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AN ANALYSIS OF BOND FUNDS' CREDIT RISK EXPOSURE AFTER THE FINANCIAL CRISIS

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Abstract: This thesis examines the credit risk exposure of US fixed income funds in the period after the great financial crisis by empirically analysing the effect of changes in the corporate bond ratings on the fund's return and net flow ratio. The findings provide evidence for an increased credit risk exposure compared to the period before the great financial crisis but give no clear indication compared to the great financial crisis. The fund types detected to be exposed to the highest downside risk after the great financial crisis are the investment-grade focused bond funds and the high yield bond funds.

Title: An analysis of Bond Funds' credit risk exposure after the financial crisis

Keywords: Corporate Debt Markets, Mutual Funds, Corporate Bonds, Credit Rating, Rating, Bond Funds

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List of Abbreviations

Abbreviation	Definition
GFC	Great Financial Crisis
ICI	Investment Company Institute
IIF	Institute of International Finance
IMF	International Monetary Fund
US	United States of America
USD	United States Dollar

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1. Introduction

The tremendous rise of the corporate debt market and fixed income mutual funds after the great financial crisis (GFC) led to concerns about the effect on financial stability, as expressed by the Financial Times (2017). In academia, the dominating opinion sees the fixed income mutual funds as a reason for potential fragility due to the mismatch of liquidity between the investor's capital and the underlying corporate bonds (Chen, Goldstein and Jiang 2010, Goldstein, Jiang and Ng 2017, Falato, Goldstein and Hortaçsu 2020). The mismatch induces liquidation costs of redemptions on the remaining investors, fostering a bank run like scenario on the bond fund investors and fire-sales by the bond funds (Goldstein, Jiang and Ng 2017). The fire-sales of one bond fund can have a spillover effect on peer funds, impacting the bond fund market and the corporate bond market potentially elevating financial instability (Cetorelli, Duarte and Eisenbach 2016, Baranova, et al. 2017, Falato, Hortacsu, et al. 2019, Fricke und Fricke 2021). The International Monetary Fund (IMF) shares these concerns with emphasis on the non-financial corporate debt and urged policymakers to address the topic to decrease the risk of financial instability, indicating the major importance of the issue (IMF 2017, IMF 2019).

The thesis focuses on one possible reason for triggering the fragility mechanism described in the previous paragraph, the credit risk exposure of the bond funds. Understanding the credit risk exposure of the bond funds is important as the quality of the average bond decreased since the GFC (Demirtaş, Çelik and Isaksson 2020), which could lead to riskier bond portfolios and increase the probability of trigging the fragility mechanism. Therefore, the thesis aims to determine the size of the credit risk exposure of the whole market in a historical context and identify the fund types within the market being the most at risk. The credit risk exposure is empirically analysed by measuring the influence of the corporate bond's credit rating changes on the bond funds' return and net flow ratio.

The research contributes to the growing literature on the credit risk of bond funds and provides detailed insights into the credit risk exposure of the market and the individual fund types. The detailed analysis is, to the best of our knowledge, one of the first studies of the bond funds credit risk exposure based on a common classification system deepening the understanding of the credit risk exposure of bond funds. The knowledge helps to understand the influence of the tremendous rise of the global corporate debt market on the bond fund market as well as the dynamics within the bond fund market.

In the empirical analysis, the US fixed income fund dataset from Morningstar and the rating dataset from the Mergent Fixed Income Securities Database is used for a period from 2004 until 2019, representing combined 949 funds. The results provide strong evidence for an increase in the credit risk exposure of the bond fund market compared to the pre-GFC period. Compared to the GFC, the credit risk exposure decreased for the individual bond funds. However, more bond funds demonstrate significant credit risk exposure. The contradicting findings do not allow a conclusion regarding the size of this period. Within this broader credit risk exposure, the investment-grade focused bond funds and the high yield bond funds are exposed to the most risk due to significant decreases in the return or the net flow ratio in response to rating downgrades. The findings indicate a higher probability than during the pre-GFC period for the potential triggering of the fragility mechanism due to the credit risk exposure of the bond funds. The investment-grade focused bond funds and the high yield bond funds are the crucial bond funds, which we expected to trigger the fragility mechanism.

The remainder of the thesis is organised as follows. Section 2 presents the background on the market development and the related literature. Section 3 introduces the data sample and the data preparation. Section 4 demonstrates the hypothesis development. Section 5 shows the empirical findings and an interpretation. Section 6 discusses the results, and Section 7 concludes.

2. Background and related work

This chapter provides an overview of the mutual fund market with a focus on the United States of America and the global debt market. Following, the current literature on ratings, bond funds performance, bond funds investing behaviour and associated risks is outlined.

2.1 Background

The total net assets of registered investment companies sum globally up to USD 55 trillion in 2020, accounting for 27 per cent of the global financial market capital. The open-end funds in the United States of America manage currently USD 26 trillion (ICI 2020), representing 47 per cent of the global total net assets. The majority, USD 21 trillion, is managed by mutual funds allocating 22 per cent of the capital into bonds. The bond mutual funds capital increased between 2010 and 2019 by USD 2.2 trillion through net inflows and reinvested dividends reaching currently around USD 4.6 trillion (ICI 2020). Due to the size, the bond mutual funds play an important role within the corporate bond market (Falato, Goldstein and Hortaçsu 2020).

The global debt market increased tremendously in size since the GFC, reaching the potential to affect financial stability (Abraham, Cortina and Schmukler 2020). The overall market grew from 292 per cent of the world gross domestic product (GDP) in 2008 to 321 per cent of GDP in 2019 (ICI 2020). The main driver for the growth is the government and non-financial corporate debt. While the government debt is seen as less risky, the non-financial corporate debt is recognised as riskier, increasing from 78 per cent in 2008 to 91 per cent of GDP in 2019 (IIF 2020). Within the non-financial corporate debt, the increase in emerging markets was the strongest (IIF 2020). The financial sector and the household debt did not contribute to the build-up in the post-crisis period, while they were important drivers in the pre-crisis period (Abraham, Cortina and Schmukler 2020).

Taking a closer look at the corporate debt quality, one recognises the riskiness of the individual bonds increased, elevating the risk of the global debt market (Demirtaş, Çelik and Isaksson 2020). Since 2010, the share of non-investment-grade bond issuance was 20 per cent or above, peaking in 2019 at 25 per cent. This represents the most extended period with such a high proportion of non-investment grade bonds issuances since 1980 (Demirtaş, Çelik and Isaksson 2020). Additionally, the share of BBB rated bonds, the lowest possible investment-grade rating category, reached 51 per cent of all investment-grade bond issuances in 2019. In contrast, the fraction during the period before the GFC was at about 39 per cent. Due to the increased share of bonds close to the crossing line between investment and non-investment-grade ratings, the rating agencies seem to be more cautious about rating downgrades from investment-grade to high yield (Demirtaş, Çelik and Isaksson 2020). This hypothesis is supported by the fact that the downgrade frequency of BBB rated bonds decreased in recent time, reaching the lowest probability for one-notch downgrades within one year (Demirtaş, Çelik and Isaksson 2020). Besides the lower ratings and adjustment frequency of the bonds, the median leverage ratio per investment-grade rating elevated compared to ten years ago. The maturity increased over the last five years to an average time to maturity of about 12 years, which was at the beginning of the 2000s at about nine years. (Demirtaş, Çelik and Isaksson 2020).

