the degrees of freedom and decreasing the collinearity among the explanatory variables. Consequently, the econometric estimates that are found are more efficient and correspond better to reality. In addition, panel data facilitate the control of omitted variables in the model. By performing the fixed effects and random effects model the existence of omitted variables is identified.

1.4 Estimates of Liquidity Measures

Liquidity and liquidity risk play a key role when analyzing bond markets empirically. Liquidity is thought to be a significant factor that influences bonds' yields to a great extent. For this reason, it has long been and continues to be the interest of many practitioners and researchers to identify in which way investors could take advantage of it to make profits. In the next subsection the estimation procedure of several important liquidity measures used in literature will be described.

In the literature regarding bond liquidity, most researches develop their own approach to measure liquidity and there is no consensus on a common measure. Maybe the simplest one is the bid-ask spread which is analyzed thoroughly by Edwards, Harris and Piwowar in 2007. In spite of the fact that the bid ask spread is an extremely direct indicator of liquidity it is unable to fully capture many liquidity aspects such as resilience and market depth. An other way of measuring the liquidity factor is through the theoretical pricing models. Nevertheless, this method is also inefficient since it suffers from misspecifications of the pricing model.

1.4.1 The Liquidity Measure of Pastor-Stambaugh

The liquidity measure of Pastor-Stambaugh is formulated on the principle that low liquidity in one trading day is followed by a higher price in the next day due to the order flow in a certain direction on a specific day. The two researchers capture the liquidity of a bond traded in the period t from the estimate of $\pi_{i,t}$ of the following least squares regression:

$$r_{i,j+1,t} = \rho_0 + \rho_1 r_{ij,t} + \pi_{i,t}\, \mathrm{sign}(r^e_{ij,t})\, Vol_{ij,t} + \varepsilon_{j+1,t}$$

where :

- $r_{i,j+1}$ reflects the return of a bond i on day j and in month t
- $r^e_{ij,t}$ is the return of the bond in excess of the market's return
- $\mathrm{sign}(r^e_{ij,t})$ is a function whose values equals to 1, if $r^e_{ij,t}$ is 1 and -1 if it is negative
- Vol reflects the volume traded in dollars

The return of the bond i is partially reversed when the market is illiquid. In that case, $\pi_{i,t}$ becomes negative. As it is clear, the liquidity measure can be computed for each bond separately. That is individual liquidity and calculated only if there are at least ten return observations that will be used in the above regression. Apart from the individual liquidity measure, an aggregate, monthly liquidity measure can also be computed by the following formula:

$$\pi_t = 1/N_t \left(\Sigma_{t=1}^{Nt} \pi_{i,t} \right)$$

where:

N_t reflects the number of corporate bonds in the specific month t.

Pastor-Stambaugh scale the difference in monthly aggregate liquidity measures by the ratio of capitalizations of the bonds in the sample, in order to take into account the effects of changes in the bond market's growth in size.

$$D\pi_t=(M_t/M_1)(p_t-p_{t\_1})$$

where:

Mt is the entire dollar value in the end of month t-1 of the bonds that are included in the month t.

1.4.2 The Amihud Measure of Illiquidity

Amihud, in his study, was bases in thee hypothesis that suggested that that return increases where there is illiquidity in the market. He finally proved that the expected market illiquidity affects ex ante in a positive way the excess returns of stocks. His results also showed that expected stock returns partially represent an illiquidity premium .

The study of Amihud was based on a liquidity measure which focuses on the impact of trading activity on prices. It is taken for granted that the liquidity of a security is high if it is traded on a high volume with a very negligible impact in price. Thee Amihud liquidity measure is the one below:

$$ILLIQ=1/Days_{it}\ (\Sigma^{Daysit}_{j=1}\ |r_{ij,t}|)/\ Vol_{ij,t}$$

where: $r_{ij,t}$ is the of the bond i in day j of the month t

$Days_{i,t}$ is the number of days for which transaction data are available for bond i

Like the liquidity measure of Pastor-Stambaugh, we can calculate an aggregate illiquidity measure in our sample per month.

$$ILLIQ= (1/N_t)\Sigma^{Nt}_{i=1} ILLIQ_{it}$$

We can also scale the monthly difference in the Amihud illiquidity series by the ratio of capitalizations of the bonds that are included in the sample in each month t such as:

$$DILLIQMt=(Mt/M1)(ILLIQ_{Mt}\_ILLIQ_{Mt-1})$$

1.5 The Dummy Variables of the Research

The excess returns of corporate bonds can be influenced not only by quantitative variables (liquidity, corporate-treasury spread, coupon, par outstanding) but also by qualitative variables (sector, maturity, rating, security, seniority). For this reason we included some qualitative factors in the form of dummies and we examine their role in the realized returns. In addition, the use of dummy variables can have a great contribution to this study since they may be confounding factors. By omitting them, biased estimates of the other coefficients may be caused. It is also important to be mentioned that with the use of dummy variables our dependent variable is described better and errors become smaller.

