Common factors in the performance of European corporate bonds – evidence before and after financial crisis

Wolfgang Aussenegg[(a)*], Lukas Goetz[(b)], and Ranko Jelic[(c)]

[(a)] Department of Finance and Corporate Control, Vienna University of Technology
Address: Theresianumgasse 27, A-1040 Vienna, Austria
E-mail: waussen@pop.tuwien.ac.at, Phone: +43 1 58801 33082
Fax: +43 1 58801 33098

[(b)] UNIQA Finanz-Service GmbH
Address: Untere Donaustraße 21, A-1029 Vienna, Austria
E-mail: lukas.goetz@uniqa.at, Phone: +43 1 211 75 2012

[(c)] Department of Accounting and Finance, University of Birmingham
Address: Birmingham, B15 2TT, United Kingdom
E-mail: r.jelic@bham.ac.uk, Phone: +44 (0) 121 414 5990
Fax: +44 (0)121 414 6238

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*Corresponding author

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Abstract

This paper examines common risk factors in Euro-denominated corporate bond returns before and after recent financial crisis. Our results suggest that level and slope of interest rate and default spread term structures significantly improve the explanatory power of asset pricing models for the cross-section of corporate bonds. Further, we demonstrate that corporate bonds with maturities between one and three years continue to yield statistically significant abnormal returns even after controlling for the levels and slopes of interest and default spread term structures. The abnormal returns are up to 151 basis points annually for these short term bonds and are thus of considerable economic interest. The sensitivity of corporate bond returns to interest rate level and slope risk is quite stable over time, whereas the sensitivity to level and slope default risk factors changed during the period of recent financial crisis. Our results are robust to GRS-test, calendar seasonality, and use of alternative risk-free benchmarks.

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1. Introduction

In the wake of the complete liberalization of capital transactions and the subsequent introduction of a single common currency, the European financial system has experienced an unprecedented transformation, most notably impacting the corporate bond market. The monetary unification and elimination of foreign exchange risks created an integrated pan-European bond market that provided an important alternative to traditional bank loans. In late 1990s, the deregulation of important sectors of the European economy (e.g. telecommunication and energy) fueled enormous borrowing requirements by the multinational groups to finance investments and acquisitions. At the same time, bank loans became more expensive due to tighter regulation of European banks. On the demand side, the further integration of European markets lead to abolishment of regulatory obstacles that prohibited many institutional investors like pension funds and insurance companies to direct their funds into foreign jurisdictions. More recently, the slump in the stock market and the development of new financial instruments, such as Exchange Traded Funds (ETF), provided further impetus for the surge of investment flows towards the corporate bond market.[1] The above mentioned developments resulted in the corporate bond market amounting to 55% of the total Eurozone GDP in early 2010, compared to only 6% in 1999.[2] In spite of the phenomenal growth and importance of this asset class, there is still a paucity of research on European corporate bonds.

The purpose of this study is to shed more light on the European corporate bond market by examining common risk factors governing the returns of these securities. We extend Fama and French (1993) model by introducing two additional explanatory variables and by focusing on the relatively young Euro-denominated bond market. We study the performance before and after financial crisis and shed more light on determinants of the performance after financial crisis. To the best of our knowledge, this is the first study to analyze the overall performance of a wide range of duration and rating-grouped corporate bond indices, including debt issues with maturity of one to three years. Usually, these maturities are either not available in databases or blended in a broader maturity bracket, most often within a maturity range of one to

[1] Publicly traded mutual funds (i.e. ETFs) experienced tremendous growth in recent years. For example, globally they have grown by 45.2% in 2009 with total investments of more than $1 trillion at the end of the same year (Blackrock, 2010). Within the entire asset class, fixed income ETFs had the highest rate of growth in 2010 (see Cummans, 2010).
[2] For comparison, US corporate bonds reached approximately 100% of the GDP in the first quarter of 2010. The figures are based on the quarterly statistics of the Bank for International Settlements (BIS) and include both industrials and financials (BIS, 2011).

five years. In a novel approach we incorporate the dynamics of the complete interest rate and default spread term structures instead of arbitrarily chosen maturities. By resorting to the method of Principal Component Analysis (PCA) we are able to fit a parsimonious and orthogonal representation of risk factors and facilitate a better understanding of the risk aspects inherent in corporate bonds. We also contribute to the ongoing discussion about abnormal returns for short dated bonds (see Pilotte and Sterbenz, 2006, and Derwall et al., 2009).

Our main findings can be summarized as follows: (i) Incorporating slope and level factors of the respective interest and default spread term structures dramatically improves the explanatory power of Fama and French (1993) two-factor asset pricing model; (ii) Common risk factors of the two-factor model are not able to price bonds with short maturities well enough, essentially underestimating their performance and leaving a significant portion of the cross-sectional return variation unexplained; (iii) In line with previous studies, we cannot find evidence that lower-rated bonds compensate investors with significantly higher returns compared to debt securities with superior credit quality; (iv) Our four-factor model depicts changes to sensitivity of returns to the default risk factors, after financial crisis in 2007; (v) The above results are robust to GRS test, calendar seasonality, and alternative risk-free benchmarks.

Our results provide important insights for performance evaluation, asset allocation, measurement of the cost of debt and adequate pricing of new bond issuances. For example, our findings help private investors to better understand the underlying risks of bond indices and bond ETFs, securities which provide the easiest access to corporate bond asset class. Furthermore, the results suggest that cost of debt could be estimated more accurately based on both levels and slopes of complete interest rate and default spread term structures.

The remainder of this paper proceeds as follows: Section 2 briefly reviews the relevant literature and motivates our hypotheses. Section 3 describes the main characteristics of our data and sample selection. Section 4 deals with methodology. The results are presented in section 5. Section 6 examines robustness of our results. Finally, section 7 sums up and concludes.

2. Literature and hypotheses

Fama and French (1993) advocate a two-factor model for bond returns, incorporating one term and one default factor. They also report that lower rated corporate bonds do not compensate investors with significantly higher returns in relation to bonds of superior credit quality. Following Fama and French, several improvements to the two-factor model have been proposed. For example, Elton et al. (1995) test a model that incorporates a premium associated with unexpected inflation changes and economic growth.[3] Elton et al. (2001) propose a model that incorporates state tax effects and an alternative specification for the default risk proxy. More recently, Gabbi and Sironi (2005) argue that the credit rating is the main determinant in the pricing of corporate bonds. Gebhardt et al. (2005) conclude that interest and default factors as well as individual bond characteristics like duration and rating-class are important determinants in the performance of corporate bonds. Duffee (1998) reports importance of a slope factor of the interest rate curve, defined as the performance difference between a 30 year Treasury bond and the 3 month Libor rate. The importance of the slope factor is more pronounced for securities of lower credit quality.[4] Overall, the above evidence suggests that a small set of carefully selected factors, incorporating term and default risk, are capable of explaining the cross-sectional performance of US corporate bond returns fairly well.[5] We anticipate that this proposition also holds in the more fragmented and hence, clearly more heterogeneous market for European corporate bonds, and, hence, specify our first testable hypothesis:

Hypothesis 1: Only a few risk factors are sufficient to explain the common movement of European corporate bond returns.

Whilst previous studies rely on arbitrarily chosen term structure risk factors, we conjecture that incorporating the dynamics of the complete term structure movements, in the form of level and slope factors, should contribute to improve the quality of the model. Thus, in a new approach we incorporate the dynamics of the complete interest rate and default spread term

[3] However, the explanatory power is only marginally improved compared to the original Fama and French specification.

[4] Similarly, in one of rare studies for European corporate bonds, Houweling et al. (2002) suggest that the slope factor (defined as the return-differential of baskets of long-dated bonds and securities with a short maturity) helps explaining excess returns of European local currency bond portfolios with different credit quality.

[5] This is also evident from the results of studies on the performance of bond mutual funds. See, for example, Blake et al. (1993), Kahn and Rudd (1995), Gallo et al. (1997), Detzler (1999), Ferson et al. (2006), Gallager and Jarnecic (2002), or Maag and Zimmerman (2000). The only studies that explicitly address corporate bond funds are Silva et al. (2003) and Dietze et al. (2009).

structure instead of arbitrarily chosen maturities. Since each term structure is the manifestation of expectations regarding yield curve movements, extracting as much information as possible is highly desirable in order to specify a proper pricing model. Our second hypothesis is therefore:

Hypothesis 2: Incorporating the dynamics of the complete interest rate and the default spread term structure significantly improves factor models' explanatory power.

The previous bond performance literature documented several performance anomalies.[6] Particularly relevant to our study is the recently debated short maturity anomaly for debt securities. This phenomenon refers to the observation that a substantial part of the performance of bonds with short maturities cannot be explained by various risk premiums associated with market, interest, credit, and liquidity risks. Pilotte and Sterbenz (2006), for example, show that US Treasury bills exhibit abnormally high Sharpe ratios and come to the conclusion that equilibrium models fail to describe the performance of corporate bonds with short maturities. Similarly, Zwart (2008) and Derwal et al. (2009) argue that common risk factors underestimate the total return of short dated corporate bonds even after controlling for short selling restrictions and transaction costs. To the best of our knowledge there were no previous studies on the above anomalies in the European corporate bond market. We conjecture that this anomaly is not unique to the US and anticipate comparable results for the European corporate bond market. This leads to hypothesis three:

Hypothesis 3: Short maturity bonds exhibit abnormal returns that fail to be captured by conventional risk factors.

The recent financial crisis has resulted in an unprecedented increase in credit risk in the European market. For example, Aussenegg et al. (2011) show that asset swap credit spreads started increasing in the European market around June 2007.[7] They then tripled during the next 3 quarters (from third quarter 2007 to first quarter of 2008) and remain stable during the second quarter of 2008. Finally, during so-called Lehman crisis (third and fourth quarter of 2008) they tripled again. The financial crisis has also radically changed the Euro sovereign bond

[6] See Nippani and Arize (2008) and Bessembinder et al. (2009) for excellent overviews regarding documented anomalies in the bond market.
[7] Empirical evidence suggests that ASW spreads tend to reveal information about credit risk more efficiently than CDS spreads (Gomes, 2010).

markets. Before the crisis, the risk associated with euro sovereign bond indices was low and almost entirely related to expectations about interest rates. During the crisis, the risk rose by approximately 30% mostly due to the increase in credit spread levels and volatility (Nomura, 2011). Consequently, sovereign bonds from peripheral EU countries such as Belgium, Greece, Italy, Ireland, Portugal, and Spain have become more akin to corporate bonds.

Aretz and Pope (2011) highlight the importance of examining common factors in default risk during sample periods that include periods of economic crisis. Same authors report increasing importance of global risk factors (as opposed to country-specific factors) during the 2008-09 credit crunch. We hypothesize that the increase in general level of credit risk together with the changing nature of risk has contributed to changes in sensitivity to risk factors after the recent financial crisis. In particular, we expect relatively higher importance of default risk factors, compared to the pre-crisis period. Thus,

Hypothesis 4: Corporate bonds' sensitivity to risk factors changed after recent financial crisis.

3. Data and sample selection

The sample of European corporate bond indices used in our paper originates from the Markit iBoxx fixed income database.[8] To pass the tightly controlled consolidation process established by Markit, bonds need to be investment grade rated, have fixed coupons, and a minimum amount outstanding of at least € 500 million. Further, actively quoted prices have to be available from several brokers and securities with a maturity of less than one year are excluded.[9] Based on the data of underlying bonds market capitalization, weighted indices are constructed by Markit within the database. Monthly rebalancing ensures that the provided benchmarks objectively reflect the European bond market.

[8] Markit is the premier fixed income data provider serving financial market practitioners to establish benchmarks that are indispensable for asset allocation and performance evaluation. Its database contains: month-end prices, duration, time to maturity, and further specific bond characteristics. Rigorous quality controls to filter erroneous and stale prices makes it the most reliable and best database currently available for European corporate bonds. For further details see Markit (2008).

[9] The main reason for the exclusion of bonds with maturity less than one year is low liquidity and potential pricing errors.

We focus on the monthly total excess return data of 23 rating and duration matched broad Euro-denominated iBoxx corporate bond indices. Our sample covers the period from September, 30^{th}, 2003 to February, 28^{th}, 2011, consisting of 90 monthly observations.[10] All bond indices are generated by Markit based on the total performance of individual bonds included in the corresponding bond index. The total performance is defined as monthly bond price changes plus monthly accrued interests plus monthly coupon payments. Total excess returns of a particular bond index for month t are obtained by subtracting the one month Euribor rate of the end of the previous month from the total corporate bond index return of month t.[11]

The evolution of the European corporate bond market, during the sample period, is illustrated in Figure 1. The sample period is characterized by a dynamic growth in the outstanding amount of Euro-denominated corporate debt. The market experienced an increase from €546.9 billion at the end of September 2003 to €1246.1 billion by the end of February 2011. In the first 45 months the volume increased by 32% (or 7.7% p.a.) to €722.3 billion. The shortage of available funding from financial institutions during the financial crisis forced firms to enter the corporate bond market. For example, from June 2007 to the end of 2009, the notional volume increased at an annual growth rate of 21.8% (see Figure 1).

*** Insert Figure1 about here ***

Table 1 provides descriptive statistics for all 23 European bond indices. They consist of five maturity brackets (from 1-3 years till over 10 years maturity) and three rating classes (AA, A, BBB). As Table 1 reveals, the two corporate bond indices with the shortest time to maturity (Corproates 1-3 and 3-5 years) exhibit the highest notional volume. This applies to the composite indices and also to each of the three rating classes. In contrast, the size of the group of corporate bonds with a maturity of more than 10 years (Corporates 10Y+) is significantly smaller. As the fourth column reveals, the average remaining time to maturity of each index falls in the middle of the respective maturity-bracket. A Jarque-Bera test rejects the null hypothesis of a normal distribution at the 5% level (or better) for all 23 bond indices.