To summarise, the bond mutual funds are an important player in a corporate bond market, which increased significantly in size but lost on average quality, increasing the average bond risk.

2.2 Related work

The credit risk ratings provided by rating agencies are a key characteristic in the corporate debt market. However, the credit risk ratings from the major players have some flaws. According to Griffin and Tang (2011), the rating agencies played an important role in the GFC, contributing to huge losses due to inflated ratings for structured securities. Despite the opinion in academia and regulation about the inherited flaws of ratings, the fixed income industry relies still heavily on these credit risk ratings and increased the use since the GFC (Baghai, Becker and Pitschner 2018). New findings also indicate risk misrepresentation via credit ratings from bond mutual funds. These funds misclassify the holdings indicating to hold more investment-grade bonds than they do. The perceived lower risk of these fund enables them to outperform the peers, impacting the fund's capital (Chen, Cohen and Guruun 2020). Therefore, the ratings are a good approximation of credit risks but could still be a biased risk estimator.

The performance of funds is, besides the risk, another key characteristic affecting the behaviour and decisions of investors. The research regarding performance increased since the availability of holdings on the security level, enabling analysis of the portfolio composition and the skill of the asset manager. The ability of superior selecting abilities was not proven in contrast to equity funds (Cici and Gibson 2012). The timing ability by bond funds did demonstrate none or weakly positive effects creating an underperformance after costs (Chen, Ferson and Peters 2010, Cici and Gibson 2012). The concentration of the portfolio regarding industries and credit ratings is another analysed performance driver. The findings show positive abnormal returns for concentrated investment-grade bond fund portfolios (Qin and Wang 2021). Though the finding indicates that portfolio construction is a crucial performance driver as the ability to generate higher return through superior selection is limited.

Since the GFC, the fund manager adapted to the limited possibility to outperform through superior selection and engaged in advanced portfolio construction. One of the behaviours the fund managers engaged in is reaching for yield (RFY). RFY is a form of additional risk-taking, which rarely materialises, increasing the overall portfolio risk by investing in higher-yielding bonds. The mutual bond funds engaging in RFY tend to generate higher returns and attract more inflows. Though, the risk-adjusted return of these funds is negatively affected by the investment behaviour (Choi and Kronlund 2018). In addition, the future returns of the bonds used in RFY are lower in a low-interest-rate environment (Chen and Choi 2019). Hence, RFY adds short term returns to the fund to the cost of additional risk, which is not disclosed to the public.

The risk of the bond funds and possible consequences of the risk materialisation received elevated interest since the GFC as the funds were seen as a potential reason for fragility. The major concern is caused by the liquidity mismatch of the underlying assets, the corporate bonds, and the invested capital. While the corporate bonds are sometimes not traded for weeks, the investors can redeem the capital at any day, receiving the quoted net asset value and implying liquidation costs on the remaining investors (Goldstein, Jiang and Ng 2017). These costs generate the incentive for a bank run (Diamond and Dybvig 1983) like scenario as the investors are incentivised to redeem the capital first. Additionally, forced selling of large bond funds can lead to downward pressure on the corporate bond price (Goldstein, Jiang and Ng 2017), as demonstrated by Ellul, Jotikasthira and Lundblad (2011) for insurance companies. The mentioned effects can lead to fire-sales spilling over from one fund to other funds (Falato, Hortacsu, et al. 2019), affecting financial stability.

To summarise, the credit ratings are possibly a flawed estimator for credit risk, and the bond funds engage in advanced portfolio construction, increasing undisclosed risks. The materialisation of the risks has the potential to cause fire-sales and impact financial stability.

3. Data sample and descriptive statistics

This chapter gives an overview of the data samples used for the analysis. The data and source are discussed, followed by an outline of the data preparation. The final data is presented by giving an overview of the developments of the Morningstar categories and critical variables.

3.1 Sample overview

The first dataset for the analysis was originally retrieved from the Mornings Star database. The data contains 1,550 fixed income funds that are domiciled in the United States of America. The reporting frequency of the individual funds varies, with the majority reporting monthly or quarterly. The original period of the data set is from January 31st, 2003, until October 24th, 2019, whereas the available date in 2019 decreased.

The second dataset was retrieved initially from the Mornings Star database containing several key characteristics of the individual fixed-income funds on fund or share level. The characteristics include net flow, fund expense ratios, fund return, fund size, share size and the Morningstar category. The data is mainly monthly provided, which are reported on an annual basis. The original period starts on January 1st, 1990 and ends on March 1st, 2020.

The third dataset was retrieved from the Wharton Research Data Service, more precise from the Mergent Fixed Income Securities Database. The primary dataset contains the initial ratings and rating adjustments by the three leading credit rating agencies (Moody's, Fitch, S&P) for more than 400,000 bonds, while the minor dataset includes closer information about the product types. The original period is from January 1St, 2000, until December 31st, 2019, while the data availability decreases in the last year.

3.2 Data preparation

The datasets were not in a standardised structure; therefore, the individual datasets were brought in common shape for merging. The Mergent Fixed Income Securities Database ratings were converted into a monthly time series for each credit rating agency. The individual ratings were translated to numerical values using the scale seen in Table 1 following Avendano, Gaillard and Nieto-Parra (2011). These three rating series were combined by averaging the ratings. The average rating series were filtered for corporate bonds through the minor dataset.

The Morning Star dataset containing the fund specific information was cleaned to overcome inconsistencies in the data due to varying reporting frequencies and multiple reporting. The individual bonds were filtered for corporate bonds and aggregated on a monthly basis on the fund level using asset-weighted averages. The aggregated key characteristics and ratings were merged with the fund information to set up the datasets. Due to missing monthly values, the data was filtered respectively aggregated to a quarterly series.

The dataset, which is described in chapter 3.3, were filtered for extreme outliers and apparently erroneous. The funds categorised of preferred share funds were excluded due to the underlying strategy focusing on preferred and perpetual bonds (Morningstar 2016). After creating additional variables using up to two lags, the funds with four or fewer entries representing up to one year were removed (Qin and Wang 2021). The minimum portfolio weight of corporate bonds in the overall portfolio was set to 20 per cent, similar to the procedure of Qin and Wang (2021). The remaining outliers in the quarterly return, expense ratio and net flow ratio were winsorised at the 1 and 99 per cent level to mitigate the influence, which is a standard practice in the literature (Goldstein, Jiang and Ng 2017).