One of the qualitative variables used in our study is the **Sector** that any of the corporate bonds belongs. As it has been already mentioned, our sample consists of 955.323 observations. From these observations the 22.93% of them are sourced from the financial sector and the rest 77.07% of them belong to other sectors of the economy. We tried our sample to approach as much as possible the existing distribution of corporate bonds in the real world. As we can notice from the information that Creditflux gives us (Appendix: Picture1) the financial sector consists of the majority of the corporate bonds traded globally. More specifically, the 36% of the corporate bonds belongs to the financial sector while the rest 64% incorporates bonds from other sectors such as energy, basic materials and consumer goods.

In addition, an other significant variable included in the research is the bonds' **Maturity**. The sample contains corporate bonds of various maturities so that both short term and long term investments in bonds to be taken into account. Most of the bonds that are contained in the sample are those with long maturities. More analytically, corporate bonds that mature in ten and more years possess the 26.67% of the sample. The rest are bonds with short term time to maturities (lower than 10 years).

We support that **Ratings** could also enhance our empirical results and for this reason we included them in the research. The ratings used in the study are calculated from the average of the ratings of S&P and Moody's agencies for each specific bond. This average is considered to be a more objective and effective measure. As it is obvious in the Appendix (Table 6), the bonds used in the sample are investment grade bonds of high and medium quality. This is reasonable thinking that the bonds used in the study are all of them chosen to be highly liquid. Bonds of BBB rating possess the highest percentage (52.1%) and category A is the second more common rating category in the sample with percentage reaching to 40.55%. Corporate bonds of the medium rating categories possess very small percentages in this study (AA: 6.54% ,AAA:0.81%).

Security is an other characteristic of corporate bonds that could affect their premia. In secured bonds there is a pledge of an asset by the issuer's side. This is a form of collateral in case that the issuer defaults and can not pay back the interests and principal. Therefore, since secured bonds contain a form of collateral, are considered to be less risky and as a results there might be a difference in their realized excess returns compared to the unsecured bonds. In this sample, the 95.06% of the observations are non secured bonds while only the 4.94 of them are secured.

Last but not least, **Seniority** is thought to play its own role in the premia of corporate bonds. Seniority refers to the order of repayment in the event of bankruptcy of the issuer. Senior debt is always paid before subordinated or pfd. It is evident that senior bonds are less risky and as a result we assume that they may affect the excess returns of the bonds. In order to investigate that, we collect data regarding the seniority of our observations the 95.42% of which are Senior bonds and the rest are subordinate and pfd bonds. The effect of each kind of bonds is going to be estimated in the empirical results of the research.

CHAPTER 2: Empirical Analysis and Results

In this section, details on the conducted regression analysis are provided and the variables used on the study are explained thoroughly.

2.1 Regressions

The dependent variable of the analysis is the excess return of US and London corporate bonds. As excess return we define the difference between the returns of the corporate bonds and the returns of Treasury bonds that are risk free. It is important to note that receiving an excess return almost always requires one to take on more risk. Therefore, by our analysis, we aim to identify which risks should an investor take into account when seeking excess returns from his investment.

The study contains independent variables that enclose both the bond specific and non bond specific factors. The independent variables that account for the bond specific part are the coupon, maturity, sector, rating, seniority, par outstanding and security. Moreover, the independent variables that account for the non bond specific part are the spread of US corporate bonds relative to treasury and their liquidity scores.

We run the following regression using daily observations:

$$Excess\ Return_{it} = \alpha + \beta_1 Coupon_{it} + \beta_2 Maturity_{it} + \beta_3 Sector_{it} + \beta_4 Rating_{it} + \beta_5 Seniority_{it} + \beta_6 Par\ Outstanding_{it} + \beta_7 Security_{it} + \beta_8 Z\text{-}Spread_{it} + \beta_9 Liquidity\ Score_{it}$$

where i is the bond issue and t the time measured on daily basis.

2.1.1 Fixed Time Effects Regression

We use the fixed time effects method since we are interested in analyzing the impact of our variables through time.

The equation for the fixed effect model is:

$$\textit{Excess Return}_{it} = \alpha_i + \beta_1 \textit{Coupon}_{it} + \beta_2 \textit{Maturity}_{it} + \beta_3 \textit{Sector}_{it} + \beta_4 \textit{Rating}_{it} + \beta_5 \textit{Seniority}_{it} + \beta_6 \textit{Par Outstanding}_{it} + \beta_7 \textit{Security}_{it} + \beta_8 \textit{Z-Spread}_{it} + \beta_9 \textit{Liquidity Score}_{it} + u_{it}$$

In this study that we have time-series cross-sectional data, the interpretation of the beta coefficients is: For a given bond, as coupon, maturity, sector, rating, seniority, par outstanding, security, corporate-treasury yield spread and liquidity score vary across time by one unit the excess return of this bond will increase or decrease by β units.