[10] The method employed for the calculation of Markit iBoxx indices conforms to the EFFAS-Standards. For further information and a detailed overview see Brown (2002).
[11] The 1 month Euribor rate is measured at the end of the previous month since it is the rate of return for the current period.

*** Insert Table 1 about here ***

The mean (median) monthly excess return is highest for Corporate 10+ bonds (25 (64) basis points) and lowest for short-dated bonds (Corporates 1-3Y, 12 (7) basis points), but the difference is not statistically significant (see Panel B of Table 1). In addition, the excess returns of the three rating classes do not differ significantly (see Panel B of Table 1). This observation for the European corporate bond market is in line with the US evidence. For example, Fama and French (1993) find little evidence that lower rated US-bonds yield significantly higher returns than debt securities that are superior in terms of credit quality

4. Methodology

We start our analysis by constructing proxies for the interest rate and default risk inherent in corporate bonds (hypothesis 1). Both proxies are based on zero-investment portfolios as in Fama and French (1993).

$$\Delta \text{Bond Index}_{t,k} = \alpha + \beta_{1,k} \cdot \text{TERM}_t + \beta_{2,k} \cdot \text{DEF}_t + \varepsilon_t \tag{1}$$

where ΔBond $\text{Index}_{t,k}$ is the excess return of the corresponding bond index k in month t, TERM_t represents a term risk premium, defined as the return difference of long-term government bonds with a maturity of 10+ years and the one month Euribor rate of the previous month. DEF_t proxies for default risk and is based on the return difference between long-term corporate bonds (the Corporate Composite index), with an average maturity of 8.5 years, and the maturity matched Euro zone Sovereign bond index.[12]

We then introduce a novel approach to incorporate the dynamics of the complete interest rate and default spread term structure instead of using arbitrarily chosen maturities. First, we construct proxies for interest rate and default risk. The proxy for the interest rate risk is the difference between the monthly return of government bonds and the one-month risk-free rate of the previous month. The proxy of the default risk is the difference between the return of corporate

[12] The Corporate Composite bond index and the Euro zone Sovereign bond index are both from Markit.

bonds and the return of maturity-matched government bonds.[13] The above proxies are constructed for the complete interest rate and default spread term structure. Thus, we utilize the complete set of available maturities of Euro zone Sovereign bonds and calculate the excess return over the 1M Euribor of the previous month.[14] Likewise, a default spread term structure is created by forming zero-investment portfolios based on the difference between European corporate bonds of the complete maturity spectrum and maturity matched Euro zone Sovereign bonds. Second, in order to extract the level and the slope of interest rate and default risk factor, from the above constructed proxies, we employ a principal component analysis (PCA).[15] We then fit and examine parsimonious and orthogonal representations of the risk factors in order to examine further determinants of the sample bonds' performance.

The extracted risk factors from the interest rate and default spread term structures are exhibited in Figure 2. We find that the level and the slope factors, together, explain 98.7% and 98.2% of the total variation of the respective term structures (see Figure 2).[16] Both, the interest as well as the default spread level factors have similar loadings to the first principal component across all maturities. This factor is more important for the default spread risk where it explains 91.8% of the total variation compared to the interest rate risk with 87.3% (see dark solid lines in Figure 2). The second common factor influences the slope of both term structures, as the loadings of the eigenvectors are a decreasing function of maturity. The slope factor (see grey dotted lines in Figure 2) is a more important determinant of interest rate than credit risk (explanatory powers of 11.4% and 6.4%, respectively).

*** Insert Figure 2 about here ***

[13] Both proxies are constructed in similar way in asset pricing literature (see Fama and French, 1993; Gebhart et al., 2005).
[14] More specifically, we are using portfolios that are based on the following maturity-based brackets: 1-3 years, 3-5 years, 5-7 years, 7-10 years, and finally more than 10 years to maturity.
[15] Principal component analysis (PCA) has first been employed in financial research to analyze the term structure of interest rates by Litterman and Scheinkman (1991). Recently, PCA has gained importance in a wide array of applications in finance such as portfolio style analysis of hedge funds (Fung and Hsieh, 1997), risk measurement and management (Golub and Tilman, 2000), modeling implied volatility smiles and skews (Alexander, 2001), portfolio optimization and optimal allocation (Amenc and Martellini, 2002), predicting movements of the implied volatility surface (Cont and da Fonseca, 2002), modeling term structure curves and seasonality in commodity markets (Tolmasky and Hindanov, 2002), calibration of the Libor Market model for pricing derivatives (Alexander, 2003), manipulation of the covariance matrix (Ledoit and Wolf, 2004), decomposing the joint structure of global yield curves (Novosyolov and Satchkov, 2008), or the co-movement of international equity market indices (Meric et al., 2008).
[16] Our results are similar to the results reported in Litterman and Scheinkman (1991) for US yield curves.

Based on the above results and the fact that changes of interest and default risks are the main determinants of bond returns, we conjecture that a model specified with the four orthogonal risk factors helps to explain the performance of the bond market indices (hypothesis 2).[17] The corresponding orthogonal model is:

$$\Delta\text{Composite}_t = \alpha + \beta_1 \cdot \Delta\text{IR\_Level}_t + \beta_2 \cdot \Delta\text{IR\_Slope}_t + \beta_3 \cdot \Delta\text{DS\_Level}_t + \beta_4 \cdot \Delta\text{DS\_Slope}_t + \varepsilon_t \tag{2}$$

where *ΔComposite*$_t$ is the excess return of the total bond market index over the 1 month Euribor rate in month t, *ΔIR_Level*$_t$ and *ΔIR_Slope*$_t$ are the PCA level and slope factors from the interest rate term structure, and *ΔDS_Level*$_t$ and *ΔDS_Slope*$_t$ are the PCA level and slope factors from the default spread term structure. This specification yields the following result for the total corporate bond index (test statistics in parenthesis):[18]

$$\begin{aligned}\Delta\text{Composite}_t = \underset{(0.56)}{0.000} + \underset{(61.75)}{0.315} \cdot \Delta\text{IR\_Level}_t + \underset{(29.52)}{0.330} \cdot \Delta\text{IR\_Slope}_t +& \\ \underset{(197.52)}{0.389} \cdot \Delta\text{DS\_Level}_t + \underset{(9.70)}{0.122} \cdot \Delta\text{DS\_Slope}_t + \varepsilon_t&\end{aligned} \tag{2a}$$

All four factors are highly significant and the intercept term is not statistically different from zero. The corresponding adjusted R^2 of 99.7% shows that this asset pricing model is suitable and, thus, captures the overall bond market dynamics extremely well.[19] For comparison purposes we specify a similar model for the overall bond market with the explanatory variables of the Fama and French (1993) model from equation (1). The adjusted R^2 of this model is 93.5% and is, therefore, missing a significant portion of the overall market dynamics. Based on the above result we establish the following orthogonal asset pricing model for each of the 23 sample bond indices:

[17] This broad bond market index contains all European corporate bonds included in the 23 maturity and rating class sub-indices.
[18] Standard errors are Newey-West corrected.
[19] To address potential multicollinearity of the two slope factors the model was tested with only one of these variables. The output however was very similar, hence it can be concluded that the high explanatory power of the fitted model is not due to a multicollinearity problem.

$$\Delta\text{Bond Index}_{t,k} = \alpha + \beta_{1,k} \cdot \Delta\text{IR\_Level}_t + \beta_{2,k} \cdot \Delta\text{IR\_Slope}_t + \beta_{3,k} \cdot \Delta\text{DS\_Level}_t + \beta_{4,k} \cdot \Delta\text{DS\_Slope}_t + \varepsilon_t \quad (3)$$

where *ΔBond Index$_{t,k}$* is the excess return of corporate bond index *k* at the intersection of rating and duration criterions for grouping single corporate bonds in month t.

Pilotte and Sterbenz (2006) and Derwall et al. (2009) independently find evidence of abnormally high returns in the performance of short maturity bonds for the US market. To complement previous research and to test for a potentially analogous anomaly for the European market (hypothesis 3) the following regression model is employed:

$$\Delta\text{Bond Index}_{t,k} = \alpha + \beta_{1,k} \cdot \Delta\text{IR\_Level}_t + \beta_{2,k} \cdot \Delta\text{IR\_Slope}_t + \beta_{3,k} \cdot \Delta\text{DS\_Level}_t + \beta_{4,k} \cdot \Delta\text{DS\_Slope}_t + \beta_{5,k} \cdot \text{SML}_t + \varepsilon_t \quad (4)$$

This model resembles the orthogonal model in equation 3, but is now augmented by SML_t, a zero investment portfolio (controlled for interest and default risk) consisting of a long position in bonds with a maturity of 1-3 years and a market value weighted short position of the remaining maturities. The construction of this portfolio is based on the sum of the intercept and residuals of equation 3, for the respective bond time-series, and serves as an orthogonalized maturity risk factor. This factor captures common variations not explained by the four orthogonal factors (ΔIR_Level_t, ΔIR_Slope_t, ΔDS_Level_t, and ΔDS_Slope_t) and, therefore, potentially may explains abnormal returns in short maturity bonds. In absence of an anomaly the factor loadings on variable SML_t are expected to be completely random and not statistical significantly different from zero.

5. Analysis of the performance of European corporate bonds

5.1 Results of alternative factor models

Table 2 (Panel A) presents descriptive statistics of the explanatory variables employed in the asset pricing models. Generally, due to the high degree of excess kurtosis in the majority of time-series, the Jarque-Bera test rejects the null hypothesis of a normal distribution for five out of seven risk factors. The correlation matrix of the traditional risk factors (TERM and DEF) and the four risk proxies extracted from the complete interest rate and default spread term structure (ΔIR_Level, ΔIR_Slope, ΔDS_Level, and ΔDS_Slope) is presented in Panel B of Table 2. The interest and default level-factors exhibit significant correlations with TERM and DEF (0.98). This provides a strong verification that our level-factors resemble traditional risk variables. More importantly, the slope factors convey additional information that is not captured otherwise. The SML factor has virtually no correlation to other risk variables. We, therefore, expect that the SML factor may explain potentially abnormal returns in bonds with short maturity (see Pilotte and Sterbenz, 2006, as well as Derwall et al. 2009).

*** Insert Table 2 about here ***

Results of our two-factor model (equation 1) are presented in Table 3. The results provide support for our hypothesis 1. The longer the maturity of bonds, the higher the sensitivity to changes in interest rates as documented by increasing coefficients for the bond indices Corporates 1-3 to Corporates 7-10. Likewise, default risk is an increasing function of maturity. The average adjusted R^2 is 80.0%, while the average standard error of all regressions exhibits a value of 0.56%. In addition, the short term corporate composite bond index with a maturity of one to three years exhibit a positive abnormal performance of 103 basis points p.a. In general, the Fama and French model performs less well for short term corporate bonds, with adjusted R^2 values ranging from 49.5% (Corporates BBB 1-3) to 76.5% (Corporates A 1-3). Overall, these results suggest, that the two proxies for the term and default risk are leaving a considerable variation in returns unexplained.[20]

*** Insert Table 3 about here ***

In Table 4 we present results of the orthogonal model specified in equation (3). The results show separate roles of level and slope factors in the term and default risk of corporate bonds, respectively. Notable, this specification seems to capture the cross-sectional variation in European corporate bond returns better than the two factor model does. The mean adjusted R^2,

[20] For example, Fama and French (1993) present results with a much higher adj. R^2 (>90 %) for US bonds.

for all 23 regressions, is 90.6% and thus higher than for the two factor model. Also, the average residual standard error, for all regressions, is only 0.38%, which is one third less than the value of the two-factor specification. Also the absolute values of AIC and SC increased in all 23 corporate bond portfolios from an average of 7.64 and 7.56 to 8.67 and 8.54, respectively. The above results lend support to our hypothesis 2.

The estimated regression coefficients for the interest rate and default spread level factors are positive and statistically significant and are, therefore, similar to TERM and DEF from Table 3. The performance of European corporate bonds is significantly related to the slope factor of both term structures (see Table 4). The estimated coefficients predominantly have positive signs. Short maturity bonds tend to have a considerably higher sensitivity to default spread slope changes compared to long dated bonds (Corporates 10+).

*** Insert Table 4 about here ***

Table 4 futher reveals that corporate bonds with a maturity of 1 to 3 years exhibit positive and significant intercept terms ranging from 0.031 to 0.126% (i.e. 37 to 151 basis points annually). To address the potential anomaly related to the superior performance of short term bonds (Pilotte and Sterbenz, 2006; Derwall et al., 2009) we extent our four factor model by the SML factor. SML is a zero investment portfolio consisting of a long position in the corporate bond 1-3Y index and a (value weighted) short position in all longer dated corporate bond indices. The corresponding results reported in Table 5 show the importance of this additional factor. First, SML has positive and statistically significant coefficients in all regressions for the one to three year maturity bracket.[21] Second, none of the intercept terms (apart from the Corporates A 7-10 bond index) is now significantly different from zero. Third, the explanatory power of the regressions is improved as documented by values of the adjusted R^2 and AIC criteria. This is especially the case for short-dated bonds. On average, the adjusted R^2 increased from 90.6 to 92.6% and for the short-dated Corporates 1-3 index from 90.7 to 99.6%.