3.3 Data description

The dataset provides 27,430 elements from the beginning of 2004 until the third quarter of 2019, with an increasing number of observations until 2019. Over this period, the data of 949 fixed-income funds categorised in nine Morningstar categories are provided, while 642 was the highest available number of funds in one year, as seen in Table 2.

The Morningstar categories show, besides the intermediate core bonds and bank loans, a coherent development over time, as seen in Figure 1. The biggest category within the dataset is the high yield bond funds, increasing the number of funds from 109 in 2004 to 164 in 2018, as seen in Table 3. The number of short-term bond funds increases from 62 in 2004 to 114 in 2018, whereas the number of intermediate core bond funds increased in the same period only from 91 to 96. The recorded intermediate core-plus bond funds rose from 32 in 2004 to 110 in 2018. The funds following a corporate bond and multisector bond strategy increased from 19, respectively, 15 in 2004 to 47, respectively, 55 in 2018. The long-term bond fund rose from 4 recorded funds in 2004 to 14 funds in 2018. The fastest-growing strategy were the non-traditional bond funds increasing from 3 funds in 2004 to 34 funds in 2018. The observed bank loans funds were one or two over the whole period and, therefore, left out for the individual fund type-specific analyses. All funds together increased by 300, reaching 636 in 2018. The summary statistics regarding the fund types are reported in Table 3 and Table 4.

The average rating of the bond funds shows some variation over time, as seen in Figure 2 using quarterly data. The rating of the 25th percentile increased from 7.44 in 2004 to 8.81 in 2019, representing a rating increase from B2 (B) to Ba3 (BB-) scaled using Table 1. The median of the bond funds rating decreased starting in 2004 from 13.42 (Baa2/BBB) until 2007, reaching 12.00 (Baa3/BBB-). The overall peak is reached in 2009 with a value of 15.23 representing A3 (A-). Since then, the median decreased and arrived in 2019 at 13.03, representing the initial median rating Baa2 (BBB) with a slightly lower score. The 75th percentile rating decreased from 15.30 (A3/A-) in 2004 to 14.07 (Baa1/BBB+) in 2019, while showing an increase in 2008 and 2009, similar to the median ratings. The development indicates a narrowing between the 25th percentile and 75th percentile at the crossing line between investment-grade and high yield.

The average time until maturity of the bond funds demonstrated a widening between the 25th and 75th percentile. While the 25th percentile of the time to maturity decreased over time from above five to around four years with a peak in 2007, the 75th percentile increased over time from eight and a half to around nine years with even higher levels between 2006 and 2017. The median decreased over time from above seven years to slightly above six years.

The corporate bond portfolio share of the overall portfolio stays relatively constant over time, with a median of 48 per cent and few variations in the 25th or 75th percentile. The quarterly return varies over time, with the highest variation during and after the GFC, as seen in Figure *2*Table *2*. The average coupons decreased over time from seven per cent in 2004 to five per cent in 2019. The quarterly expense ratio also decreased from 26 bps in 2004 to 19 bps in 2019. The summary statistic describing the development and distribution of the aggregated variable on the fund level is reported in Table 2.

To summarise, within the bond funds, the high yield bond is the biggest fund type. The average ratings approach the crossing line between investment-grade and high yield, while the maturity slightly increased.

4. Hypothesis development

The section focuses on developing the hypothesis for the empirical analysis based on the underlying literature and proven characteristics.

The hypotheses are based on the theory that the credit risk exposure of bond funds can be analysed by determining the effect size of credit risk changes on the bond fund's key characteristics. The reactions materialise in our analysis either on the return or on the net flow ratio. Focusing on these two variables and the response of these key variable on the change in the credit risk enables us to conclude on the credit risk exposure of the bond funds.

Fama and French (1993) showed the effect of the credit ratings on the return of bonds. This finding is evidence for the underlying relationship between the credit risk and the return. Building on this relationship, one expects the return of bond funds to be affected by changes in the credit rating as the price of a bond adjusts to changes in key characteristics delivering short-term returns. Therefore, the stronger the relationship of the rating change to the return, the bigger the credit risk exposure of the fund. This credit risk exposure is expected to have increased over time due to the characteristics and quality changes of the average bond, as described in 2.1. This leads to the first hypothesis.

> **Hypothesis 1:** The credit risk exposure of the bond funds increased over time, manifesting in the increasing reaction towards the return in response to rating changes.

Feroli et al. (2014) found evidence for the interaction of mutual fund flows with price changes generated through the policy changes. Though, one can expect to see a similar behaviour caused by price changes through the credit rating change, enabling us to analyse the credit risk exposure using the relationship between the rating changes and the net flow ratio. The net flow ratio is expected to react stronger for a portfolio with a higher credit risk exposure for a rating change. This credit risk exposure is expected to have increased over time due to the characteristics and quality changes of the average bond, as described in 2.1. This leads to the second hypothesis.

> **Hypothesis 2:** The credit risk exposure of the bond funds increased over time, manifesting in the increasing reaction towards the net flow ratio in response to rating upgrades and downgrades.

The investors of bonds vary with the characteristics of the bonds. The investors in investment-grade rated bonds are expected to be rather risk-averse and sensitive towards risk changes as the upside-potential of the bond is limited. In contrast, investors of high yield bonds are expected to be less risk-averse and sensitive towards changes in the risk profile of the bond as the upside potential of the bond is higher. Therefore, one can expect the return of investment-grade focused bond funds to react stronger to the change in the credit risk than high yield focused bond funds. This leads to the third hypothesis.

> **Hypothesis 3:** The credit risk exposure measured through the relationship between the rating change and the return tends to be stronger for investment-grade focused bond funds.

Following up on the above idea, that the credit risk exposure of the investment-grade focused bond funds indicates to be stronger than for high yield focused bond funds, one would expect the net flow ratio also to react stronger in response to the change in the rating for investment-grade focused bond funds. The reasoning is that the investment-grade focused bond funds are seen as an investment with low risk, for which investors are more sensitive towards risk increases, whereas the high yield focused bond funds are riskier, for which investors are less sensitive to increased risk and rather focused on profits. This leads to the fourth hypothesis:

> **Hypothesis 4:** The credit risk exposure measured through the relationship between the rating change and the net flow ratio tends to be stronger for investment-grade focused bond funds.

5. Empirical Results

This chapter provides an overview of the empirical findings of the study. A set of regression models was developed to investigate the impact of the credit risk exposure on the bond fund market in the context of time and individually for each bond fund type in the post-GFC period.