In fixed time effects we assume that there is an unobserved factor that affects all bonds excess returns in the same way but this factor may differ at different points in time. To control for such an unobserved variable that may vary by time we run a time fixed effects regression model.

Observing the results in the Appendix (Table 1) we notice that Prob>F=0.00000. F-test checks whether all the coefficients of the model are different than zero and since the number is lower than 0.05 we can be convinced that our model is of good quality. Moreover, R-squared is 2.63% which means that the variance of the excess returns are explained by the independent variables that are used in the analysis by 2.63%. This is an expected percentage since we work on an analysis which is composed of panel data. In the table, next to each of our independent variables we have the opportunity to check the two-tailed p-value test. This test checks the possibility that each coefficient is different from zero. In cases where p-value is lower than 0.05 we can accept that the variable has a significant influence on the excess returns. T-values also test the hypothesis that each coefficient is not zero. To reject this t-value has to be higher than 1.96 (for 95% confidence level). It is rational to think that the higher the t-value the higher the relevance of the variable. In the same table, there are also the confidence intervals for each variable with 95% confidence level. From the results of the regression we have:

Excess Return =0.0189943 - 0.0006814Coupon - 0.0263606Maturity(1-3years) - 0.0311824Maturity(3-5years)-0.0205541Maturity(5-7years)-0.0210344Maturity(10+) + 0.0035587Financial Sector - 0.0149306 Other BroadSector - 0.0005469Rating(AA) + 0.0034442Rating(AAA) + 0.0101906 Rating(BBB) - 0.0042756 Senior Seniority - 0.0198903Pfd Seniority + 0.0028662 Par Outstanding + 0.0166844Secured + 0.0079391Z-Spread + 0.0104546 Liquidity Score

As we can notice from Table 1, the excess returns of the corporate bonds of our sample is robustly related to a number of factors. This can be concluded from the fact that most of our variables are statistically significant (p-values<0.05, |t-statistic|>1.96). However there are also some variables that are of no statistical importance, since their p-values are higher than 0.05, such as the coupon, the seniority, the high ratings (A, AA) and the sector of the bond.

Initially, we highlight the strong dependence of the corporate bonds' excess returns on the **corporate-treasury spread**. As it is apparent, this spread affects positively the excess returns of the bonds which means that the higher it is the greater the compensation for the extra risk is. This result seems logical since spreads reflect the riskiness of a bond. Therefore, in case they increase, the bond should offer greater returns as a reward for the greater risk. From the results of the fixed time effects regression we could say that the increase of the credit spread by 1 unit provokes the increase of the excess returns of the bonds by almost 0.008 units.

It is also significant to be referred, the strong relationship of **liquidity** and excess returns. As we observe from the table, we could state that liquidity affects positively the excess returns of the bonds. This result is not what we have expected in the beginning of this study. More specifically, we expected liquidity to affect negatively the excess returns of the bonds for the reason that holding a bond in times of high liquidity in the market is a more secure investment. However, the expected excess return with the realised excess return of a bond many times differ. In this research, an increase of a bond's liquidity by 1 unit increases the excess return of the bond by 0.01 units.

In addition, we notice that the **security** of a bond affects positively its excess return. According to the theory, the issuer of a secured bond, in the event of a default, passes title of the asset or the money that has been set aside to the bondholders. This is a form of collateral for the bond buyers. Due to the existence of this kind of collateral secured bonds are considered to be less risky than the unsecured bonds and as a result they have the tendency to provide lower returns. In contrast to the theory, we can observe that in our study the relationship of excess returns and bonds' security is positive. This is obvious from table 1 in Appendix that shows the t statistic is positive (+3.48).

Among the bond ratings the only statistically significant variable is the **BBB rating** and therefore, it affects the excess returns of the bonds. As it is most known, the leading rating agencies assess most issuers of corporate bonds taking into account their ability and willingness to pay interest and repay principal as agreed. Typically, only bonds issued by the largest and strongest companies are qualified with "investment-grade" ratings, which indicate outstanding relative credit. In contrast, bonds that carry a higher likelihood of default (speculative grade bonds) often pay higher yields. In this research, the variable of BBB rating is positively related to excess returns (t-statistic= +4.68).

Another significant factor in our estimations is the **maturity** of the bonds. Generally, bonds that are held for longer time are usually exposed to more risks, including the risk of high inflation. In case that inflation goes up while a bond matures, the rate of inflation should be deducted from the interest on the bond in order a realistic calculation of earnings to be found. As a result, we expect longer bond maturities to offer higher yields. Taking a glance at our empirical results we notice that maturity has a negative effect on yields which means that the longer they are, the lower the returns will be.(t-statistics - 1-3 years: -8.3, 3-5 years: -9.23, 5-7 years: -5.69,10+

years: -6.82). This abnormal result can be attributed to the fact that maturity does not reflect precisely a bond's riskiness. A most reliable measure is duration. A bond's duration reflects its value overtime. The more fluctuation there is in a bond's duration, the riskier the bond is. Therefore, at this point, duration could give us more realistic empirical results.