*** Insert Table 5 about here ***

[21] Interestingly, the slope coefficients for SML are negative and statistically significant in some of the regressions for 7-10Y bracket.

Our findings suggest that after controlling for common risk factors, bonds with short maturities are preferred to longer dated bonds. The results, therefore, lend support to our hypothesis 3. Our results are also consistent with the results for the performance of US-Treasury bonds reported in Pilotte and Sterbenz (2006).

5.2 Common factors and financial crisis

In order to examine the determinants of performance before and after recent financial crisis, we divide our investigation period into two equally sized sub-periods of 45 month each. The first (pre-crisis) sub-period ranges from September, 30th, 2003 to May, 31st, 2007. The second (crisis) sub-period spans from June, 30th, 2007 till February, 28th, 2011.

Panel A of Table 6 compares the two factor model with TERM and DEF as only risk factors. In sub-period 1, all coefficients of the TERM parameter are significantly positive and are increasing with bond maturities. The same applies to DEF variable. No abnormal performance can be observed for short-dated bonds in the pre-crisis period. In sub-period 2, the coefficients of TERM and DEF are similar compared to sub-period 1. The only exception is the Corporates 10+ index for TERM (2.90 in sub-period 1 compared to 1.07 in sub-period 2). The results also show the short term corporate bond anomaly for Corporates 1-3 bonds (with an annualized outperformance of +238 basis points). The pre-crisis period exhibits lower average standard errors (0.246% vs. 0.491%). In addition, the pre-crisis period exhibits lower average adjusted R^2s (83.5% vs. 88.8%) and higher absolute AIC values (9.17 vs. 7.79) compared to the crisis period.

*** Insert Table 6 about here ***

In our orthogonal 4-Factor model, the explanatory power increases in both sub-periods (see Panel B of Table 6). This is in line with the observation already documented for the total period. Thus, the adjusted R^2 improves in sub-period 1 to a mean value of 98.1% and the standard error drops to a mean value of 0.049%. The average absolute AIC value increase to 12.6. The corresponding values for the crisis period are 97.9%, 0.176% and 9.8, respectively.

Whilst the coefficients of the two interest rate term structure factors (level and slope) are similar in both sub-periods, the default spread level factor has significantly higher coefficients in sub-period 2. The results suggest that the financial crisis, embedded in sub-period 2, has resulted in a higher importance of credit risk. The larger coefficients suggest that a similar (relative) change in the default spread level lead to a stronger reaction in corporate bond returns. On the other hand, coefficients for the default spread slope factor tend to be (significantly) lower in sub-period 2, regardless of different maturities (see Panels B and C of Table 6). Thus, during financial crisis the default spread level tend to be much more important than the default spread slope.

Overall, as documented for the total period, the 4-factor orthogonal model significantly improves the explanatory power compared to the traditional two-factor model in both sub-periods. Notable, short-dated bonds (Corporates 1-3) still have a positive and significant abnormal performance in sub-period 2 (+133 and +238 basis points p.a. for 4-factor and Fama and French model, respectively). Thus, the 4-factor model explains a part of the abnormal performance of short-dated bonds not explained by the 2-factor model.

Panel C of Table 6 reveals the results for the 4-factor model, plus the SML factor. As for the total period, the SML factor improves the explanatory power in both sub-periods. In the pre-crisis period, the average adjusted R^2 increases to 99.8%, the mean standard error drops to 0.028%, and the average absolute AIC value increases to 13.7. The respective values in the crisis period are 99.2%, 0.136% and 10.5, respectively.

In line with the results for the total period, the significant abnormal performance of short-dated corporate bonds (Corporate 1-3) nearly disappears. The SML factor is, therefore, also able to explain the outperformance of short-dated corporate bonds in two sub-periods. Notably, the coefficients of the four interest rate and default spread factors are nearly equal in Panels B and C. Since the SML factor is not significantly correlated to any of the other four risk factors (see Table 2 - Panel B), the above results are not surprising.

Overall, the results reveal that the explanatory power significantly improves for our 4-factor orthogonal model in both sub-periods. The SML factor is especially helpful in explaining the short maturity anomaly of corporate bonds. The coefficients for interest level and slope factors are very similar in both sub-periods, whereas this is not the case for the two default risk factors. The different results for the default risk factors indicate that the sensitivity of the bond performance to credit risk increased significantly during the recent financial crisis.

6. Robustness of the results

This section checks the robustness of the results. First, we conduct a formal GRS-test to examine the empirical fit of our models.[22] This is followed by an examination of the sensitivity of our results to seasonal effects, and use of more conservative alternative to proxy for risk-free benchmark returns.

6.1 GRS test

The underlying null-hypothesis of this test is that no cross-sectional variation is unexplained by an accurate asset pricing model. The derived θ-Statistic is defined as:[23]

$$\theta = \left[(T - N - K)/K\right] \cdot \left[1 + \mu' \cdot \Omega^{-1} \cdot \mu\right]^{-1} \cdot \alpha' \cdot \Sigma^{-1}\alpha \tag{5}$$

where T is the number of observations, N is the number of bond indices, or intercepts tested, K is the number of risk factors in the asset pricing model, μ is a column vector of mean returns of the risk factors, Ω is the unbiased estimate of the covariance matrix of the risk factors with dimension (K x K), α is the (N x 1) column vector of the regression model's intercept terms and Σ is the unbiased estimate of the covariance matrix of regression residuals with dimension (N x N). Under the null hypothesis (i.e. the intercepts are jointly equal to zero) and with the assumption of normality of all variables the statistic is asymptotically central $F_{(N,T-N-K)}$ -distributed.

The GRS-test rejects the null hypothesis for majority of 2-factor models for short maturity (1-3 years) bonds. The GRS-test, however, cannot reject the hypothesis that the orthogonal mod-

[22] The test was introduced by Gibbons et al. (1989) and subsequently used in asset pricing literature (for example, see Gebhart et al (2005)).
[23] See Gibbons et al. (1989) for a formal derivation of the θ-Statistic.

el adequately prices corporate bonds, at the 5% significance level. Similarly, the GRS-test of the orthogonal model augmented with the SML factor does not reject the null hypothesis. Overall, the GRS test confirms a very good fit of the orthogonal models. They also suggest that a linear function of risk factors seems to be appropriate to explain sample returns.

*** Insert Table 7 about here ***

6.2 Further robustness checks

The January effect was documented in the seminal work of Roll (1983).[24] To check for the January effect, we specify the following regression model for the risk factors:

$$\text{risk factor}_t = \alpha + \beta_1 \cdot \text{Jan}_t + \eta_t \tag{7}$$

$$\varepsilon_t = \alpha + \beta_1 \cdot \text{Jan}_t + \eta_t \tag{8}$$

where the variable risk factor_t represents the j-th common risk factor used in our models in month t, ε_t are the regression residuals of model (4) for each bond index in our sample and Jan_t is a January dummy that takes a value of 1 in January and zero otherwise. This formulation implies that the intercept terms (α) represent the average monthly returns from February until December and the coefficient of the dummy variables (β_1) measures the performance-difference in January. If our explanatory variables are subject to January effects, we anticipate that the risk factors would absorb cross-sectional seasonality in the regressions.

The results in Table 8 clearly show that neither the risk factors (equation 7) nor the regression residuals (equation 8) exhibit significantly higher returns in January. The only significant regression coefficient (at the 5% level) is the dummy variable for A-rated bonds with a maturity of 5 to 7 years (see Panel B of Table 8).

*** Insert Table 8 about here ***

[24] For more on other anomalies related to the performance of bonds see Maxwell (1998).

Germany is regarded as an EU country with the smallest probability of default. Consequently, Germany's government bonds have the lowest yield in the European market. Thus, we reproduce model (4) with a different set of risk-free benchmark returns:[25]

$$\begin{aligned}\Delta \text{Bond Index}_{t,k} = \alpha + \beta_1 \cdot \Delta \text{IR\_Level}_t + \beta_2 \cdot \Delta \text{IR\_Slope}_t + \beta_3 \cdot \Delta \text{DS\_Level}_t + \\ \beta_4 \cdot \Delta \text{DS\_Slope}_t + \beta_5 \cdot \text{SML}_t + \varepsilon_t\end{aligned} \tag{9}$$

where ΔBond $\text{Index}_{t,k}$ represents the k-th corporate bond index at the intersection of rating and maturity criteria in month t. $\Delta \text{IR\_Level}_t$ and $\Delta \text{IR\_Slope}_t$ are the level and slope factor extracted by PCA of the interest rate risk term structure, including excess returns of the complete maturity spectrum of German Government bonds over 1 month Euribor rate of the previous month. $\Delta \text{DS\_Level}_t$ and $\Delta \text{DS\_Slope}_t$ are the level and slope of the default factor extracted by PCA from the default spread risk term structure, including maturity-matched zero-investment portfolio returns as the difference between the complete maturity spectrum of corporate bonds and German Government bonds. Finally, ΔSML_t represents the returns of a zero-investment portfolio - after controlling for interest rate and default risk - of a long position in short-maturity corporate bonds (with a tenor of 1-3 years) and a short position of a market-value-weighted set of all remaining bond maturities. The results, presented in Table 9, are economically and statistically consistent with the results presented in Table 5. Hence, we can conclude that our findings are robust to the choice of an alternative risk-free benchmark.

*** Insert Table 9 about here ***

7. Conclusion

This paper provides evidence for the performance of a set of maturity and rating-grouped corporate bonds indices from the Euro-denominated bond market. We examine the monthly total excess return data of 23 broad Euro-denominated iBoxx corporate bond indices before and after recent financial crisis. Our sample includes segments of one to three years maturity that

[25] For more on quantification of a common risk free rate in the Euro Zone and other possible alternatives, see Gomes (2010).

were neglected in the previous literature. Furthermore, we propose a new specification for bond asset pricing models. Specifically, we consider effects of changes in the level and slope of the interest and default rate term structures to the performance of corporate bonds. The explanatory power of our orthogonal model is significantly better compared to the Fama and French specification.

We also find that after controlling for term and default related risk factors only bonds with short maturities (i.e. 1 to 3 years) exhibit significant over-performance. Consequently common risk factors underestimate the expected returns of this segment of the fixed income market. The above results are robust to calendar seasonality and choice of an alternative risk-free benchmark. We also find that investors allocating funds to corporate bonds of lower credit quality are not compensated with significantly higher yields compared to securities with superior credit ratings.

Our results are important for investment areas such as performance measurement and asset allocation. The results are also relevant for assessment of corporate finance decisions in terms of measuring the cost of capital and pricing of new bond issuances. Finally, our sample indices represent the underlying benchmarks for nearly complete European corporate debt ETF market. The adequate assessment of the bond risk and returns are, therefore, of the critical importance for pricing of these and similar fixed income instruments.

References

Alexander, C. (2001), Principles of the Skew, Risk Magazine, Vol. 14, No. 1, pp. 29-32.

Alexander, C. (2003), Common correlation and calibration the lognormal forward rate model, Wilmott Magazine, March, pp. 68-78.

Amenc, N. and Martellini, L. (2002), Portfolio optimization and hedge fund style allocation decisions, Journal of Alternative Investments, Vol. 5, No. 2, pp: 7-20.

Aretz, K. and Pope, P.F. (2011), Common Factors in Default Risk Across Countries and Industries, European Financial Management, doi: 10.1111/j.1468-036X.2010.00571.x

Ausennegg, W., Goetz, L. and Jelic, R. (2011), European Asset Swap Spreads and the Credit Crisis, Working Paper, Inquire UK research seminar, Bristol, September 2011.

Bank for International Settlements (BIS), (2011), Quarterly statistics, www.bis.org.

Bessembinder, H., Kahle, K., Maxwell, W. and Xu, D. (2009) Measuring abnormal bond performance, Review of Financial Studies, Vol. 22, No. 10, pp. 4219-4258.

Blackrock, (2010), ETF Landscape Year End 2009, Global ETF Research and Implementation Strategy Report, 01-2010.

Blake, C., Elton E., and Gruber, M. (1993), The performance of bond mutual funds, Journal of Business, Vol. 66, No. 3, pp. 371-403.

Brown, P. (2002), Constructing and calculating bond indices – a guide to the EFFAS European Bond Commission Standardized Rules, GDP, Cambridge.

Cont, R. and da Fonseca, J. (2002), The dynamics of implied volatility surfaces, Quantitative Finance, Vol. 2, No. 1, pp. 45-60.

Cummans, J. (2010), Year of the Bond ETF, Research Note, ETF Database.

Derwall, J., Huij, J. and Zwart, G. (2009), The short-term corporate bond anomaly, Working Paper, RSM Erasmus University.

Detzler, M. (1999), The performance of global bond mutual funds, Journal of Banking and Finance, Vol. 23, No. 8, pp. 1195-1217.

Dietze, L., Entrop, O. and Wilkens, M. (2009), The performance of investment grade corporate bond funds: evidence from the European market, European Journal of Finance, Vol. 15, No. 2, pp.191-209.

Duffee, G. (1998), The relation between treasury yields and corporate bond yield spreads, Journal of Finance, Vol. 53, No. 6, pp. 2225-2241.

Elton E. J., Gruber M. J. and Blake C. R. (1995), Fundamental economic variables, expected returns, and bond fund performance, Journal of Finance, Vol. 40, pp. 1229-1256.

Elton E. J., Gruber M. J., Agrawal, D. and Mann C. (2001), Explaining the rate spread on corporate bonds, Journal of Finance, Vol. 56, No. 1, pp. 247-278.