5.1 The credit risk exposure on the return over time

The first hypothesis claims that the bond funds demonstrate over time an increasing credit risk exposure manifesting in the increasing reactions of the return to rating changes. This hypothesis is tested in a temporal context dividing the analysed period in the period before the GFC, the GFC and after the GFC. The corresponding regression equation, which considers fund-specific control variables, can be formulated as follows:

$$\begin{aligned} r_{i,t} = \beta_0 &+ \beta_1 \Delta Rating\ Upgrade\ pre-GFC_{i,t} + \beta_2 \Delta Rating\ Upgrade\ GFC_{i,t} \\ &+ \beta_3 \Delta Rating\ Upgrade\ post-GFC_{i,t} \\ &+ \beta_4 \left|\Delta Rating\ Downgrade\ pre-GFC_{i,t}\right| \\ &+ \beta_5 \left|\Delta Rating\ Downgrade\ GFC_{i,t}\right| \\ &+ \beta_6 \left|\Delta Rating\ Downgrade\ post-GFC_{i,t}\right| + \beta_7 Rating\ pre-GFC_{i,t} \\ &+ \beta_8 Rating\ GFC_{i,t} + \beta_9 Rating\ post-GFC_{i,t} \\ &+ \beta_{10} \frac{NetFlow_{i,t-1}}{Market\ Value_{i,t-2}} + \beta_{11} Expense\ Ratio_{i,t-1} \\ &+ \beta_{12} Portfolio\ Weight_{i,t-1} + \beta_{13} \ln Market\ Value_{i,t-1} \\ &+ \beta_{14} \ln Maturity_{i,t-1} + \beta_{15} \ln Fund\ Age_{i,t-1} + \epsilon_{i,t} \end{aligned} \tag{1}$$

With $i = 1,\ldots,n;\ t = 1,\ldots,T$

Table 5 illustrate the regression results, which are based on style (according to the Morningstar category) and time fixed effects; the standard errors are clustered at the fund and time level.

The overall market, model (1), shows only a significant relationship at a 1 per cent significance level between the rating upgrade and the return during the GFC. The upgrade by one-notch decreases the return by 0.9 per cent. The rating downgrade is significant for the time during and after the GFC at a 5 per cent significance level. The relationship is negative and weaker in the period after the GFC as the return decreases by 1.5 per cent during and by 0.3 per cent after the GFC for a one-notch downgrade. The investment-grade rated bond funds, model (2), show the same relationship with a 0.9 per cent return decrease for a one-notch rating upgrade during the GFC. The significance level is at 10 per cent. The rating downgrade has a significant effect during and after the GFC, where the significance level is at 10 and 1 per cent. The influence weakens as the return decreases by 1.2 per cent during and by 0.2 per cent after the GFC for a one-notch downgrade. The high yield rated bond funds, model (3), demonstrate a significant positive relationship during the GFC between the rating upgrade and the return, with the return increasing by 0.6 per cent for a one-notch upgrade. The significance is at a 10 per cent level. Besides, the rating downgrade is significant in the period after the GFC. The significance level is at 1 per cent, and the return decreases by 0.6 per cent for a one-notch downgrade. The bonds rated BBB or BB, model (4), show only a significant relationship at a 1 per cent significant level between the rating downgrade and the return in the post-GFC period decreasing the return by 0.3 per cent for a one-notch downgrade.

The rating upgrade does not seem to have a major influence on the return of bond funds. The influence was only significant in the period during the GFC, where the return of high yield graded bond funds increased in response to an upgrade. The overall market and investment-grade rated bond funds showed a negative effect, which is weaker than the one generated through a downgrade in the same period, reducing the loss. The rating downgrades have a more substantial and persistent effect. The return of the overall market and the investment-grade rated bond funds suffered during the GFC per one-notch rating downgrade a reduced return of 1.5 and 1.2 per cent. In the post-GFC period, all samples prove a negative relationship between rating downgrades and the return. The strongest return decrease per one-notch rating downgrade is found for high yield rated bond funds with a 0.6 per cent decrease. The reaction of the overall market, the investment-grade and BBB and BB-rated bond funds decreased after the GFC to 0.30, 0.20 and 0.30 per cent reduced return per one-notch rating downgrade. The reaction of the overall market and the investment-grade rated bond funds decreased after the GFC to 0.30 and 0.20 per cent reduced return per one-notch rating downgrade, whereas the BBB and BB-rated bond funds show a 0.30 per cent decreased return for a one-notch downgrade.

The results suggest compared to the GFC, a broader but lower credit risk exposure measured through the increased and consistent reaction of the return towards rating downgrades, with high yield rated bond funds being exposed the most. The rating upgrades do not show a persistent or increasing relationship towards the return, indicating the credit risk reveals primarily through rating downgrades. To summarise, the credit risk exposure increased compared to the pre-GFC period but lost in intensity compared to the GFC, which leads to a decline of the first hypothesis.

5.2 The credit risk exposure on the net flow over time

The second hypothesis proposes that the credit risk exposure increases over time, increasing the reaction of the net flow ratio in response to rating changes. This hypothesis is tested in a temporal context dividing the analysed period in the period before the GFC, the GFC and after the GFC. The corresponding regression equation, which considers fund-specific control variables, can be formulated as follows:

$$
\begin{aligned}
\frac{NetFlow_{i,t}}{Market\ Value_{i,t-1}} &\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad (2)\\
&= \beta_0 + \beta_1 \Delta Rating\ Upgrade\ pre-GFC_{i,t} \\
&+ \beta_2 \Delta Rating\ Upgrade\ GFC_{i,t} + \beta_3 \Delta Rating\ Upgrade\ post-GFC_{i,t} \\
&+ \beta_4 |\Delta Rating\ Downgrade\ pre-GFC_{i,t}| \\
&+ \beta_5 |\Delta Rating\ Downgrade\ GFC_{i,t}| \\
&+ \beta_6 |\Delta Rating\ Downgrade - post\ GFC_{i,t}| + \beta_7 Rating\ pre-GFC_{i,t} \\
&+ \beta_8 Rating\ GFC_{i,t} + \beta_9 Rating\ post-GFC_{i,t} \\
&+ \beta_{10} Pos. Quarterly\ Return_{i,t-1} \\
&+ \beta_{11} |Neg. Quarterly\ Return_{i,t-1}| + \beta_{12} \frac{NetFlow_{i,t-1}}{Market\ Value_{i,t-2}} \\
&+ \beta_{13} Expense\ Ratio_{i,t-1} + \beta_{14} Portfolio\ Weight_{i,t-1} \\
&+ \beta_{15} \ln Market\ Value_{i,t-1} + \beta_{16} \ln Maturity_{i,t-1} \\
&+ \beta_{17} \ln Fund\ Age_{i,t-1} + \epsilon_{i,t}
\end{aligned}
$$

With $i = 1, \ldots, n;\ t = 1, \ldots, T$

Table 6 illustrate the regression results, which are based on style (according to the Morningstar category) and time fixed effects; the standard errors are clustered at the fund and time level.