2.1.2 Random Effects Regression

Random effects method is used in our analysis in order to check the possibility of existing omitted variables that may be constant over time but vary between cases, and others that may be fixed between cases but vary over time. In 2008, Green clarified the main difference of random effects and fixed time effects model " ...the crucial distinction between fixed and random effects is whether the unobserved individual effect embodies elements that are correlated with the regressors in the model, not whether these effects are stochastic or not. Consequently, this examination will help us have a more complete picture of our analysis.

The form of the random effects model is:

$$Excess\ Return_{it} = \alpha_i + \beta_1 Coupon_{it} + \beta_2 Maturity_{it} + \beta_3 Sector_{it} + \beta_4 Rating_{it} + \beta_5 Seniority_{it} + \beta_6 Par\ Outstanding_{it} + \beta_7 Security_{it} + \beta_8 Z\text{-}Spread_{it} + \beta_9 Liquidity\ Score_{it} + u_{it} + \varepsilon_{it}$$

U_{it} reflects the between entity error while ε_{it} reflects the within entity error. In addition, random effects assume that the error term of entities is not correlated with the predictors. This allows for time-invariant variables to play a role as explanatory variables.

Random effects model gives analysts the opportunity to specify the individual characteristics that may or may not affect the predictor variable. However, there are cases in which some important variables may not be included because they are not available and as a result there is an omitted variable bias in the model.

Regressing our variables on the excess return we come across the following results (see Appendix: Table 2):

Excess Return =0.0174787 - 0.0016268Coupon - 0.0290858Maturity(1-3years) - 0.0338163Maturity(3-5years)-0.0250376Maturity(5-7years)-0.0241444Maturity(10+) - 0.0018828Financial Sector - 0.0308692 Other BroadSector + 0.0005976Rating(AA) + 0.0022305Rating(AAA) + 0.0116799 Rating(BBB) - 0.000378 Senior Seniority - 0.0264545Pfd Seniority + 0.0027227 Par Outstanding + 0.0117742Secured + 0.0266761Z-Spread + 0.0586178 Liquidity Score

Our model is trustworthy like the fixed effect model since Prob>chi2= 0.00>0.05. Sigma_u is 2.8 % and reflects the standard deviation of the residuals within the groups u_{i}.. Additionally, sigma_e is the standard deviation of the residuals e_{i}. In this regression sigma_e is 99.5%..

By taking a glance at the table, it can easily be realized that the results of the random effects regression are similar to the results of fixed effects regression. The only difference is that the coefficients of the random effects model tend to be greater than the coefficients of the fixed effects model. This is due to the fact that the former include both the within entity and between entity effects.

More analytically, it is obvious that **liquidity score** and **corporate-treasury spread** are statistically significant variables since their p-values are zero. Moreover, according to random effects model the increase of liquidity score of bonds by one unit provokes an increase of their excess returns by 0.058 units. Similarly, z-spread is positively correlated with excess returns and when it changes by one unit the excess returns of corporate bonds change in the same direction by 0.026 units. In addition, **Par outstanding** is positively related to our dependent variable and so is **BBB rating**. In contrast, like the fixed effect model, **maturities** are negatively related to excess returns.

2.1.2.1 Hausman Test

In order to decide which of the two models (fixed or random effects) describes better our formula we perform the Hausman Test. In other words, the Hausman test checks a more efficient model against a less efficient but consistent model to make sure that the more efficient model also gives consistent results. In this test the null hypothesis is that the coefficients estimated by the efficient random effects estimator are the same as the ones estimated by the consistent fixed effects estimator. In case they are (p-value>0.05), then it is safe to use random effects. However, if p-value is significant (<0.05), then fixed effects are more reliable.

In table 3 of the Appendix, we can view the results of the Hausman Test. At the top of the table, a summary of the results is provided. As we notice, the p-value is zero which means that **fixed effects are preferred** because they approach more the real relationship of the regressor with its regressands. The next part of output reveals additional details, showing the coefficient estimates from both the random and fixed effects estimators, along with the variance of their difference. It also contains the associated p-values for the hypothesis that there is no difference. From the table content we conclude that there are specific variables in which we can see a notable variance of difference in the coefficient estimates such as the dummy variables of our model. However, there are some coefficients that present no variation in differences between them such us the coefficients of the variables of liquidity and corporate-treasury spread.

2.1.3 Fama-MacBeth Cross-Sectional Regression Test

Fama-MacBeth regression is a premium estimation model. It estimates the premium with which an investor should be rewarded for exposing himself to a particular risk factor in the market.

Many asset pricing models such as the capital asset pricing model (CAPM) and the arbitrage pricing theory (APT) pose the excess return of an asset as follows:

$$R=\beta\gamma$$

where R: Excess Return

b: vector of factors affecting excess returns

γ: vector of excess returns for each of the risk factors

We assume that an investor has n bonds which in T periods offer to him excess return $R_{i,t}$.