Fama, E. F. and French, K. R. (1993), Common risk factors in the returns on stocks and bonds, Journal of Financial Economics, Vol. 33, No. 1, pp. 3-56.

Ferson, W., Henry, T. and Kisgen, D. (2006), Evaluating government bond fund performance with stochastic discount factors, Review of Financial Studies, Vol. 19, No. 2, pp. 423-455.

Fung, W. and Hsieh, D. A. (1997), Empirical Characteristics of Dynamic Trading Strategies: The Case of Hedge Funds, Review of Financial Studies, Vol. 10, No. 275-302.

Gabbi G. and Sironi, A. (2005), Which Factors Affect Corporate Bonds Pricing: Empirical Evidence from Eurobonds Primary Market Spreads, European Journal of Finance, Vol. 11, No. 1, pp. 59-74.

Gallager, D. and Jarnecic, E. (2002), The performance of active Australian bond funds, Australian Journal of Management, Vol. 27, No. 1, pp. 163-185.

Gallo, J., Lockwood, L. and Swanson, P. (1997), The performance of international bond funds, International Review of Economics and Finance, Vol. 6, No. 1, pp. 17-35.

Gebhardt, W. R., Hvidkjaer S., and Swaminathan B. (2005), The cross-section of expected corporate bond returns: Betas or characteristics? Journal of Financial Economics, Vol. 75, No. 1, pp. 85-114.

Gibbons, M. R., Ross, S. A., and Shanken, J. (1989), A test of efficiency of a given portfolio, Econometrica, Vol. 57, No. 1, pp. 1121-1152.

Golub, B. and Tilman, L. (2000), Risk Management: Approached for Fixed Income Markets, Wiley, New York.

Gomes, S.M. (2010), Four Essays on the interaction between credit derivatives and fixed income markets, unpublished PhD thesis, Universidad Carlos III de Madrid, 2010.

Houweling, P., Mentink, A. and Vorst, T. (2002), Is liquidity reflected in bond yields?, Evidence from the Euro Corporate bond market, Working Paper, Erasmus University Rotterdam.

Kahn, R. and Rudd, A. (1995), Does historical performance predict future performance, Financial Analyst Journal, Vol. 51, No. 6, pp. 43-52.

Ledoit, O. and Wolf, M. (2004), Honey, I shrunk the sample covariance matrix, Journal of Portfolio Management, Vol. 30, No. 4, pp. 110-19.

Litterman, R. and Scheinkman, J. (1991), Common factors affecting bond returns. Journal of Fixed Income, Vol. 1, No. 1, pp. 54-61.

Maag, F. and Zimmerman, H. (2000), On benchmarks and the performance of DEM bond mutual funds, Journal of Fixed Income, Vol. 10, No. 3, pp. 31-45.

Markit, (2008), Markit IBoxx Eur Benchmark Guide, Market User Guide, Markit Group Limited.

Maxwell, W. (1998), The January effect in the corporate bond market: A systematic examination, Financial Management, Vol. 27, No. 2, pp. 18-30.

Meric, I., Ratner, M. and Meric, G. (2008), Co-movements of sector index returns in the world's major stock markets in bull and bear markets: Portfolio diversification implications, International Review of Financial Analysis, Vol, 17, No. 1, pp. 156-177.

Nippani, S. and Arize, A. (2008), U.S. corporate bond returns: A study of market anomalies based on broad industry groups, Review of Financial Economics, Vol. 17, No. 3, pp. 157-171.

Nomura Global Economics (2011), Europe will work, Nomura, March 2011.

Novosyolov, A. and Satchkov, D. (2008), Global term structure modeling using principal component analysis, Journal of Asset Management, Vol. 9, No. 1, pp. 49-60.

Pilotte, E. and Sterbenz, F. (2006), Sharpe and Treynor ratios on treasury bonds, Journal of Business, Vol. 79, No. 1, pp. 149-180.

Roll, R. (1983), The turn of the year effect and the return premia of small firms, Journal of Portfolio Management, Vol. 9, pp- 18-28.

Silva, F., Cortez, M. and Armada, M. (2003), Conditioning information and European bond fund performance, European Financial Management, Vol. 9, No. 2, pp. 201-230.

Tolmasky, C. and Hindanov, D. (2002), Principal component analysis for correlated curves and seasonal commodities: The case of the petroleum market, Journal of Futures Markets, Vol. 22, No. 11, pp. 1019-1035.

Zwart, G. (2008), Empirical studies on financial markets: Private equity, corporate bonds and emerging markets, unpublished PhD Thesis, Erasmus Research Institute of Management, Erasmus University Rotterdam.

Figure 1: Evolution of the European corporate bond market

This figure presents the outstanding total volume of European corporate bonds for the respective bond indices. Percentage of total volume (grey areas, left hand scale) and total outstanding volume in billion EUR (solid black line, right hand scale) from September, 30th, 2003 to February, 28th, 2011.

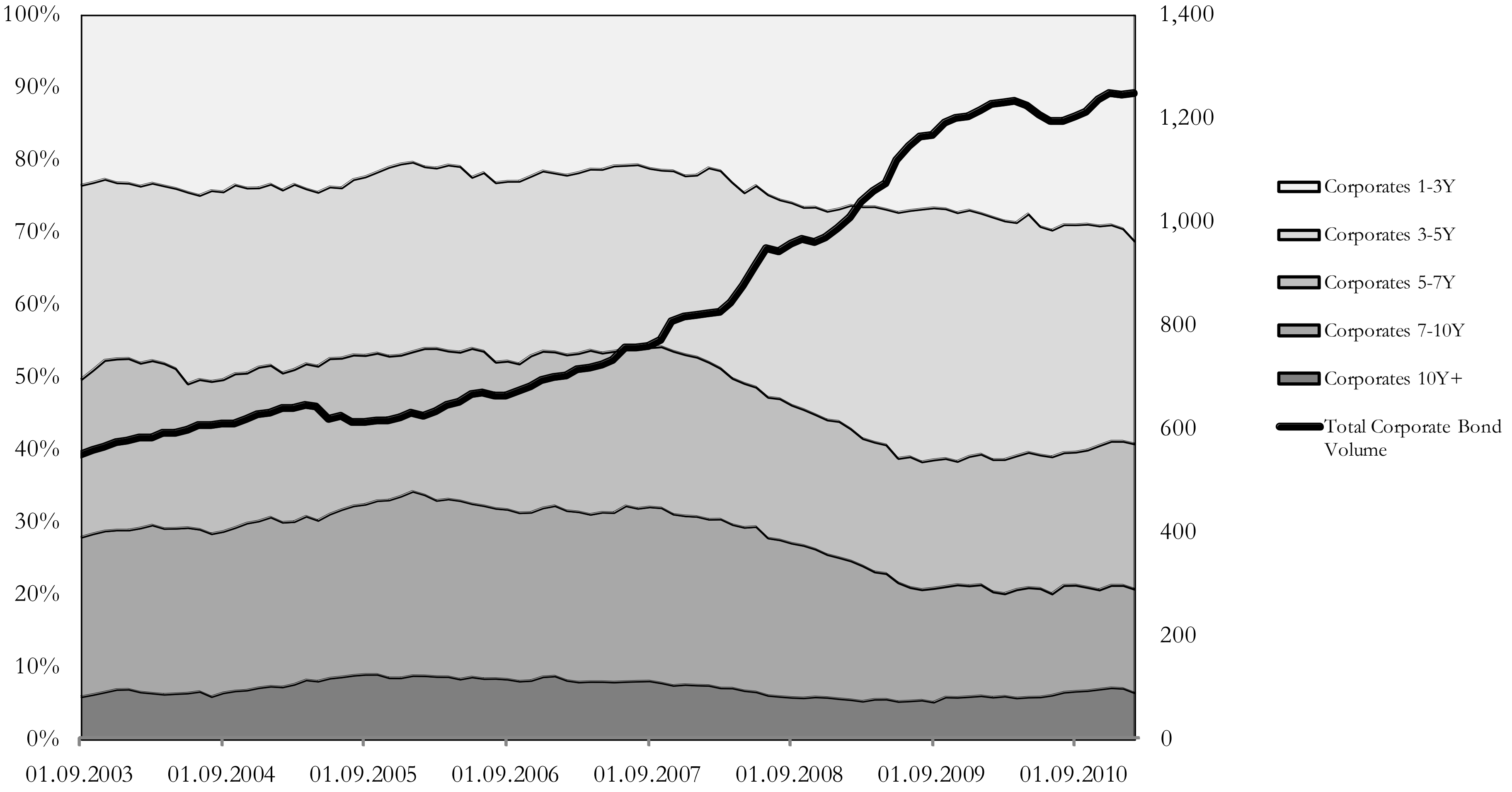
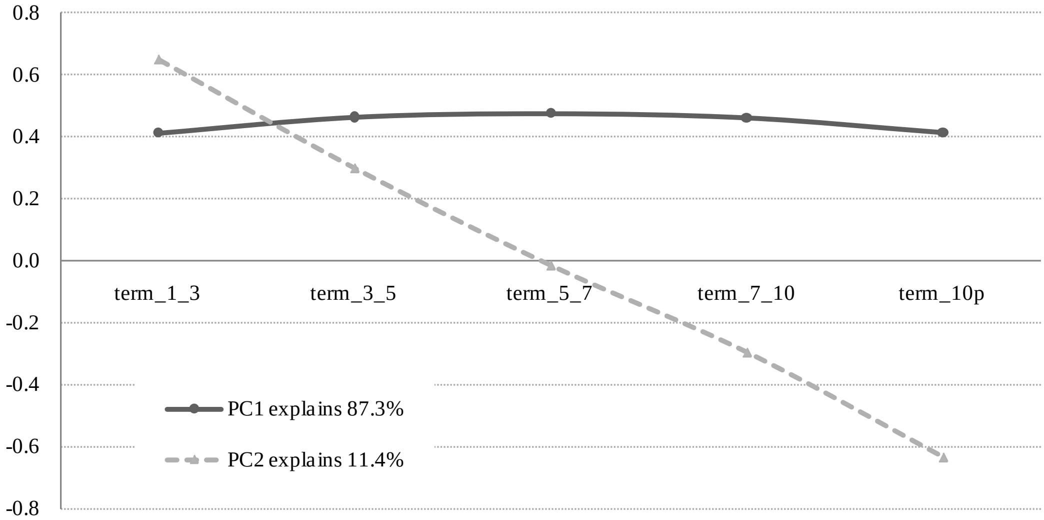


Figure 2: Results of the principal component analysis (PCA)

The proxy for the interest rate risk is the difference between the monthly return of government bonds and the one-month risk-free rate of the previous month. The proxy of the default risk is the difference between the return of corporate bonds and the return of maturity-matched government bonds. The level and slope interest rate risk factors are estimated using PCA, based on the correlation matrix of the monthly returns. Data points are connected by spline interpolation. The first principal component (PC1) represents the level factor (solid full-bodied line). The second principal component (PC2) represents the slope factor (dotted line). Percentage figures for PC1 and PC2 indicate the marginal contributions is explaining the complete risk term structure by the respective principal component.

Panel A: Interest rate term structure



Panel B: Default spread term structure

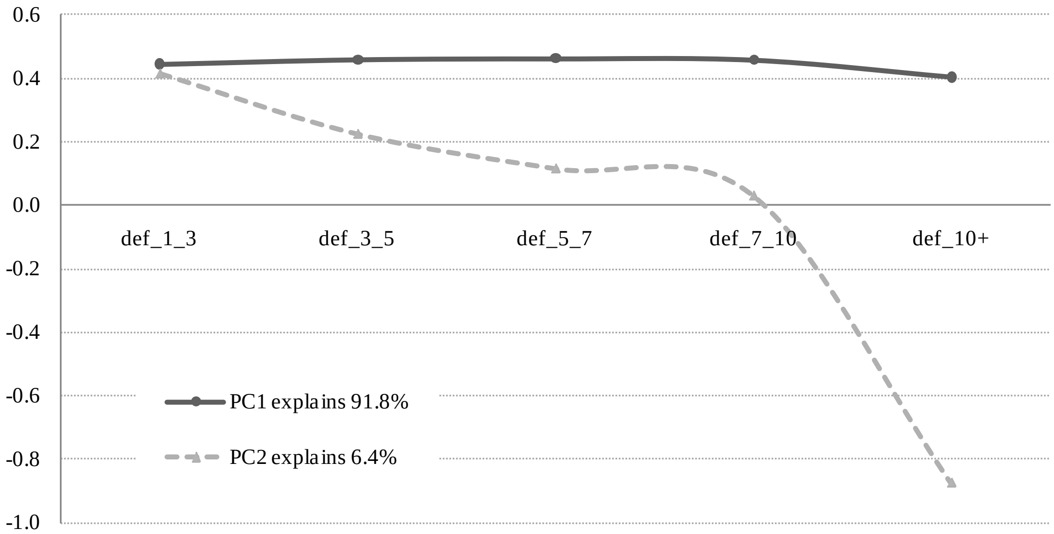


Table 1: Sample descriptive statistics

Panel A: Descriptive Statistics of the respective corporate bond indices from September, 30th, 2003 to February, 28th, 2011.

The first column contains the notional amount for the respective bond indices in billion EUR. Modified duration and time to maturity in years. Mean monthly excess return, median monthly excess returns, and standard deviations are in percentages per month. The Jarque-Bera test statistic is reported in the last column. Monthly excess returns are based on 90 monthly observations for each bond index.