The overall market, model (1), demonstrates a significant relationship between the rating upgrade and the net flow ratio in the pre-and post-GFC period at a 5, respectively, 1 per cent significance level. The relationships indicate an increase in the net flow ratio of 5.4 per cent pre-GFC and 7.1 per cent post-GFC for a one-notch upgrade. The rating downgrade shows a significant effect on the net flow ratio at a 1 per cent significance level for the GFC and post-GFC period with a decrease in the net flow ratio of 14.7, respectively, 4.9 per cent for a one-notch downgrade. The investment-grade rated bond funds, model (2), show only a significant relationship between the rating upgrade and the net flow ratio in the period after the GFC. The significance is at a 1 per cent level with an increase in the net flow ratio of 5.8 per cent for a one-notch upgrade. The rating downgrades demonstrate significant effects on the net flow ratio for all periods. The significance levels for the period before, during and after the GFC are at 1, 1 and 5 per cent with net flow ratio decreases of 4.6, 15.3 and 4.4 per cent for a one-notch downgrade. The high yield rated bond funds, model (3), shows a significant relationship between the rating upgrade and the net flow ratio for the per-and post-GFC period. The relationship is significant at a 1 per cent significance level, increasing the net flow ratio by 10.7 and 10.0 per cent for a one-notch upgrade. The rating downgrade influences the net flow ratio significantly during and after the GFC at a significance level of 1 and 5 per cent. The net flow ratio decreases by 10.1 and 4.3 per cent in response to a one-notch downgrade during, respectively, after the GFC. The BBB and BB-rated bond funds, model (4), demonstrate a significant effect of the rating upgrade on the net flow ratio in the post-GFC period. The significance level is at 1 per cent, and the net flow ratio increases by 7.3 per cent for a one-notch upgrade. The rating downgrade shows a significant relationship to the net flow ratio during and after the GFC at a significance level of 1 per cent. The net flow ratio decreases by 17.8, respectively, 4.8 per cent for a one-notch downgrade during and after the GFC.

The positive relationship between the rating upgrade and the net flow ratio has increased, primarily in the investment-grade environment, reaching post-GFC a 5.8 per cent increase per a one-notch rating upgrade for investment-grade rated bond funds. The increasing effect spilt over to the overall market and the BBB and BB-rated bond funds, elevating the rating upgrade's effect. The relationship of the high yield rated bond funds was persistent in the pre-and post-GFC period, with an around 10 per cent increase in the net flow ratio for a one-notch rating upgrade. During the GFC, the relationship was not significant. The rating downgrade increased the influence significantly on all bond funds during the GFC and on the overall market, the high yield and BBB and BB-rated bond funds in the post-GFC period. The relationship for the investment-grade rated bond funds reached the pre-GFC level in the post-GFC period with a 4.4 per cent decrease in the net flow ratio for a one-notch rating downgrade. The effect was extraordinary during the GFC varying between a 10.1 per cent and 17.8 per cent decrease in the net flow ratio for a one-notch rating downgrade in the high yield and the BBB and BB-rated bond funds. The post-GFC downgrade effect is homogenous for all samples, with a decrease of 4.3 to 4.9 per cent in the net flow ratio for a one-notch rating downgrade.

The findings indicate an increasing credit risk exposure through the more substantial and coherent relation between the rating upgrade and the net flow ratio. The relationship between the rating downgrades and the net flow ratio indicates a more persistent and stronger relationship compared to the pre-GFC period, but a lower one compared to the GFC. This finding implies less credit risk exposure compared to the GFC, leading to a decline of the hypothesis.

5.3 The credit risk exposure on the return per bond fund type

The third hypothesis claims that the credit risk exposure, measured through the return reaction in response to a rating change, of the investment-grade bond focused funds is higher than the credit risk exposure of the high yield focused bond funds. The hypothesis is tested by running individual regressions for each of the eight tested bond fund types. The corresponding regression equation, which considers fund-specific control variables, can be formulated as follows:

$$\begin{aligned} r_{i,t} = {} & \beta_0 + \beta_1 \Delta Rating\ Upgrade_{i,t} + \beta_2 |\Delta Rating\ Downgrade_{i,t}| + \beta_3 Rating_{i,t} \\ & + \beta_4 \frac{NetFlow_{i,t-1}}{Market\ Value_{i,t-2}} + \beta_5 Expense\ Ratio_{i,t-1} \\ & + \beta_6 Portfolio\ Weight_{i,t-1} + \beta_7 \ln Market\ Value_{i,t-1} \\ & + \beta_8 \ln Maturity_{i,t-1} + \beta_9 \ln Fund\ Age_{i,t-1} + \epsilon_{i,t} \end{aligned} \tag{3}$$

With $i = 1, \ldots, n;\ t = 1, \ldots, T$

Table 7 illustrate the regression results, which are based on time fixed effects; the standard errors are clustered at the fund and time level.

The intermediate core bond funds, model (1), shows no significant relationship between the rating upgrade and the return. The rating downgrade shows a significant effect on the return at a 5 per cent significance level. The return decreases by 0.1 per cent for a one-notch downgrade.

The intermediate core-plus bond funds, model (2), demonstrates a significant effect at a 5 per cent significance level of the rating upgrade on the return. The return decreases by 0.2 per cent for a one-notch upgrade. The rating downgrade by one-notch reduces the return also by 0.2 per cent with a significance level of 10 per cent. The long-term bond funds, model (3) and corporate bond funds, model (4), do not show any significant results regarding credit rating changes. The high yield bond funds, model (5), prove a significant relationship between rating downgrades and the return at a 10 per cent significance level reducing the return by 0.6 per cent for a one-notch downgrade. The multisector bond funds, model (6), do not show any significant results regarding credit rating changes. The short-term bonds funds, model (7), demonstrate a significant relationship between the rating downgrade and the return at a 5 per cent significance level. The return decreases by 0.1 per cent for a one-notch downgrade. The non-traditional bond funds, model (8), do not show significant relationships between the return and credit rating related variables.

The intermediate core bonds represent mainly investment-grade bonds (Morningstar 2021a), demonstrating a similar picture as the investment-grade rated bond funds in the first analysis. The rating downgrade negatively affects the returns by 10 bps for each one-notch downgrade. The intermediate core-plus bonds follow a similar strategy as the intermediate core bonds but with a higher degree of flexibility regarding non-core bonds, resulting in a riskier portfolio (Morningstar 2021b). The one-notch rating upgrade and downgrade lead to the same effect for this fund type, a return decrease of 20 bps. The long-term bond funds invest mainly in long term bond with an investment-grade rating, leading to high interest-rate sensitivity and less sensitivity towards credit risk (Morningstar 2016). Therefore, no significant relationship is found. The corporate bond funds invest primarily in corporate bonds with a flexible but limited portion of high yield bonds, indicating no relationship between rating changes and the return. The high yield bond funds invest primarily in high yield or not rated bonds, resulting in a risky portfolio. The fund's return decreases by 60 bps for a one-notch rating downgrade, giving a similar result as the high yield rated bond funds seen in the first analysis. The multisector bond funds hold various fixed income instruments with a variable portion of high yield or not rated bonds, which can even be dominating. The return of the fund does not show any significant interaction with the rating changes. The short-term bond funds invest mainly in investment-grade bonds with short maturity, exposing the fund to less interest rate risk. The return of the fund decreases by 10 bps for a one-notch downgrade, demonstrating a higher exposure to credit risk. The non-traditional bond funds do not show a relationship to rating changes. This could be due to the variety of strategies within the category and the alternative investment approach of these strategies (Morningstar 2016).