Firstly, we would like to be aware if some specific factors denoted as $F_{1,t}$, $F_{2,t}$,.... $F_{m,t}$ explain the excess return of the bonds. To test that, we perform a set of regressions that are equal in number to the number of the bonds. In other words, we perform time series regressions of each bond on the risk factors. In this way, we determine the bonds' beta for that risk factors.

$$R_{1,t} = \alpha_1 + \beta_{1,F1} F_{1,t} + \beta_{1,F2} F_{2,t} + \ldots\ldots\ldots + \beta_{1,Fm} F_{m,t} + \varepsilon_{1,t}$$

$$R_{2,t} = \alpha_2 + \beta_{2,F1} F_{1,t} + \beta_{2,F2} F_{2,t} + \ldots\ldots\ldots + \beta_{2,Fm} F_{m,t} + \varepsilon_{2,t}$$

$$R_{n,t} = \alpha_n + \beta_{n,F1} F_{1,t} + \beta_{n,F2} F_{2,t} + \ldots\ldots\ldots + \beta_{n,Fm} F_{m,t} + \varepsilon_{n,t}$$

However, the above regressions can not inform us of the premium rewarded to the investor for his exposure to each of the factors. This information will come from the second stage of Fama MacBeth regression model.

In the second part, since we have collected all the betas ($\hat{\beta}_{i,Fk}$) of each bond, we calculate the factor premiums for each of the factors. As $\hat{\beta}$ we define the empirically estimated factor loading while β is the true and unobservable factor. In order the premiums for each factor to be calculated we run a number of cross-sectional regressions as follows:

$$R_{i,1} = \alpha_1 + \gamma_{1,1}\,\hat{\beta}_{i,F1} + \gamma_{2,1}\,\hat{\beta}_{i,F2} + \dots\dots\dots + \gamma_{m,1}\,\hat{\beta}_{i,Fm} + e_1$$

$$R_{i,2} = \alpha_2 + \gamma_{1,2}\,\hat{\beta}_{i,F1} + \gamma_{2,2}\,\hat{\beta}_{i,F2} + \dots\dots\dots + \gamma_{m,2}\,\hat{\beta}_{i,Fm} + e_2$$

$$R_{i,T} = \alpha_1 + \gamma_{1,T}\,\hat{\beta}_{i,F1} + \gamma_{2,T}\,\hat{\beta}_{i,F2} + \dots\dots\dots + \gamma_{m,T}\,\hat{\beta}_{i,Fm} + e_T$$

In our research, we performed the steps of Fama-MacBeth model in order to investigate the contribution of a number of bond and non bond specific factors in the corporate bonds' realized excess returns (Appendix: Table 4). Multiple regressions are computed, one for each day with systemic factors, coupon and par outstanding as independent variables.

2.1.4 Liquidity in the Role of the Regressand

In this part of the research, we examine if our liquidity measure depends on the systematic and unsystematic factors that were used in the previous regressions. We want to identify if this measure rather than liquidity incorporates other information too. The form of the equation is:

$$\textit{Liquidity Score}_{it} = \alpha_i + \beta_1 \textit{Coupon}_{it} + \beta_2 \textit{Maturity}_{it} + \beta_3 \textit{Sector}_{it} + \beta_4 \textit{Rating}_{it} + \beta_5 \textit{Seniority}_{it} + \beta_6 \textit{Par Outstanding}_{it} + \beta_7 \textit{Security}_{it} + \beta_8 \textit{Z-Spread}_{it} + u_{it}$$

From the results of the regression (Appendix: Table 5) we observe that R squared is 37.47% which means that the variation of the liquidity score is explained by the independent variables by 37.47%. From the p-value test and test statistics it is apparent that there are some independent variables that are statistically significant and others with no notable importance. After regressing the liquidity score with the risk factors our equation has the following form:

Liquidity Score = - 0.003112 - 0. 0012344Coupon + 0.0078377Maturity(1-3years) + 0.0158364Maturity(3-5years) + 0.0266846Maturity(5-7years) + 0.013486Maturity (10+) -0.0180315 Financial Sector+ 0.0081377 Other BroadSector - 0.010688Rating(AA) - 0.0192896 Rating(AAA) + 0.0011806 Rating(BBB) - 0.0058027Senior Seniority - 0.0041619Pfd Seniority + 0.0205067Par Outstanding + 0.0234308Secured + 0.0010394Z-Spread

Taking a glance at each of the variables separately we can make the following remarks:

The **Sectors** of corporate bonds which are contained in the regression model as a dummy variables are statistically significant since their p-value=0<0.05. To the same conclusion we can reach by noticing the t statistic of this variable which is higher than 1.96 (95% confidence level). **Financial Sector** is negatively correlated with liquidity. The rest broad-sectors are incorporated in the variable "**Other BroadSector**" and as we notice they affect positively the corporate bond liquidity.