				Monthly Excess Returns							
Index	Notional Amount (Billion EUR)	Mod. Duration (years)	Time to Maturity (years)	Mean	Median	Maximum	Minimum	Standard Deviaton	Skewness	Excess Kurtosis	Jarque-Bera
Corporates 1-3Y	208.5	1.80	1.97	0.12%	0.07%	2.04%	-1.54%	0.55%	0.78	2.80	38.58
Corporates 3-5Y	235.6	3.43	3.95	0.15%	0.08%	3.22%	-4.49%	1.02%	-0.52	4.55	81.74
Corporates 5-7Y	166.3	4.89	5.93	0.15%	0.13%	4.61%	-6.96%	1.53%	-0.83	5.42	120.69
Corporates 7-10Y	165.3	6.69	8.42	0.13%	0.23%	5.62%	-8.73%	1.94%	-0.85	4.79	96.88
Corporates 10Y+	57.2	10.04	16.19	0.25%	0.64%	5.69%	-7.39%	2.05%	-0.30	1.42	8.92
Corporates AA	198.1	4.51	5.90	0.12%	0.21%	2.24%	-4.31%	1.02%	-0.89	2.78	40.83
Corporates A	394.4	4.51	5.73	0.08%	0.15%	3.90%	-6.58%	1.37%	-1.11	6.06	156.33
Corporates BBB	210.9	4.23	5.57	0.24%	0.26%	4.71%	-6.68%	1.42%	-0.72	6.56	169.17
Corporates AA 1-3Y	54.3	1.84	1.99	0.09%	0.09%	1.40%	-1.15%	0.46%	0.11	0.68	1.93
Corporates AA 3-5Y	55.9	3.48	3.95	0.14%	0.18%	2.27%	-3.72%	0.90%	-0.76	2.91	40.53
Corporates AA 5-7Y	34.2	4.98	5.95	0.12%	0.28%	2.81%	-5.80%	1.25%	-1.09	4.52	94.27
Corporates AA 7-10Y	38.2	6.66	8.47	0.12%	0.29%	3.58%	-8.09%	1.65%	-1.25	5.44	134.26
Corporates AA 10Y+	15.4	11.29	17.19	0.19%	0.39%	6.98%	-8.50%	2.28%	-0.25	1.89	14.32
Corporates A 1-3Y	90.8	1.80	1.97	0.11%	0.08%	2.48%	-2.05%	0.64%	0.53	3.94	62.43
Corporates A 3-5Y	111.1	3.43	3.94	0.09%	0.06%	3.66%	-5.82%	1.18%	-0.95	7.18	206.72
Corporates A 5-7Y	80.6	4.88	5.91	0.06%	0.13%	4.34%	-8.64%	1.67%	-1.62	8.22	292.37
Corporates A 7-10Y	85.7	6.47	8.41	0.03%	0.16%	5.97%	-10.51%	2.21%	-1.22	6.31	171.57
Corporates A 10Y+	26.2	9.63	14.98	0.28%	0.53%	5.87%	-7.96%	2.07%	-0.29	2.06	17.17
Corporates BBB 1-3Y	53.9	1.78	1.96	0.19%	0.09%	2.73%	-2.94%	0.74%	0.38	5.20	103.47
Corporates BBB 3-5Y	60.3	3.39	3.95	0.23%	0.19%	3.85%	-6.08%	1.21%	-1.11	7.85	249.41
Corporates BBB 5-7Y	47.0	4.82	5.92	0.32%	0.31%	6.51%	-7.96%	1.81%	-0.35	6.17	144.61
Corporates BBB 7-10Y	36.7	6.34	8.35	0.34%	0.31%	7.78%	-10.25%	2.29%	-0.51	6.18	147.23
Corporates BBB 10Y+	13.0	9.90	17.97	0.33%	0.58%	7.28%	-9.83%	2.38%	-0.64	3.24	45.50

Panel B: Mean and median differences of excess returns

This panel presents mean and median differences in the monthly excess returns. Mean and medians are in percentage terms. P-values are provided for (i) a two sample T test (difference in means=0 vs. difference in means $\neq 0$) and (ii) a two sample standardised Mann-Whitney test (difference in medians = 0, vs. difference in medians $\neq 0$).

	Mean Difference	T-Test (p-value)	Median Difference	MW-Test (p-value)
Corporates 1-3Y	0.122		0.072	
Corporates 10Y+	0.247		0.637	
Difference	0.125	0.558	0.564	1.084
		(0.577)		(0.278)
Corporates AA	0.121		0.207	
Corporates BBB	0.239		0.264	
Difference	0.118	0.640	0.056	0.635
		(0.522)		(0.525)
Corporates AA	0.121		0.207	
Corporates A	0.081		0.152	
Difference	-0.039	-0.218	-0.056	-0.137
		(0.827)		(0.891)
Corporates A	0.081		0.152	
Corporates BBB	0.239		0.264	
Difference	0.157	0.755	0.112	0.790
		(0.450)		(0.430)

Table 2: Descriptive statistics and correlation matrix of risk factors

Panel A reports descriptive statistics for various risk factors from September, 30^{th}, 2003 until February, 28^{th}, 2011 (i.e. overall 90 monthly observations for each factor). Panel B presents Spearman correlations of the risk factors. *TERM* is the difference between monthly long-term (10Y+) Eurozone Sovereign bond returns and the 1 month Euribor rate of the previous month. *DEF* is the difference in returns between a composite index of European corporate bonds (with an average maturity of 8.5 years) and a maturity-matched composite of Eurozone Sovereign bonds. Δ*IR_Level* and Δ*IR_Slope* are the returns of the first and the second principal component of the interest rate term structure. It consists of portfolio returns based on the excess return of the complete maturity spectrum of Eurozone Sovereign bonds and the 1 month Euribor rate of the previous month. Δ*DS_Level* and Δ*DS_Slope* are the returns of the first and the second principal component of the default spread term structure consisting of maturity-matched zero-investment portfolio returns based on the difference between the complete maturity spectrum of European corporate bonds and Eurozone Sovereign bonds. Finally *SML* is a zero-investment portfolio - after controlling for interest rate and default risk - of a long position in short-maturity corporate bonds (with a maturities of 1-3 years) and a short position of a market-value-weighted set of all remaining bond maturities (i.e. the brackets 3-5Y, 5-7Y, 7-10Y, and 10Y+). The mean monthly excess return, the median monthly excess return and the standard deviation of each risk factor are given on monthly basis, in percentages. The Jarque-Bera test statistic is reported in the last column (H_o: Normal distribution). ** and * denote significance at the 1% and 5% level, respectively.

Panel A: Descriptive statistics (Monthly excess returns)

Risk Factors	Mean	Median	Maximum	Minimum	Standard Deviaton	Skewness	Excess Kurtosis	Jarque-Bera
TERM	0.01%	0.05%	3.75%	-5.32%	1.08%	-1.13	7.77**	245.86**
DEF	0.19%	0.30%	7.39%	-4.76%	2.04%	0.38	1.26	8.12*
ΔIR_Level	0.31%	0.67%	9.19%	-6.62%	2.67%	0.16	0.47	1.20
ΔIR_Slope	0.07%	0.04%	2.30%	-1.62%	0.72%	0.51	0.45	4.71
ΔDS_Level	0.03%	0.25%	8.57%	-14.37%	2.74%	-1.52	9.40**	366.43**
ΔDS_Slope	-0.03%	-0.04%	2.21%	-2.18%	0.69%	0.18	2.14	17.63**
SML	0.06%	0.03%	0.65%	-0.47%	0.17%	0.52	2.90	35.57**

Panel B: Correlation matrix

	TERM	DEF	ΔIR_Level	ΔIR_Slope	ΔDS_Level	ΔDS_Slope	SML
TERM	1.00						
DEF	-0.28**	1.00					
ΔIR_Level	0.98**	-0.34**	1.00				
ΔIR_Slope	-0.21*	-0.25**	0.00	1.00			
ΔDS_Level	-0.12	0.98**	-0.19*	-0.33**	1.00		
ΔDS_Slope	0.48**	-0.06	0.38**	-0.53**	0.00	1.00	
SML	-0.02	0.02	0.02	0.02	-0.02	0.01	1.00

Table 3: Results of the Fama and French (1993) model

This table presents the results of the following model:

$$\Delta \text{Bond Index}_{t,k} = \alpha + \beta_{1,k} \cdot \text{TERM}_t + \beta_{2,k} \cdot \text{DEF}_t + \varepsilon_t$$

where $\Delta Bond\ Index_{t,k}$ is the excess return of corporate bond index k at the intersection of rating and duration criterions for grouping single corporate bonds in month t. The index comprises all available EUR-denominated corporate bonds with the specific group characteristics. All portfolio excess returns are market-value-weighted based on the market value of the respective bond at the end of the previous month. $TERM_t$ is the difference between monthly long-term (10Y+) Eurozone Sovereign bond returns and the 1 month Euribor rate of the previous month. DEF_t is the difference in returns between a composite index of corporate bonds (with an average tenor of 8.5 years) and a maturity-matched composite of Eurozone Sovereign bonds. The sample period spans from September, 30th, 2003 until February, 28th, 2011, comprising 90 monthly observations. s(ε) denotes the residual standard error of regression and AIC and SC are the Akaike and Schwarz Information Criteria, respectively. Standard errors are Newey-West corrected. ** and * denote significance at the 1% and 5% level, respectively.

	Intercept (%)	TERM	DEF	adj. R^2 (%)	s(ε) (%)	AIC	SC
Corporates 1-3	0.086	0.3872	0.1692	68.5	0.311	-8.68	-8.59
	(1.89)	(5.00)**	(8.48)**				
Corporates 3-5	0.066	0.7496	0.3777	85.6	0.388	-8.23	-8.15
	(1.32)	(13.45)**	(14.98)**				
Corporates 5-7	0.035	1.2021	0.5720	93.7	0.382	-8.26	-8.18
	(0.79)	(28.27)**	(21.29)**				
Corporates 7-10	-0.027	1.4996	0.7653	96.5	0.364	-8.36	-8.28
	(-0.70)	(30.63)**	(30.64)**				
Corporates 10+	0.055	1.0931	0.9502	91.8	0.587	-7.41	-7.32
	(1.00)	(13.31)**	(25.11)**				
Corporates AA	0.033	0.5492	0.4304	79.4	0.462	-7.88	-7.80
	(0.64)	(8.69)**	(12.64)**				
Corporates A	-0.027	1.0817	0.5185	94.7	0.318	-8.63	-8.55
	(-0.86)	(26.36)**	(24.55)**				
Corporates BBB	0.143	1.0585	0.4519	76.7	0.687	-7.09	-7.01
	(1.61)	(8.12)**	(11.47)**				
Corporates AA 1-3	0.064	0.2200	0.1476	49.6	0.326	-8.58	-8.50
	(1.32)	(3.34)**	(7.12)**				
Corporates AA 3-5	0.070	0.4502	0.3388	64.5	0.534	-7.59	-7.51
	(1.08)	(5.40)**	(9.65)**				
Corporates AA 5-7	0.019	0.7500	0.4985	78.5	0.578	-7.43	-7.35
	(0.30)	(10.24)**	(13.43)**				
Corporates AA 7-10	-0.029	0.9678	0.7224	87.4	0.586	-7.41	-7.33
	(-0.54)	(9.86)**	(21.78)**				
Corporates AA 10+	-0.012	0.9654	1.0277	80.9	0.998	-6.34	-6.26
	(-0.15)	(5.56)**	(15.38)**				
Corporates A 1-3	0.064	0.4879	0.1940	76.5	0.311	-8.68	-8.59
	(1.67)	(6.22)**	(10.18)**				
Corporates A 3-5	0.006	0.9264	0.4159	89.1	0.390	-8.22	-8.14
	(0.16)	(15.90)**	(18.55)**				
Corporates A 5-7	-0.065	1.3295	0.6051	93.0	0.441	-7.98	-7.90
	(-1.32)	(17.35)**	(23.91)**				
Corporates A 7-10	-0.143	1.7998	0.8013	95.2	0.482	-7.80	-7.72
	(-2.43)*	(26.96)**	(28.34)**				
Corporates A 10+	0.088	1.0859	0.9711	93.0	0.549	-7.54	-7.46
	(1.72)	(15.82)**	(35.34)**				

Table 3 (continued)

	Intercept (%)	TERM	DEF	adj. R^2 (%)	s(ε) (%)	AIC	SC
Corporates BBB 1-3	0.157 (2.06)*	0.4703 (4.19)**	0.1638 (5.18)**	49.5	0.522	-7.64	-7.56
Corporates BBB 3-5	0.150 (1.77)	0.8343 (7.13)**	0.3627 (9.96)**	66.7	0.697	-7.06	-6.98
Corporates BBB 5-7	0.205 (2.04)*	1.3982 (8.40)**	0.5610 (10.19)**	79.6	0.816	-6.75	-6.66
Corporates BBB 7-10	0.185 (1.50)	1.7329 (8.99)**	0.7599 (13.69)**	81.2	0.990	-6.36	-6.28
Corporates BBB 10+	0.146 (1.04)	1.4501 (7.35)**	0.8828 (9.69)**	72.1	1.256	-5.88	-5.80

Table 4: Results of the orthogonal model

This table presents the results of the following model:

$$\Delta\text{Bond Index}_{t,k} = \alpha + \beta_{1,k}\cdot\Delta\text{IR\_Level}_t + \beta_{2,k}\cdot\Delta\text{IR\_Slope}_t + \beta_{3,k}\cdot\Delta\text{DS\_Level}_t + \beta_{4,k}\cdot\Delta\text{DS\_Slope}_t + \varepsilon_{t,k}$$

where $\Delta Bond\ Index_{t,k}$ is the excess return of corporate bond index k at the intersection of rating and duration criterions for grouping single corporate bonds in month t. The index comprises all available EUR-denominated corporate bonds with the specific group characteristics. All portfolio excess returns are market-value-weighted based on the current market of the respective bond at the end of the previous month. ΔIR_Level_t and ΔIR_Slope_t are the level and slope of the interest rate factor extracted by PCA of the interest rate risk term structure. It consists of portfolio returns based on the excess return of the complete maturity spectrum of Eurozone Sovereign bonds and the 1 month Euribor rate of the previous month. ΔDS_Level_t and ΔDS_Slope_t are the level and slope of the default risk factor also extracted by PCA on the default spread term structure consisting of maturity-matched zero-investment portfolio returns based on the difference between the complete maturity spectrum of European corporate bonds and Eurozone Sovereign bonds. The sample period spans from September, 30th, 2003 until February, 28th, 2011, comprising 90 monthly observations. s(ε) denotes the residual standard error of regression and AIC and SC are the Akaike and Schwarz Information Criteria, respectively. Standard errors are Newey-West corrected. ** and * denote significance at the 1% and 5% level, respectively.