The results suggest that investment-grade focused bond funds without long duration strategies and the high yield bond funds are significantly exposed to credit risk, with the high yield bond fund being exposed the most. The fund types having a mixed portfolio between investment-grade and high yield or a long duration strategy do not indicate credit risk exposure. To summarise, the hypothesis cannot be confirmed as the high yield bond funds are exposed to the most credit risk.

5.4 The credit risk exposure on the net flow per bond fund type

The fourth hypothesis proposes that the credit risk exposure, measured through the reaction of the net flow ratio in response to a rating change, is stronger for the investment-grade focused bond funds. The hypothesis is tested by running individual regressions for each of the eight tested bond fund types. The corresponding regression equation, which considers fund-specific control variables, can be formulated as follows:

$$
\begin{aligned}
\frac{NetFlow_{i,t}}{Market\ Value_{i,t-1}} &= \beta_0 + \beta_1 \Delta Rating\ Upgrade_{i,t} + \beta_2 |\Delta Rating\ Downgrade_{i,t}| \\
&+ \beta_3 Rating_{i,t} + \beta_4 Pos.Quarterly\ Return_{i,t-1} \\
&+ \beta_5 |Neg.Quarterly\ Return_{i,t-1}| + \beta_6 \frac{NetFlow_{i,t-1}}{Market\ Value_{i,t-2}} \\
&+ \beta_7 Expense\ Ratio_{i,t-1} + \beta_8 Portfolio\ Weight_{i,t-1} \\
&+ \beta_9 \ln Market\ Value_{i,t-1} + \beta_{10} \ln Maturity_{i,t-1} \\
&+ \beta_{11} \ln Fund\ Age_{i,t-1} + \epsilon_{i,t}
\end{aligned} \tag{4}
$$

With $i = 1, \ldots, n;\ t = 1, \ldots, T$

Table 8 illustrate the regression results, which are based on time fixed effects; the standard errors are clustered at the fund and time level.

The intermediate core bonds, model (1), show a significant relationship at a 1 per cent significance level between the rating downgrade and the net flow ratio. The net flow ratio decreases by 12.8 per cent in response to a one-notch upgrade. The intermediate core-plus bond funds, model (2), demonstrate a significant effect of the rating upgrade on the net flow ratio, increasing the net flow ratio by 7.8 per cent for a one-notch upgrade. The corresponding significance level is at 10 per cent. The long-term bond funds, model (3), proves a significant effect of the rating downgrades on the net flow ratio at a 10 per cent significance level, which decreases the net flow ratio by 20.6 per cent for a one-notch downgrade. The corporate bonds funds, model (4), show a significant relationship at a 1 per cent significance level between the rating upgrade and the net flow ratio. The net flow ratio increases by 20.7 per cent for a one-notch upgrade. The high yield bond funds, model (5), demonstrate a significant effect of the rating upgrades on the net flow ratio at a 1 per cent significance level. The response of the net flow ratio to a one-notch upgrade is an increase by 8.9 per cent. The multisector bond funds, model (6), show as the only sample a significant relationship to both rating related variables. The rating upgrade shows a positive relationship, increasing the net flow ratio by 6.2 per cent for a one-notch upgrade. The rating downgrade indicates a negative relationship with a decrease in the net flow ratio of 4.5 per cent for a one-notch downgrade. The respective significance levels are at 10 and 5 per cent. The short-term bond funds, model (7), prove a significant relationship between the rating downgrade and the net flow ratio at a significance level of 1 per cent. The net flow decreases by 9.1 per cent for a one-notch downgrade. The non-traditional bond funds, model (8), do not show any significant relationship between the net flow ratio and the rating related variables.

The intermediate core bond funds, investing primarily in investment-grade bonds (Morningstar 2021a), show only a significant relationship to a rating downgrade. The net flow ratio decreases by 12.8 per cent for a one-notch downgrade. The intermediate core-plus bond funds, with a similar but riskier portfolio than the intermediate core bond funds (Morningstar 2021b), react exclusively to rating upgrades. The net flow ratio increases by 7.8 per cent for a one-notch upgrade. The long-term bond funds with a portfolio of primarily investment-grade, long-term bond funds demonstrate a significant relationship with a rating downgrade. The rating downgrade by one-notch leads to a decrease in the net flow ratio of 20.6 per cent. The corporate bond funds, investing mainly in corporate bonds with flexibility towards riskier bonds, show only an effect of a rating upgrade on the net flow ratio. The net flow increases by 20.7 per cent for a one-notch upgrade. This result is, despite the high coefficient, significant at a 1 per cent significance level. The high yield bond funds, which mainly invest in high yield and not rated bonds, demonstrate a similar but weaker relationship. The net flow ratio of the fund increases by 8.9 per cent in response to a one-notch upgrade. The multisector bond funds hold a diversified portfolio of fixed-income instruments with high flexibility towards high yield and not rated bonds. The flexibility enables the portfolio to hold the majority share in below-investment-grade bonds. This portfolio construction leads to a significant relationship towards rating down-and upgrades. The one-notch rating upgrade increases the net flow ratio by 6.2 per cent, while the one-notch downgrade decreases the net flow ratio by 4.5 per cent. The short-term bond funds, holding a portfolio of primarily investment-grade bonds with short duration, demonstrate a relationship between the rating downgrades and the net flow ratio. The one-notch downgrade decreases the net flow ratio by 9.1 per cent. The non-traditional bond funds show, like the previous analysis, no relationship between rating related variables and the net flow ratio. This finding could be due to the various strategies within the category (Morningstar 2016).

The findings indicate that the net flow ratio of bond funds with dominating investment-grade bonds in the portfolio tends to be mainly affected by rating downgrades, while high yield dominated portfolios' net flow ratio tends to be influenced by rating upgrades. The findings show that investment-grade focused bond funds and high yield focused bond funds have a similar credit risk exposure, whereas the investment-grade focused bond funds are exposed to downside risk, and the high yield focused bond funds rather to upside chances. To summarise, we cannot confirm the hypothesis, as for investment-grade and high yield focused bond funds, the relationship indicating the risk exposure is similar in size but for the different rating changes.