Moreover, **Maturities** are all statistically significant as their p-values tend to zero and have a positive correlation with liquidity scores. For instance the coefficient of the maturity in 1-3 years is +0.0078while that of the maturity in 10 and more years is +0.0134.

Ratings are also variables of statistical importance except for BBB rating which has a p-value 0.495>0.05. They are negatively correlated with liquidity since their coefficients are almost equal to +0.01 (for AA rating) and +0.02 (for AAA rating).

In addition, **Security** of corporate bonds is also significant since its p-value is zero. The relationship of liquidity and security of bond is positive since the correlation coefficient is +0.0234.

At last, liquidity incorporates also the information regarding the **Par Outstanding**. The relationship of these two variables is positive and we could state that the increase of par outstanding by 1 unit causes the increase of liquidity by +0.02 units.

Conclusion

In this study we provide evidence on the role of several risk factors in the realized excess returns of corporate bonds. We have used a long-span sample composed of daily data that contained corporate bonds of high liquidity independently of their time to maturities, ratings or seniority. This study extends the work of Chen, Lesmond and Wei in 2007, Fama and French in 1993 and Gebhardt, Hvidkjaer, and Swaminathan in 2003. It sets new light to the relationship of marketwide liquidity and corporate-treasury spread with the premia of corporate bonds as well as to the information that marketwide liquidity incorporates. In order to succeed that, apart from the systemic risk factors, the study also includes bond specific characteristics so that all the potential effects on the corporate bonds' returns to be captured.

The results show that corporate bond returns are affected by several risk factors. One of these factors is corporate-treasury spread which accounts for a significant portion of corporate bond risk premium. The positive relationship of these two variables was expected since the higher the spread is the greater risk an investor undertakes and as a result the return should be higher as a compensation for the extra risk. Additionally, another significant finding of the research is the positive and economically significant relationship of the excess returns and liquidity risk. Although this is not an expected result, as we considered that the existence of illiquidity would offer higher returns to the investors, we can attribute this opposite result to the fact that expected excess returns are not always identical to realized excess returns. Many times, there are several factors that make these two elements differ. Furthermore, we find that corporate bond premia are positively related to secured bonds. This is an other non-expected result because as theory suggests the secured bonds since they contain a pledge on an asset are considered to be more safe and as a result they are thought to provide lower returns. This theory is not approved by this specific study. In contrast, ratings do not tend to affect the corporate bonds' excess returns except for BBB rating which is positively related to them. Last but not least, maturities have their own impact in the bonds' premia. Both short term and long term bonds are negatively related to them.

As it is obvious from the results, market-wide liquidity has a greater impact than the corporate-treasury yield spread on bonds' premia while these two systematic risk factors have the same statistical significance. Furthermore, comparing their effect with the effect of bond specific factors we could point out that all the systemic risk factors and a number of bond characteristics such as security and maturity are important determinants of bond returns.

One direction for future research is the exploration of the factors that have an influence on the excess returns of other financial markets. Furthermore, a future research could use an expanded set of both bond specific and non bond specific variables which might provide additional information content about the impact on corporate bond premia.

Results strongly suggest that liquidity risk and corporate-treasury spread are important determinants of the corporate bond excess returns. In addition, the security of bonds and their maturities play their own role in the configuration of the corporate bond premia. Potential investors should be informed of the economic environment and ,taking into account the empirical results of the study, to formulate the analogous investment behaviour.

APPENDIX

Table 1: Fixed Time Effects Regression

Linear regression, absorbing indicators

Number of obs	=	955322
F(16, 954996)	=	16.37
Prob > F	=	0.0000
R-squared	=	0.0263
Adj R-squared	=	0.0260
Root MSE	=	0.9869

z2ExcessReturn	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
z2Coupon	-.0006814	.0010174	-0.67	0.503	-.0026754	.0013126
z2ParOutstanding	.0028662	.0010111	2.83	0.005	.0008846	.0048479
z2LiquidityScore	.0104546	.0012769	8.19	0.000	.007952	.0129573
z2z_spread_treasury	.0079391	.0014143	5.61	0.000	.0051672	.0107109
Senior_Seniority	-.0042756	.0055291	-0.77	0.439	-.0151125	.0065613
Pfd_Seniority	-.0198903	.0157476	-1.26	0.207	-.0507551	.0109746
Secured	.0166844	.0048009	3.48	0.001	.0072748	.0260941
BBB	.0101906	.0021759	4.68	0.000	.005926	.0144553
AAA	.0034442	.0113726	0.30	0.762	-.0188457	.0257341
AA	-.0005469	.0042932	-0.13	0.899	-.0089614	.0078676
five_to_seven	-.0205541	.0036111	-5.69	0.000	-.0276317	-.0134765
three_to_five	-.0311824	.0033777	-9.23	0.000	-.0378026	-.0245622
one_to_three	-.0263606	.0031761	-8.30	0.000	-.0325856	-.0201356
ten_plus	-.0210344	.0030863	-6.82	0.000	-.0270834	-.0149854
Other_BroadSector	-.0149306	.9870612	-0.02	0.988	-1.949537	1.919676
Financials	-.0035587	.0027127	-1.31	0.190	-.0088755	.0017581
_cons	.0189943	.0062748	3.03	0.002	.006696	.0312927
daily	F(309, 954996) =		67.512	0.000	(310 categories)	