	Intercept (%)	Interest Rate Level	Interest Rate Slope	Default Spread Level	Default Spread Slope	adj. R^2 (%)	s(ε) (%)	AIC	SC
Corporates 1-3	0.060	0.1062	0.4168	0.1857	0.2134	90.7	0.173	-9.83	-9.69
	(2.95)**	(13.11)**	(11.31)**	(11.62)**	(5.78)**				
Corporates 3-5	0.027	0.2531	0.4956	0.3408	0.1921	98.2	0.139	-10.27	-10.13
	(2.01)*	(30.46)**	(19.87)**	(57.46)**	(7.56)**				
Corporates 5-7	0.000	0.3690	0.4262	0.5167	0.2090	99.5	0.112	-10.71	-10.57
	(0.01)	(79.28)**	(12.14)**	(53.63)**	(9.62)**				
Corporates 7-10	-0.043	0.4797	0.2300	0.6226	0.2717	99.2	0.180	-9.75	-9.61
	(-2.33)*	(58.13)**	(4.55)**	(91.51)**	(6.10)**				
Corporates 10+	0.012	0.7478	-0.5751	0.4381	-0.8890	99.9	0.067	-11.73	-11.60
	(1.84)	(184.2)**	(-23.95)**	(94.53)**	(-46.58)**				
Corporates AA	-0.013	0.3260	0.3113	0.2580	-0.0502	91.7	0.301	-8.72	-8.58
	(-0.49)	(28.09)**	(4.30)**	(13.24)**	(-1.07)				
Corporates A	-0.049	0.3229	0.3301	0.4578	0.2507	98.5	0.173	-9.83	-9.69
	(-2.06)*	(30.29)**	(9.17)**	(29.58)**	(4.79)**				
Corporates BBB	0.110	0.2951	0.3617	0.4528	0.1052	82.2	0.614	-7.30	-7.16
	(1.92)	(13.54)**	(3.22)**	(9.92)**	(0.57)				
Corporates AA 1-3	0.031	0.1117	0.3937	0.1215	0.1110	85.2	0.181	-9.74	-9.60
	(1.51)	(12.15)**	(8.08)**	(10.35)**	(2.72)**				
Corporates AA 3-5	0.017	0.2579	0.5236	0.2313	0.0822	87.2	0.328	-8.55	-8.41
	(0.66)	(21.33)**	(6.78)**	(11.23)**	(1.63)				
Corporates AA 5-7	-0.037	0.3793	0.3387	0.3430	-0.1376	90.8	0.387	-8.22	-8.08
	(-1.06)	(26.10)**	(3.98)**	(14.16)**	(-1.65)				
Corporates AA 7-10	-0.064	0.5121	0.1428	0.4191	-0.0153	91.8	0.485	-7.77	-7.63
	(-1.55)	(29.81)**	(1.46)	(10.87)**	(-0.14)				
Corporates AA 10+	-0.071	0.8542	-0.7544	0.3897	-1.2707	92.8	0.630	-7.24	-7.11
	(-1.13)	(33.93)**	(-5.18)**	(10.84)**	(-6.27)**				

Table 4 (continued)

	Intercept (%)	Interest Rate Level	Interest Rate Slope	Default Spread Level	Default Spread Slope	adj. R^2 (%)	s(ε) (%)	AIC	SC
Corporates A 1-3	0.045 (2.33)*	0.1077 (13.90)**	0.4142 (13.29)**	0.2229 (14.09)**	0.3003 (9.27)**	92.0	0.185	-9.69	-9.55
Corporates A 3-5	-0.024 (-1.27)	0.2565 (25.70)**	0.4936 (12.08)**	0.4066 (24.43)**	0.3053 (4.51)**	97.3	0.199	-9.55	-9.41
Corporates A 5-7	-0.085 (-2.12)*	0.3664 (25.50)**	0.3802 (4.33)**	0.5592 (14.05)**	0.3411 (3.25)**	96.7	0.310	-8.66	-8.52
Corporates A 7-10	-0.144 (-3.07)**	0.4660 (27.65)**	0.2223 (2.73)**	0.7335 (35.43)**	0.4356 (4.92)**	97.4	0.363	-8.34	-8.20
Corporates A 10+	0.046 (1.61)	0.7348 (35.82)**	-0.3015 (-3.79)**	0.4497 (22.32)**	-0.5205 (-5.52)**	97.5	0.332	-8.52	-8.38
Corporates BBB 1-3	0.126 (2.64)**	0.1021 (6.14)**	0.4764 (5.78)**	0.2231 (6.37)**	0.2074 (2.06)*	66.6	0.435	-7.98	-7.85
Corporates BBB 3-5	0.112 (2.24)*	0.2460 (12.72)**	0.4083 (3.49)**	0.3669 (9.10)**	0.0869 (0.45)	74.9	0.619	-7.28	-7.14
Corporates BBB 5-7	0.166 (2.68)**	0.3517 (12.19)**	0.5323 (4.96)**	0.5987 (10.52)**	0.2418 (1.11)	85.3	0.709	-7.01	-6.87
Corporates BBB 7-10	0.164 (1.76)	0.4607 (10.84)**	0.3839 (1.95)	0.7216 (10.60)**	0.3676 (1.26)	84.6	0.917	-6.49	-6.35
Corporates BBB 10+	0.104 (1.05)	0.7046 (14.40)**	-0.7596 (-4.01)**	0.5650 (8.15)**	-1.2299 (-5.16)**	83.3	0.993	-6.33	-6.19

Table 5: Results of the augmented orthogonal model

This table presents the results of the following model:

$$\Delta \text{Bond Index}_{t,k} = \alpha + \beta_{1,k}\cdot\Delta\text{IR\_Level}_t + \beta_{2,k}\cdot\Delta\text{IR\_Slope}_t + \beta_{3,k}\cdot\Delta\text{DS\_Level}_t + \beta_{4,k}\cdot\Delta\text{DS\_Slope}_t + \beta_{5,k}\cdot\Delta\text{SML}_t + \varepsilon_t$$

where $\Delta Bond\ Index_{t,k}$ is the excess return of corporate bond index k at the intersection of rating and duration criterions for grouping single corporate bonds in month t. The index comprises all available EUR-denominated corporate bonds with the specific group characteristics. All portfolio excess returns are market-value-weighted based on the market value of the respective bond at the end of the previous month. ΔIR_Level_t and ΔIR_Slope_t are the level and slope of the interest rate risk factor extracted by PCA of the interest rate term structure. It consists of portfolio returns based on the excess return of complete maturity spectrum of Eurozone Sovereign bonds and the 1 month Euribor rate of the previous month. ΔDS_Level_t and ΔDS_Slope_t are the level and slope of the default risk factor also extracted by PCA on the default spread term structure consisting of maturity-matched zero-investment portfolio returns based on the difference between the complete maturity spectrum of European corporate bonds and Eurozone Sovereign bonds. Finally, ΔSML_t is the return of a zero-investment portfolio - after controlling for interest rate and default risk - of a long position in short-maturity corporate bonds (with a tenor of 1-3 years) and a short position of a market-value-weighted set of all remaining bond maturities (specifically, buckets of 3-5Y, 5-7Y, 7-10 and 10Y+ were used). The sample period spans from September, 30th, 2003 until February, 28th, 2011, comprising 90 monthly observations. s(ε) denotes the residual standard error of regression and AIC and SC are the Akaike and Schwarz Information Criteria, respectively. Standard errors are Newey-West corrected. ** and * denote significance at the 1% and 5% level, respectively.

	Intercept (%)	Interest Rate Level	Interest Rate Slope	Default Spread Level	Default Spread Slope	SML	adj. R^2 (%)	s(ε) (%)	AIC	SC
Corporates 1-3	0.004	0.1057	0.4121	0.1866	0.2099	0.9479	99.6	0.036	-12.94	-12.78
	(1.47)	(38.93)**	(52.50)**	(86.57)**	(31.66)**	(34.47)**				
Corporates 3-5	0.012	0.2530	0.4943	0.3410	0.1911	0.2539	98.3	0.132	-10.36	-10.19
	(1.17)	(29.40)**	(22.91)**	(39.32)**	(8.26)**	(1.88)				
Corporates 5-7	0.005	0.3690	0.4265	0.5167	0.2092	-0.0779	99.5	0.111	-10.70	-10.53
	(0.44)	(81.96)**	(12.53)**	(59.61)**	(9.79)**	(-1.13)				
Corporates 7-10	-0.011	0.4800	0.2327	0.6222	0.2737	-0.5480	99.4	0.153	-10.07	-9.90
	(-0.83)	(64.13)**	(5.62)**	(60.97)**	(6.84)**	(-3.63)**				
Corporates 10+	0.001	0.7477	-0.5760	0.4383	-0.8897	0.1944	99.9	0.057	-12.03	-11.86
	(0.16)	(214.9)**	(-30.86)**	(146.9)**	(-50.52)**	(4.12)**				
Corporates AA	0.010	0.3262	0.3132	0.2577	-0.0487	-0.3805	91.6	0.295	-8.75	-8.59
	(0.33)	(28.18)**	(4.09)**	(15.36)**	(-1.10)	(-1.28)				
Corporates A	-0.022	0.3231	0.3323	0.4574	0.2523	-0.4541	98.7	0.154	-10.05	-9.89
	(-1.21)	(35.30)**	(11.06)**	(50.30)**	(5.48)**	(-3.93)**				
Corporates BBB	0.014	0.2943	0.3536	0.4542	0.0991	1.6309	85.4	0.544	-7.53	-7.36
	(0.23)	(13.30)**	(2.95)**	(14.75)**	(0.61)	(3.17)**				
Corporates AA 1-3	-0.001	0.1114	0.3910	0.1220	0.1090	0.5364	88.7	0.154	-10.05	-9.88
	(-0.06)	(12.61)**	(11.05)**	(13.90)**	(3.20)**	(3.10)**				
Corporates AA 3-5	0.028	0.2580	0.5246	0.2311	0.0829	-0.1944	86.6	0.328	-8.54	-8.37
	(0.91)	(20.78)**	(6.50)**	(11.89)**	(1.67)	(-0.63)				
Corporates AA 5-7	-0.004	0.3796	0.3415	0.3425	-0.1355	-0.5589	90.9	0.376	-8.26	-8.10
	(-0.10)	(26.39)**	(3.87)**	(16.84)**	(-1.65)	(-1.63)				
Corporates AA 7-10	0.008	0.5128	0.1489	0.4180	-0.0108	-1.2268	93.1	0.435	-7.97	-7.80
	(0.17)	(29.87)**	(1.67)	(16.27)**	(-0.13)	(-2.91)**				
Corporates AA 10+	0.001	0.8549	-0.7483	0.3886	-1.2661	-1.2240	93.2	0.594	-7.35	-7.18
	(0.01)	(29.07)**	(-5.29)**	(17.67)**	(-6.91)**	(-2.47)*				

Table 5 (continued)

	Intercept (%)	Interest Rate Level	Interest Rate Slope	Default Spread Level	Default Spread Slope	SML	adj. R^2 (%)	s(ε) (%)	AIC	SC
Corporates A 1-3	0.003	0.1073	0.4106	0.2235	0.2976	0.7205	95.6	0.135	-10.32	-10.15
	(0.17)	(18.55)**	(14.53)**	(39.94)**	(9.07)**	(4.34)**				
Corporates A 3-5	-0.016	0.2565	0.4943	0.4065	0.3059	-0.1416	97.2	0.199	-9.54	-9.37
	(-0.89)	(26.17)**	(11.78)**	(27.25)**	(4.56)**	(-0.74)				
Corporates A 5-7	-0.028	0.3669	0.3850	0.5583	0.3448	-0.9736	97.6	0.258	-9.02	-8.85
	(-1.07)	(30.32)**	(5.36)**	(23.01)**	(3.92)**	(-4.62)**				
Corporates A 7-10	-0.072	0.4666	0.2283	0.7325	0.4400	-1.2059	98.2	0.295	-8.75	-8.58
	(-2.52)*	(29.61)**	(4.13)**	(48.16)**	(6.60)**	(-4.46)**				
Corporates A 10+	0.046	0.7348	-0.3016	0.4497	-0.5206	0.0089	97.4	0.334	-8.50	-8.33
	(1.38)	(35.50)**	(-3.77)**	(22.18)**	(-5.49)**	(0.04)				
Corporates BBB 1-3	0.028	0.1013	0.4682	0.2246	0.2012	1.6682	81.1	0.319	-8.59	-8.42
	(0.70)	(10.29)**	(8.31)**	(12.51)**	(3.05)**	(6.83)**				
Corporates BBB 3-5	0.019	0.2452	0.4006	0.3682	0.0811	1.5640	78.7	0.557	-7.48	-7.31
	(0.35)	(11.35)**	(2.96)**	(11.14)**	(0.45)	(2.77)**				
Corporates BBB 5-7	0.050	0.3507	0.5226	0.6004	0.2345	1.9590	88.2	0.621	-7.26	-7.09
	(0.81)	(12.22)**	(4.14)**	(16.98)**	(1.21)	(3.40)**				
Corporates BBB 7-10	0.071	0.4599	0.3761	0.7230	0.3617	1.5706	85.2	0.879	-6.57	-6.40
	(0.72)	(10.44)**	(1.82)	(14.72)**	(1.33)	(1.90)				
Corporates BBB 10+	-0.020	0.7036	-0.7700	0.5668	-1.2377	2.1034	84.8	0.926	-6.46	-6.30
	(-0.19)	(15.15)**	(-3.91)**	(10.21)**	(-5.99)**	(2.70)**				