6. Discussion

The credit risk exposure of the bond fund market increased in the overall exposure as more funds are affected by the credit risk. This counts for the return as well as the net flow ratio in response to a rating downgrade. The intensity increased compared to the pre-GFC period but decreased compared to the GFC. The downgrades during the GFC had a stronger effect for a one-notch downgrade on the return and the net flow ratio. The rating upgrade confirms the findings as the effect on the net flow increased, affecting the whole market with increased intensity except for the high yield rated funds, which stayed on the same level. Within the increased overall exposure, all bond fund types except the non-traditional bond funds are exposed to credit risk. The majority of the investment-grade focused bond funds demonstrate the exposure either through a decreased net flow ratio, a decreased return or both in response to a one-notch downgrade, with the intermediate core bond and short-term bond funds being the most at risk. The credit risk exposure for the high yield bond funds reveals through the strongest decline in the return to a rating downgrade and, as high yield focused bond funds, through an increased net flow after a rating upgrade. The credit risk exposure demonstrated through the rating upgrades are at a similar size as the downgrades affecting the investment-focused bond funds.

Focusing on the downside risk caused by the credit risk exposure, which is critical for potentially triggering a bank run like scenario, we can conclude that the downside credit risk exposure increased since the pre-GFC period. Compared to the GFC, the intensity of the individual bond's credit risk exposure decreased, but more bond funds demonstrate significant credit risk exposure. Within this broader exposure, the investment-grade focused bond funds and the high yield bond funds are the most at risk. To summarise, the critical downside risk of the credit risk exposure of the bond funds caused by corporate bonds strongly increased compared to the period before the GFC with the investment-grade focused bond funds and the high yield bond primarily being at risk.

7. Conclusion

The thesis addressed the credit risk exposure of bond funds in the period after the GFC, focusing on the size of the bond fund's credit risk exposure in a temporal context and determining the bond fund types within the marked being the most at risk.

The results of the empirical analysis of the 949 US fixed income funds from 2004 until 2019 indicate an increased credit risk exposure of the bond funds in the post-GFC period compared to the pre-GFC period. The manifestation of the increased credit risk exposure is measurable through the effect of rating changes on the return and the net flow ratio. The comparison between the GFC and post-GFC period does not allow a conclusion regarding the size of the credit risk exposure. The intensity of the credit risk exposure decreased in the post-GFC period, but more bond funds demonstrate significant effects of the rating change on the return. Within the credit risk exposure, the investment-grade focused bond funds and the high yield bond funds are the most at risk for increases in the credit risk. The credit risk exposure for the investment-grade focused bond funds manifests through a decrease in the net flow ratio and the return after a rating downgrade, while the high yield bond funds are primarily exposed to reduced returns. These findings indicate an increased likelihood to trigger the fragility mechanism through the credit risk exposure compared to the pre-GFC period. The investment-grade focused bond funds and the high yield bond funds are the crucial fund types expected to trigger this mechanism.

The empirical results give a good indication about the credit risk exposure of the bond funds, but additional research is needed to conclude with confidence about the bond funds situation after the GFC. The results of the return analysis could be made more robust by a risk adjustment of the return and the portfolio holdings of the SEC could be used to be independent of the correctness of the data provided by the financial institutes to Morningstar. Therefore, this thesis should serve as a start for further research in the credit risk exposure, completing our understanding of the current market environment and the risk for financial stability caused by the bond fund market.

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9. Appendix

9.1 Variable directory

Abbreviation	Definition
Return:	The quarterly return of the fund i at the time t as a decimal number.
Net Flow Ratio:	The quarterly flow of the fund i at the time t divided by the market value of the fund i at the time t-1.
Rating:	The rating of the fund i representing the market-weighted average of the underlying bond ratings, which are the average rating of the main rating agencies (Moody's, Fitch, S&P), at time t.
Rating pre-GFC	The rating of the fund i representing the market-weighted average of the underlying bond ratings, which are the average rating of the main rating agencies (Moody's, Fitch, S&P), at time t before December 2007.
Rating GFC	The rating of the fund i representing the market-weighted average of the underlying bond ratings, which are the average rating of the main rating agencies (Moody's, Fitch, S&P), at time t between December 2007 and June 2009.
Rating post-GFC	The rating of the fund i representing the market-weighted average of the underlying bond ratings, which are the average rating of the main rating agencies (Moody's, Fitch, S&P), at time t after June 2009.
Δ Rating Upgrade	The positive, measured rating upgrade of the fund i in time t compared to the previous quarter t-1.
Δ Rating Upgrade pre-GFC	The positive, measured rating upgrade of the fund i in time t before December 2007 compared to the previous quarter t-1.
Δ Rating Upgrade GFC	The positive, measured rating upgrade of the fund i in time t after December 2007 and before June 2009 compared to the previous quarter t-1.
Δ Rating Upgrade post-GFC	The positive, measured rating upgrade of the fund i in time t after June 2009 compared to the previous quarter t-1.
|Δ Rating Downgrade|	The absolute value of the measured rating downgrade of the fund i in time t compared to the previous quarter t-1.

|Δ Rating Downgrade pre-GFC|	The absolute value of the measured rating downgrade of the fund i in time t before December 2007 compared to the previous quarter t-1.
|Δ Rating Downgrade GFC|	The absolute value of the measured rating downgrade of the fund i in time t after December 2007 and before June 2009 compared to the previous quarter t-1.
|Δ Rating Downgrade post-GFC|	The absolute value of the measured rating downgrade of the fund i in time t after June 2009 compared to the previous quarter t-1.
Pos. Quarterly Return	The positive, quarterly return of the fund i at the time t as a decimal number.
|Neg. Quarterly Return|	The absolute value of the negative, quarterly return of the fund i at the time t as a decimal number.
Expense Ratio	The quarterly expense ratio of the fund i at time t in per cent.
Portfolio Weight	The portfolio shares of the overall portfolio invested in corporate bonds as a decimal number.
Ln Market Value	The logarithmical market value of the fund i in the period t.
Ln Maturity	The logarithmical average number of years until maturity of the bonds in the fund i in the period t.
Ln Age	The logarithmical number of years since interception of the first issued security within the fund i in the period t.

9.2 Tables

Table 1: Rating Transformation

This table reports the linear transformation applied to the ratings of the three main rating agencies (Moody's, Fitch, S&P). The scale follows the example of Avendano, Gaillard and Nieto-Parra (2011). The grade indicates the classification into investment-grade and speculative-grade. The description provides more details about the rating classes describing the quality of the bond rated accordingly.