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Table 1: Fixed Time Effects Regression: *This table shows the impact of the variables of our model through time. The variables: Liquidity Score, Corporate_treasury Spread, Par Outstanding, Coupon were standardized since they had been on different scales. In this way, each of the variables has a mean equal to 0 and a standard deviation equal to 1.*

Table 2: Random Effects Regression

Random-effects GLS regression — Number of obs = 955322
Group variable: code — Number of groups = 4364

R-sq: within = 0.0042 — Obs per group: min = 1
between = 0.1693 — avg = 218.9
overall = 0.0051 — max = 310

Wald chi2(16) = 4829.63
corr(u_i, X) = 0 (assumed) — Prob > chi2 = 0.0000

z2ExcessReturn	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
z2Coupon	-.0016268	.0011371	-1.43	0.153	-.0038555	.0006019
z2z_spread_treasury	.0266761	.0010492	25.42	0.000	.0246196	.0287325
z2ParOutstanding	.0027227	.0010244	2.66	0.008	.0007149	.0047305
z2LiquidityScore	.0586178	.0010498	55.84	0.000	.0565603	.0606753
Senior_Seniority	-.0003578	.0061836	-0.06	0.954	-.0124775	.0117619
Pfd_Seniority	-.0264545	.0174273	-1.52	0.129	-.0606114	.0077024
Secured	.0117742	.0053293	2.21	0.027	.001329	.0222195
BBB	.0116799	.0024084	4.85	0.000	.0069596	.0164001
AAA	.0022305	.012743	0.18	0.861	-.0227454	.0272063
AA	.0005976	.0047205	0.13	0.899	-.0086544	.0098496
five_to_seven	-.0250376	.0039207	-6.39	0.000	-.0327219	-.0173532
three_to_five	-.0338163	.0036993	-9.14	0.000	-.0410668	-.0265659
one_to_three	-.0290858	.0034958	-8.32	0.000	-.0359375	-.022234
ten_plus	-.0241444	.0034202	-7.06	0.000	-.0308478	-.017441
Other_BroadSector	-.0308692	.9975014	-0.03	0.975	-1.985936	1.924198
Financials	-.0018828	.0030311	-0.62	0.534	-.0078236	.004058
_cons	.0174787	.0069949	2.50	0.012	.003769	.0311885
sigma_u	.02871811					
sigma_e	.99573853					
rho	.00083111	(fraction of variance due to u_i)				

Table 2: Random Effects Regression: *This table shows the sensitivity of excess returns to each of the factors provided that there may exist variables that are omitted in the model. We observe that the results are similar to those of the fixed time effects regression.*

Table 3: Hausman Test

Correlated Random Effects - Hausman Test
Equation: RANDOM_EFFECTS
Test period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Period random	164.937410	16	0.0000

Period random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
(FLAGBROADSECTOR="Non_Financi...	10431890...	102707630...	330525552...	0.0000
(FLAGBROADSECTOR="Other")	-3333577...	-35141340...	462599669...	0.7906
(FLAGRATING="AA")	-1603156...	-14995773...	191907914...	0.0181
(FLAGRATING="AAA")	10096405...	100257397...	312705254...	0.2063
(FLAGRATING="BBB")	29872719...	299048444...	355307379...	0.0883
(FLAGMATURITY="10+")	15613059...	156611450...	388886703...	0.0148
(FLAGMATURITY="3_5")	-1413468...	-14020237...	393160183...	0.0000
(FLAGMATURITY="5_7")	17021222...	169354127...	157580513...	0.0306
(FLAGMATURITY="7_10")	77273317...	775765140...	107832397...	0.0000
(FLAGSECURED="Yes")	48908746...	484910320...	222639999...	0.0000
(FLAGSENIORITY="Senior")	45772769...	466439756...	246329226...	0.0000
(FLAGSENIORITY="Sub")	58306282...	588540001...	147580445...	0.0000
COUPON	-8263655...	-85828631...	179493726...	0.0000
PAROUTSTANDING	0.000000	0.000000	0.000000	0.1011
LIQUIDITYSCORE	0.000000	0.000000	0.000000	0.0000
Z_SPREAD_TREASURY_	0.000074	0.000084	0.000000	0.0000

Table 3: Hausman Test: *In this table Hausman test is being performed so that the most trustworthy regression to be chosen. From the results of the test we conclude that fixed time effects are more suitable to our sample.*