Table 6: Bond pricing models before and after financial crisis

This table presents results for the five corporate composite bond indices in two sub-periods. The first sub-period ranges from September, 30th, 2003 to May, 31st, 2007 and the second sub-period spans from June, 30th, 2007 till February, 28th, 2011. Panel A compares the two sub-periods regarding the two factor model with *TERM* and *DEF* as risk factors. Panel B exhibits the corresponding results for the 4-factor orthogonal model with two interest rate factors (*ΔIR_Level*, *ΔIR_Slope*) and two default spread factors (*ΔDS_Level*, *ΔDS_Slope*). Panel C presents the results of the augmented 4-factor model. T-test statistics for the difference in coefficients between the two sub-periods (Panels A, B and C) presented in brackets. s(ε) denotes the residual standard error of regression and AIC and SC are the Akaike and Schwarz Information Criteria, respectively. Standard errors are Newey-West corrected. ** and * denote significance at the 1% and 5% level, respectively.

Panel A: Fama and French model

Sub-period 1	Intercept (%)	TERM	DEF	adj. R^2 (%)	s(ε) (%)	AIC	SC
Corporates 1-3	-0.031 (-1.20)	0.4992 (3.92)**	0.1680 (7.94)**	61.7	0.175	-9.79	-9.67
Corporates 3-5	-0.046 (-0.98)	0.9280 (3.32)**	0.3889 (9.30)**	77.4	0.292	-8.77	-8.65
Corporates 5-7	-0.044 (-0.90)	1.2047 (4.04)**	0.5594 (11.77)**	85.1	0.333	-8.51	-8.39
Corporates 7-10	-0.026 (-0.70)	1.5570 (5.89)**	0.7384 (19.24)**	94.9	0.243	-9.13	-9.01
Corporates 10+	-0.065 (-2.46)*	2.9000 (24.97)**	1.1190 (68.10)**	98.6	0.187	-9.66	-9.54

Sub-period 2	Intercept (%)	TERM	DEF	adj. R^2 (%)	s(ε) (%)	AIC	SC
Corporates 1-3	0.198 (2.66)**	0.3899 (5.91)**	0.1773 (5.96)**	73.0	0.375	-8.27	-8.15
Corporates 3-5	0.170 (2.15)*	0.7504 (16.04)**	0.3820 (10.15)**	88.3	0.449	-7.91	-7.79
Corporates 5-7	0.116 (1.73)	1.2057 (32.25)**	0.5804 (14.84)**	95.6	0.420	-8.04	-7.92
Corporates 7-10	-0.026 (-0.41)	1.5025 (30.20)**	0.7840 (21.32)**	96.7	0.459	-7.87	-7.75
Corporates 10+	0.081 (0.86)	1.0680 (12.22)**	0.9498 (16.39)**	90.6	0.754	-6.87	-6.75

Difference	Intercept (%)	TERM	DEF
Corporates 1-3	0.229 (2.908)**	-0.109 (-0.762)	0.009 (0.255)
Corporates 3-5	0.216 (2.355)*	-0.178 (-0.627)	-0.007 (-0.122)
Corporates 5-7	0.160 (1.935)	0.001 (0.003)	0.021 (0.342)
Corporates 7-10	0.000 (-0.055)	0.001 (-0.203)	0.999 (0.839)
Corporates 10+	0.145 (1.502)	-1.832 (-12.607)**	-0.169 (-2.810)**

Panel B: 4-factor orthogonal model

Sub-periode 1	Intercept (%)	Interest Rate Level	Interest Rate Slope	Default Spread Level	Default Spread Slope	adj. R^2 (%)	s(ε) (%)	AIC	SC
Corporates 1-3	-0.017 (-1.47)	0.0939 (7.17)**	0.4029 (5.85)**	0.0330 (0.68)	0.5256 (2.66)**	91.8	0.085	-11.20	-11.00
Corporates 3-5	-0.006 (-1.15)	0.2515 (47.50)**	0.5250 (19.81)**	0.1418 (9.60)**	0.4916 (6.34)**	99.4	0.048	-12.34	-12.13
Corporates 5-7	0.007 (1.19)	0.3743 (102.2)**	0.4672 (31.48)**	0.2309 (20.09)**	0.3896 (11.39)**	99.8	0.043	-12.57	-12.36
Corporates 7-10	0.013 (1.85)	0.4877 (98.80)**	0.2025 (6.48)**	0.3550 (16.93)**	0.4456 (5.82)**	99.8	0.053	-12.15	-11.95
Corporates 10+	-0.006 (-3.13)**	0.7417 (642.0)**	-0.6039 (-90.19)**	0.8953 (331.0)**	-0.3764 (-19.70)**	99.9	0.016	-14.56	-14.36

Sub-period 2	Intercept (%)	Interest Rate Level	Interest Rate Slope	Default Spread Level	Default Spread Slope	adj. R^2 (%)	s(ε) (%)	AIC	SC
Corporates 1-3	0.111 (3.49)**	0.1081 (11.32)**	0.4397 (11.33)**	0.1910 (14.45)**	0.2223 (6.18)**	92.7	0.205	-9.44	-9.24
Corporates 3-5	0.053 (2.12)*	0.2499 (19.19)**	0.4909 (14.07)**	0.3431 (52.44)**	0.1829 (5.99)**	98.1	0.190	-9.59	-9.39
Corporates 5-7	0.016 (0.80)	0.3650 (52.22)**	0.3815 (8.48)**	0.5167 (61.11)**	0.1698 (7.36)**	99.5	0.145	-10.14	-9.94
Corporates 7-10	-0.095 (-2.62)**	0.4772 (36.96)**	0.2485 (3.32)**	0.6265 (82.74)**	0.2767 (4.97)**	99.2	0.245	-9.08	-8.88
Corporates 10+	0.026 (1.92)	0.7524 (110.6)**	-0.5500 (-15.23)**	0.4274 (97.13)**	-0.8875 (-34.89)**	99.9	0.097	-10.94	-10.74

Difference	Intercept (%)	Interest Rate Level	Interest Rate Slope	Default Spread Level	Default Spread Slope
Corporates 1-3	0.127 (3.786)**	0.014 (0.879)	0.037 (0.467)	0.158 (3.166)**	-0.303 (-1.511)
Corporates 3-5	0.059 (2.320)*	-0.002 (-0.113)	-0.034 (-0.780)	0.201 (12.469)**	-0.309 (-3.706)**
Corporates 5-7	0.008 (0.411)	-0.009 (-1.181)	-0.086 (-1.810)	0.286 (20.025)**	-0.220 (-5.331)**
Corporates 7-10	-0.108 (-2.930)**	-0.011 (-0.761)	0.046 (0.568)	0.272 (12.182)**	-0.169 (-1.786)
Corporates 10+	0.032 (2.364)*	0.011 (1.553)	0.054 (1.468)	-0.468 (-90.617)**	-0.511 (-16.072)**

Panel C: Augmented orthogonal model

Sub-periode 1	Intercept (%)	Interest Rate Level	Interest Rate Slope	Default Spread Level	Default Spread Slope	SML	adj. R^2 (%)	s(ε) (%)	AIC	SC
Corporates 1-3	0.002	0.0939	0.4038	0.0327	0.5270	0.9637	99.9	0.009	-15.68	-15.44
	(1.78)	(96.29)**	(97.58)**	(12.94)**	(46.75)**	(40.72)**				
Corpoares 3-5	0.000	0.2515	0.5254	0.1417	0.4921	0.3499	99.6	0.038	-12.81	-12.57
	(0.09)	(85.87)**	(30.18)**	(17.19)**	(13.85)**	(6.29)**				
Corporates 5-7	0.005	0.3743	0.4671	0.2310	0.3894	-0.1369	99.8	0.042	-12.60	-12.36
	(0.76)	(114.7)**	(25.57)**	(14.60)**	(12.07)**	(-1.64)				
Corporates 7-10	0.005	0.4877	0.2021	0.3551	0.4450	-0.4079	99.9	0.039	-12.72	-12.48
	(0.88)	(168.5)**	(12.55)**	(55.10)**	(11.03)**	(-5.81)**				
Corporates 10+	-0.004	0.7417	-0.6038	0.8953	-0.3762	0.0919	99.9	0.014	-14.81	-14.57
	(-2.52)*	(598.7)**	(-81.96)**	(215.7)**	(-17.02)**	(1.96)*				

Sub-period 2	Intercept (%)	Interest Rate Level	Interest Rate Slope	Default Spread Level	Default Spread Slope	SML	adj. R^2 (%)	s(ε) (%)	AIC	SC
Corporates 1-3	0.011	0.1069	0.4308	0.1914	0.2172	0.9500	99.5	0.049	-12.27	-12.03
	(1.52)	(24.12)**	(38.62)**	(87.49)**	(28.20)**	(21.93)**				
Corpoares 3-5	0.031	0.2497	0.4889	0.3432	0.1818	0.2106	98.0	0.187	-9.60	-9.36
	(1.17)	(17.93)**	(15.41)**	(38.15)**	(5.96)**	(1.02)				
Corporates 5-7	0.016	0.3650	0.3815	0.5167	0.1699	-0.0076	99.5	0.146	-10.09	-9.85
	(0.68)	(51.60)**	(8.39)**	(60.85)**	(7.26)**	(-0.07)				
Corporates 7-10	-0.032	0.4780	0.2542	0.6262	0.2799	-0.6025	99.3	0.213	-9.35	-9.11
	(-0.96)	(39.11)**	(4.18)**	(52.46)**	(5.13)**	(-2.76)**				
Corporates 10+	0.003	0.7521	-0.5521	0.4275	-0.8887	0.2173	99.9	0.086	-11.15	-10.91
	(0.22)	(131.8)**	(-18.09)**	(123.1)**	(-35.01)**	(2.90)**				

Difference	Intercept (%)	Interest Rate Level	Interest Rate Slope	Default Spread Level	Default Spread Slope	SML
Corporates 1-3	0.009	0.013	0.027	0.159	-0.310	-0.014
	(1.203)	(2.867)**	(2.265)*	(47.417)**	(-22.691)**	(-0.278)
Corpoares 3-5	0.030	-0.002	-0.036	0.202	-0.310	-0.139
	(1.139)	(-0.131)	(-1.009)	(16.515)**	(-6.630)**	(-0.656)
Corporates 5-7	0.012	-0.009	-0.086	0.286	-0.220	0.129
	(0.479)	(-1.195)	(-1.747)	(15.913)**	(-5.511)**	(0.995)
Corporates 7-10	-0.036	-0.010	0.052	0.271	-0.165	-0.195
	(-1.094)	(-0.775)	(0.829)	(19.989)**	(-2.434)*	(-0.849)
Corporates 10+	0.007	0.010	0.052	-0.468	-0.512	0.125
	(0.582)	(1.788)	(1.650)	(-86.464)**	(-15.227)**	(1.423)

Table 7: Results for the GRS-test

Results from the GRS-test. Each column corresponds with regressions of the specified models in the study. The θ-Statistic is for H_0: intercept = 0 ∀i (= 1, …, N), defined as

$$\theta = \left[(T - N - K)/K\right] \cdot \left[1 + \mu' \cdot \Omega^{-1} \cdot \mu\right]^{-1} \cdot \alpha' \cdot \Sigma^{-1} \alpha$$

where T is the number of observations, N is the number of bond indices, or intercepts tested, K is the number of risk factors in the asset pricing model, μ is a column vector of mean returns of the risk factors, Ω is the unbiased estimate of the covariance matrix of the risk factors with dimension *(KxK)*, α is the *(Nx1)* column vector of the regression model's intercept terms and Σ is the unbiased estimate of the covariance matrix of regression residuals with dimension *(NxN)*. With the assumption of normality of all variables the statistic is asymptotically central $F_{(N,T-N-K)}$ distributed under the null hypothesis that the intercepts are jointly zero. All tested bond portfolios time-series are excess returns, which are market-value-weighted based on the current market value of the respective bond at the end of the previous month. The sample period spans from September, 30th, 2003 until February, 28th, 2011, resulting in T = 90 monthly observations. N = 23 regressions or equivalently tested intercept terms and K is dependent on the size of explanatory variables in each specific model.

	Fama and French model	Orthogonal model	Augmented orthogonal model
θ-Statistic	1.83	1.68	1.23
p-value	0.029	0.054	0.256

Table 8: Tests for January effects

Panel A: Risk factors

The table presents the results of the following model: risk $\text{factor}_t = \alpha + \beta_1 \cdot \text{Jan}_t + \eta_t$; where *risk factor$_t$* is a specific risk factor used in model (4) and *Jan_t* is a dummy variable that takes the value of 1 in January and zero in the remaining months. All risk factors are either excess returns or returns on zero-investment portfolios. The sample period spans from September, 30th, 2003 until February, 28th, 2011, comprising 90 monthly observations. *$s(\eta)$* denotes the residual standard error of regression and AIC and SC are the Akaike and Schwarz Information Criteria, respectively. Standard errors are Newey-West corrected. ** and * denote significance at the 1% and 5% level, respectively.

Risk Factor	Intercept (%)	January Dummy	adj. R^2 (%)	$s(\eta)$ (%)	AIC	SC
ΔIR_Level	0.334 (1.06)	-0.0028 (-0.26)	-1.0	2.68	-4.38	-4.32
ΔIR_Slope	0.039 (0.49)	0.0037 (1.16)	1.1	0.72	-7.01	-6.96
ΔDS_Level	-0.005 (-0.01)	0.0042 (0.61)	-0.9	2.75	-4.32	-4.27
ΔDS_Slope	0.004 (0.06)	-0.0043 (-1.70)	2.0	0.68	-7.11	-7.06
ΔSML	0.052 (2.25)*	0.0008 (1.11)	0.7	0.17	-9.86	-9.80

Panel B: Residuals

The table presents the results of the following model: $\varepsilon_t = \alpha + \beta_1 \cdot \text{Jan}_t + \eta_t$; where ε_t is the time-series residual of model (4) for a specific bond index from our sample and *Jan_t* is a dummy variable that takes the value of 1 in January and zero in the remaining months. The sample period spans from September, 30th, 2003 until February, 28th, 2011, comprising 90 monthly observations. *$s(\eta)$* denotes the residual standard error of regression and AIC and SC are the Akaike and Schwarz Information Criteria, respectively. Standard errors are Newey-West corrected. ** and * denote significance at the 1% and 5% level, respectively.

Risk Factor	Intercept (%)	January Dummy	adj. R^2 (%)	$s(\eta)$ (%)	AIC	SC
Corporates 1-3	0.0000 (0.00)	-0.0000 (-0.02)	-1.1	0.035	-13.03	-12.98
Corpoares 3-5	-0.0019 (-0.13)	0.0002 (0.55)	-0.9	0.129	-10.45	-10.39
Corporates 5-7	-0.0022 (-0.19)	0.0002 (0.76)	-0.7	0.109	-10.79	-10.74
Corporates 7-10	0.0034 (0.21)	-0.0004 (-0.69)	-0.6	0.149	-10.16	-10.11
Corporates 10+	-0.0005 (-0.10)	0.0001 (0.22)	-1.0	0.056	-12.12	-12.06

Panel B (continued)

Risk Factor	Intercept (%)	January Dummy	adj. R^2 (%)	s(η) (%)	AIC	SC
Corporates AA	-0.0034 (-0.12)	0.0004 (0.41)	-1.0	0.288	-8.84	-8.79
Corporates A	-0.0061 (-0.30)	0.0007 (1.87)	0.6	0.149	-10.16	-10.10
Corporates BBB	0.0029 (0.05)	-0.0003 (-0.33)	-1.1	0.531	-7.62	-7.56
Corporates AA 1-3	0.0001 (0.00)	0.0000 (-0.01)	-1.1	0.151	-10.14	-10.08
Corporates AA 3-5	0.0011 (0.03)	-0.0001 (-0.14)	-1.1	0.321	-8.63	-8.57
Corporates AA 5-7	0.0025 (0.06)	-0.0003 (-0.28)	-1.1	0.368	-8.35	-8.30
Corporates AA 7-10	-0.0057 (-0.13)	0.0006 (0.63)	-0.9	0.425	-8.06	-8.01
Corporates AA 10+	0.0002 (0.00)	0.0000 (-0.02)	-1.1	0.580	-7.44	-7.38
Corporates A 1-3	-0.0002 (-0.01)	0.0000 (0.05)	-1.1	0.132	-10.41	-10.35
Corporates A 3-5	-0.0036 (-0.19)	0.0004 (0.73)	-0.8	0.194	-9.63	-9.58
Corporates A 5-7	-0.0123 (-0.42)	0.0014 (2.34)*	1.4	0.249	-9.13	-9.08
Corporates A 7-10	-0.0036 (-0.10)	0.0004 (0.51)	-1.0	0.288	-8.84	-8.79
Corporates A 10+	-0.0058 (-0.16)	0.0007 (0.77)	-0.8	0.326	-8.59	-8.54
Corporates BBB 1-3	0.0006 (0.01)	-0.0001 (-0.14)	-1.1	0.312	-8.68	-8.62
Corporates BBB 3-5	-0.0041 (-0.08)	0.0005 (0.41)	-1.1	0.544	-7.57	-7.51
Corporates BBB 5-7	0.0012 (0.02)	-0.0001 (-0.11)	-1.1	0.607	-7.35	-7.29
Corporates BBB 7-10	0.0231 (0.24)	-0.0026 (-1.72)	-0.4	0.855	-6.66	-6.61
Corporates BBB 10+	0.0189 (0.18)	-0.0021 (-1.03)	-0.7	0.902	-6.56	-6.50

Table 9: Results with an alternative default-free benchmark

This table presents the results of the following model:

$$\Delta \text{Bond Index}_{t,k} = \alpha + \beta_1 \cdot \Delta \text{IR\_Level}_t + \beta_2 \cdot \Delta \text{IR\_Slope}_t + \beta_3 \cdot \Delta \text{DS\_Level}_t + \beta_4 \cdot \Delta \text{DS\_Slope}_t + \beta_5 \cdot \Delta \text{SML}_t + \varepsilon_t$$

where $\Delta Bond\ Index_{t,k}$ is the excess return of corporate bond index k at the intersection of rating and duration criterions for grouping single corporate bonds in month t. The index comprises all available EUR-denominated corporate bonds with the specific group characteristics. All portfolio excess returns are market-value-weighted based on the current market value of the respective bond at the end of the previous month. ΔIR_Level_t and ΔIR_Slope_t are level and slope of the interest rate risk factor extracted by PCA of the interest rate term structure of German government bonds. This term structure consists of excess returns of the complete maturity spectrum of German Sovereign bonds and the 1 month Euribor rate of the previous month. ΔDS_Level_t and ΔDS_Slope_t are the level and slope of the default risk factor also extracted by PCA on the default spread term structure, including maturity-matched zero-investment portfolio returns based on the difference between the complete maturity spectrum of corporate bonds and German Sovereign bonds. ΔSML_t is a zero-investment portfolio - after controlling for interest rate and default risk - of a long position in short-maturity corporate bonds (with a tenor of 1-3 years) and a short position of a market-value-weighted set of all remaining bond maturities (specifically, buckets of 3-5Y, 5-7Y, 7-10Y, and 10Y+ are used). The sample period spans from September, 30th, 2003 until February, 28th, 2011, comprising 90 monthly observations. s (ε) denotes the residual standard error of regression and AIC and SC are the Akaike and Schwarz Information Criteria, respectively. Standard errors are Newey-West corrected. ** and * denote significance at the 1% and 5% level, respectively.

	Intercept (%)	Interest Rate Level	Interest Rate Slope	Default Spread Level	Default Spread Slope	SML	adj. R^2 (%)	s(ε) (%)	AIC	SC
Corporates 1-3	0.0041	0.0816	0.4310	0.1754	0.2390	0.9495	99.7	0.030	-13.30	-13.13
	(1.61)	(38.32)**	(65.94)**	(79.13)**	(33.56)**	(31.76)**				
Corpoares 3-5	0.0100	0.2212	0.5433	0.3292	0.2642	0.2471	98.7	0.118	-10.58	-10.41
	(1.23)	(31.06)**	(26.92)**	(39.25)**	(11.05)**	(1.68)				
Corporates 5-7	0.0089	0.3405	0.4725	0.4964	0.2529	-0.1116	99.4	0.115	-10.64	-10.47
	(0.89)	(48.91)**	(12.95)**	(52.18)**	(6.50)**	(-1.93)				
Corporates 7-10	-0.0114	0.4468	0.2241	0.6076	0.2155	-0.4451	99.5	0.134	-10.33	-10.16
	(-1.09)	(55.98)**	(8.21)**	(58.29)**	(6.67)**	(-2.90)**				
Corporates 10+	-0.0008	0.7930	-0.5154	0.4951	-0.8222	0.1186	100.0	0.045	-12.52	-12.36
	(-0.20)	(313.0)**	(-40.39)**	(248.5)**	(-69.88)**	(3.50)**				
Corporates AA	-0.0045	0.2925	0.4198	0.2666	0.1336	-0.3704	93.0	0.269	-8.93	-8.77
	(-0.18)	(30.54)**	(5.98)**	(18.35)**	(2.61)**	(-1.22)				
Corporates A	-0.0214	0.2920	0.3918	0.4391	0.2802	-0.4940	98.8	0.153	-10.06	-9.90
	(-1.19)	(22.66)**	(10.01)**	(46.29)**	(4.80)**	(-4.88)**				
Corporates BBB	0.0400	0.3207	0.1840	0.4498	-0.1899	1.6401	87.9	0.494	-7.72	-7.55
	(0.76)	(9.95)**	(1.44)	(17.79)**	(-1.14)	(3.46)**				
Corporates AA 1-3	-0.0070	0.0854	0.4404	0.1203	0.1977	0.5390	90.9	0.138	-10.26	-10.10
	(-0.51)	(11.93)**	(14.30)**	(16.30)**	(5.46)**	(2.97)**				
Corporates AA 3-5	0.0129	0.2124	0.6304	0.2330	0.2808	-0.1642	88.5	0.304	-8.69	-8.53
	(0.50)	(19.42)**	(7.88)**	(13.38)**	(4.67)**	(-0.53)				
Corporates AA 5-7	-0.0144	0.3451	0.4878	0.3410	0.1542	-0.5860	92.3	0.346	-8.43	-8.26
	(-0.51)	(20.66)**	(6.55)**	(20.00)**	(1.74)	(-1.52)				
Corporates AA 7-10	-0.0168	0.4599	0.2686	0.4304	0.1854	-1.1033	93.2	0.431	-7.99	-7.82
	(-0.44)	(21.01)**	(2.21)*	(17.21)**	(1.38)	(-3.01)**				
Corporates AA 10+	-0.0127	0.8931	-0.5752	0.4556	-0.9167	-1.3208	93.9	0.565	-7.45	-7.28
	(-0.23)	(20.92)**	(-4.40)**	(20.50)**	(-4.39)**	(-2.71)**				

Table 9 (continued)

	Intercept (%)	Interest Rate Level	Interest Rate Slope	Default Spread Level	Default Spread Slope	SML	adj. R^2 (%)	s(ε) (%)	AIC	SC
Corporates A 1-3	0.0024	0.0763	0.4562	0.2062	0.3311	0.6902	95.8	0.132	-10.37	-10.20
	(0.14)	(8.72)**	(16.52)**	(32.95)**	(7.96)**	(4.56)**				
Corporates A 3-5	-0.0170	0.2142	0.5831	0.3814	0.4116	-0.1900	97.5	0.186	-9.68	-9.51
	(-1.05)	(14.29)**	(12.83)**	(23.39)**	(6.69)**	(-1.06)				
Corporates A 5-7	-0.0263	0.3272	0.4564	0.5294	0.3860	-1.0212	97.5	0.262	-8.99	-8.82
	(-1.06)	(15.47)**	(5.22)**	(23.11)**	(3.59)**	(-4.90)**				
Corporates A 7-10	-0.0662	0.4300	0.2124	0.6971	0.3476	-1.1278	98.5	0.273	-8.90	-8.74
	(-2.56)*	(26.43)**	(4.06)**	(57.86)**	(4.47)**	(-4.20)**				
Corporates A 10+	0.0241	0.7242	-0.1232	0.4973	-0.3299	-0.0420	97.7	0.311	-8.64	-8.48
	(0.80)	(37.31)**	(-1.49)	(31.72)**	(-2.82)**	(-0.24)				
Corporates BBB 1-3	0.0404	0.1009	0.3641	0.2148	0.0649	1.7057	82.9	0.304	-8.69	-8.52
	(1.07)	(6.06)**	(5.25)**	(15.28)**	(0.65)	(7.63)**				
Corporates BBB 3-5	0.0419	0.2683	0.2630	0.3687	-0.1686	1.5366	81.4	0.521	-7.61	-7.44
	(0.81)	(7.74)**	(1.87)	(14.15)**	(-0.96)	(2.95)**				
Corporates BBB 5-7	0.0805	0.3662	0.3718	0.5814	-0.0378	1.9360	89.7	0.581	-7.39	-7.23
	(1.44)	(10.03)**	(2.47)*	(19.26)**	(-0.18)	(3.69)**				
Corporates BBB 7-10	0.0996	0.4769	0.1184	0.7135	-0.1207	1.7085	87.7	0.802	-6.75	-6.58
	(1.14)	(8.28)**	(0.61)	(15.96)**	(-0.49)	(2.13)*				
Corporates BBB 10+	0.0433	0.8856	-1.1708	0.6308	-1.8417	2.0421	89.5	0.772	-6.83	-6.66
	(0.56)	(26.20)**	(-6.68)**	(14.69)**	(-8.41)**	(3.08)**				