Table 4: Fama Macbeth Regression

Fama-MacBeth (1973) Two-Step procedure

Number of obs	=	955322
Num. time periods	=	310
F(4, 309)	=	2.45
Prob > F	=	0.0464
avg. R-squared	=	0.0029

z2ExcessReturn	Coef.	Fama-MacBeth Std. Err.	t	P>|t|	[95% Conf.	Interval]
z2LiquidityScore	.0138902	.009269	1.50	0.135	-.0043481	.0321286
z2z_spread_treasury	-.0201829	.0235238	-0.86	0.392	-.0664701	.0261043
z2ParOutstanding	-4039.822	1647.563	-2.45	0.015	-7281.683	-797.9602
z2Coupon	-.0003276	.0016429	-0.20	0.842	-.0035602	.0029051
_cons	-34.46608	14.05525	-2.45	0.015	-62.12217	-6.809978

Table 4: Fama Macbeth Regression: *The table shows the results of Fama Macbeth regression.*

Table 5: Liquidity in the role of the regressand

Linear regression, absorbing indicators

Number of obs	=	955322
F(15, 954997)	=	20.21
Prob > F	=	0.0000
R-squared	=	0.3747
Adj R-squared	=	0.3745
Root MSE	=	0.7909

z2LiquidityScore	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
Financials	-.0180315	.0021403	-8.42	0.000	-.0222264	-.0138365
Other_BroadSector	.0081377	.0021936	3.71	0.000	.0038383	.0124372
ten_plus	.0134865	.0024955	5.40	0.000	.0085954	.0183776
one_to_three	.0078377	.0024859	3.15	0.002	.0029653	.01271
three_to_five	.0158364	.0027925	5.67	0.000	.0103633	.0213095
five_to_seven	.0266846	.0029775	8.96	0.000	.0208488	.0325204
AA	-.010688	.0032917	-3.25	0.001	-.0171397	-.0042363
AAA	-.0192896	.007851	-2.46	0.014	-.0346773	-.003902
BBB	.0011806	.0017303	0.68	0.495	-.0022108	.004572
Secured	.0234308	.0037673	6.22	0.000	.016047	.0308145
Pfd_Seniority	-.0041619	.0088787	-0.47	0.639	-.0215638	.01324
Senior_Seniority	-.0058027	.0041121	-1.41	0.158	-.0138624	.0022569
z2ParOutstanding	.0205067	.0047991	4.27	0.000	.0111006	.0299128
z2z_spread_treasury	.0010394	.0035612	0.29	0.770	-.0059404	.0080193
z2Coupon	-.0012344	.0007639	-1.62	0.106	-.0027317	.0002629
_cons	-.003112	.0048204	-0.65	0.519	-.0125597	.0063358
daily	absorbed					(310 categories)

Table 5: *Liquidity in the role of the regressand: In this table the information incorporated in market wide liquidity are being explored. There are several variables that are found to be statistically significant such as the Financial Sector, Maturities, AA and AAA ratings, Security and Par Outstanding (p-value<0.05).*

Table 6: Dummy Variables

FlagBroadSector	Freq.	Percent	Cum.
Financials	219,031	22.93	22.93
Non_Financials	736,291	77.07	100.00
Other	1	0.00	100.00
Total	955,323	100.00	

FlagMaturity	Freq.	Percent	Cum.
10+	254,761	26.67	26.67
1_3	224,626	23.51	50.18
3_5	169,059	17.70	67.88
5_7	130,434	13.65	81.53
7_10	176,442	18.47	100.00
Total	955,322	100.00	

FlagRating	Freq.	Percent	Cum.
A	387,346	40.55	40.55
AA	62,484	6.54	47.09
AAA	7,741	0.81	47.90
BBB	497,751	52.10	100.00
Total	955,322	100.00	

FlagSecured	Freq.	Percent	Cum.
No	908,136	95.06	95.06
Yes	47,186	4.94	100.00
Total	955,322	100.00	

FlagSeniority	Freq.	Percent	Cum.
Pfd	4,436	0.46	0.46
Senior	911,552	95.42	95.88
Sub	39,334	4.12	100.00
Total	955,322	100.00	

Table 6: Dummy Variables: *These tables show the portion of each dummy variable in the sample. In the first columns there are the frequencies of each of the variables and in the next column the relevant percentages.*

Picture 1 : Distribution of Corporate bonds depending on the Sector

Corporate: top sectors	
Sector	**Market share**
Financial Services	36%
Energy	24%
Basic Materials	9%
Consumer Goods	5%
Retailing	5%
Media	4%
Construction	3%
Telecoms	3%
Property	3%
Leisure	2%
Other	2%
Total	**100%**

Picture 1 : Distribution of Corporate bonds depending on the Sector: *The picture shows the real distribution of corporate bonds in sectors at a global level. (Article published in 31/08/11, Picture sourced by Creditflux)*

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