Grade	**Scale**	**Moody's**	**Fitch**	**S&P**	**Description**
Investment Grade	**21**	Aaa	AAA	AAA	Highest quality
Investment Grade	**20**	Aa1	AA+	AA+	High quality
Investment Grade	**19**	Aa2	AA	AA	High quality
Investment Grade	**18**	Aa3	AA-	AA-	High quality
Investment Grade	**17**	A1	A+	A+	Strong payment quality
Investment Grade	**16**	A2	A	A	Strong payment quality
Investment Grade	**15**	A3	A-	A-	Strong payment quality
Investment Grade	**14**	Baa1	BBB+	BBB+	Adequate payment capacity
Investment Grade	**13**	Baa2	BBB	BBB	Adequate payment capacity
Investment Grade	**12**	Baa3	BBB-	BBB-	Adequate payment capacity
Speculative Grade	**11**	Ba1	BB+	BB+	Likely to fulfil obligations, ongoing uncertainty
Speculative Grade	**10**	Ba2	BB	BB	Likely to fulfil obligations, ongoing uncertainty
Speculative Grade	**9**	Ba3	BB-	BB-	Likely to fulfil obligations, ongoing uncertainty
Speculative Grade	**8**	B1	B+	B+	High credit risk
Speculative Grade	**7**	B2	B	B	High credit risk
Speculative Grade	**6**	B3	B-	B-	High credit risk
Speculative Grade	**5**	Caa1	CCC+	CCC+	Very high credit risk
Speculative Grade	**4**	Caa2	CCC	CCC	Very high credit risk
Speculative Grade	**3**	Caa3	CCC-	CCC-	Very high credit risk
Speculative Grade	**2**	Ca	CC	CC	Near default with the possibility of recovery
Speculative Grade	**2**	Ca	C	C	Near default with the possibility of recovery
Default	**1**	C	DDD	SD	Default
Default	**1**	C	DD	D	Default
Default	**1**	C	D	D	Default

Table 2: Summary statistics of the dataset

This table summarised the combined dataset from Morningstar and the Mergent Fixed Income Securities Database, including 949 US bond funds that hold at least 20 per cent of the portfolio for one year during the sample period from 2004 until 2019 in corporate bonds. The observations are aggregated on a quarterly basis and represent the average fund characteristics. The portfolio share, years until maturity, quarterly return, coupon, net flow ratio and expense ratio are calculated based on the Morningstar dataset. The rating is calculated based on the Mergent Fixed Income Securities Database matched on the bond level with the Morningstar dataset. The quarterly return, expense ratio and net flow ratio are winsorised at a 1 and 99 per cent level.

Year	**Overall**		**Portfolio Share**			**Rating**			**Years until Maturity**			**Quarterly Return**			**Coupon**	**NetFlow Ratio**			**Expense Ratio**
	Number	**Observations**	**p25**	**p50**	**p75**	**p25**	**p50**	**p75**	**p25**	**p50**	**p75**	**p25**	**p50**	**p75**	**p50**	**p25**	**p50**	**p75**	**p50**
2004	336	952	0.30	0.41	0.71	7.44	13.42	15.30	5.36	7.36	8.50	-0.01	0.01	0.03	0.07	-0.06	0.00	0.05	0.26
2005	358	1,186	0.29	0.44	0.79	7.56	12.80	15.20	5.67	7.39	8.57	-0.01	0.01	0.01	0.07	-0.08	-0.02	0.04	0.26
2006	344	1,174	0.29	0.49	0.79	7.63	12.19	14.76	6.26	7.42	9.14	0.00	0.02	0.03	0.07	-0.07	-0.01	0.06	0.26
2007	344	1,205	0.30	0.50	0.77	7.58	12.00	14.72	6.30	7.50	9.72	0.00	0.01	0.02	0.07	-0.06	-0.01	0.07	0.25
2008	378	1,295	0.30	0.50	0.75	7.92	13.20	15.09	5.65	6.83	9.37	-0.06	-0.02	0.01	0.06	-0.09	-0.02	0.03	0.24
2009	475	1,589	0.35	0.49	0.73	8.28	13.66	15.23	5.63	6.92	9.18	0.02	0.04	0.08	0.07	-0.03	0.04	0.19	0.24
2010	492	1,774	0.33	0.47	0.72	8.23	13.42	15.05	5.58	7.12	9.37	0.01	0.02	0.03	0.06	-0.05	0.01	0.11	0.23
2011	481	1,719	0.33	0.48	0.74	8.24	13.25	14.88	5.26	7.21	9.15	0.01	0.01	0.02	0.06	-0.05	0.01	0.08	0.22
2012	499	1,832	0.33	0.48	0.75	8.29	13.08	14.61	5.26	7.22	9.12	0.01	0.02	0.03	0.06	-0.03	0.03	0.12	0.22
2013	517	1,919	0.35	0.49	0.74	8.39	12.96	14.30	5.24	7.23	9.52	0.00	0.00	0.02	0.06	-0.08	-0.01	0.07	0.22
2014	562	2,070	0.33	0.48	0.73	8.45	12.91	14.24	5.00	7.15	9.93	0.00	0.01	0.02	0.05	-0.04	0.01	0.09	0.21
2015	615	2,285	0.33	0.47	0.73	8.70	12.96	14.27	5.01	7.07	9.95	-0.01	0.00	0.01	0.05	-0.07	-0.01	0.05	0.21
2016	607	2,285	0.33	0.47	0.73	8.70	13.13	14.29	4.82	7.07	10.02	0.01	0.02	0.03	0.05	-0.06	0.00	0.07	0.21
2017	642	2,293	0.33	0.49	0.75	8.62	13.14	14.30	4.48	6.88	9.65	0.01	0.01	0.02	0.04	-0.05	0.00	0.07	0.20
2018	636	2,343	0.32	0.48	0.75	8.87	13.15	14.21	4.05	6.43	9.04	-0.01	0.00	0.01	0.04	-0.08	-0.02	0.04	0.19
2019*	578	1,509	0.30	0.44	0.68	8.81	13.03	14.07	4.05	6.19	8.99	0.02	0.03	0.04	0.05	-0.05	0.00	0.07	0.19
Overall	949	27,430	0.32	0.48	0.74	8.27	13.09	14.54	5.15	7.10	9.35	0.00	0.01	0.02	0.06	-0.06	0.00	0.08	0.22

** The numbers are based on the data until the third quarter of 2019 and do not represent the whole year of 2019.*

Table 3: Summary statistics of the Morningstar Categories

This table summarised the development of the individual Morningstar categories within the Morningstar dataset, including 949 US bond funds that hold at least 20 per cent of the portfolio for one year during the sample period from 2004 until 2019 in corporate bonds. The numbers are calculated on a quarterly basis and represent all bond funds used for the analysis. The growth of the bond funds class is based on the quarterly observations of the number of bond funds per Morningstar category.

Year	**Intermediate Core Bond**		**Intermediate Core-Plus Bond**		**Long-Term Bond**		**Corporate Bond**		**High Yield Bond**		**Multisector Bond**		**Short-Term Bond**		**Non-traditional Bond**		**Bank Loan**	**Sum**
	Number	**Growth**	**Number**	**Growth**	**Number**	**Growth**	**Number**	**Growth**	**Number**	**Growth**	**Number**	**Growth**	**Number**	**Growth**	**Number**	**Growth**	**Number**	
2004	91	-	32	-	4	-	19	-	109	-	15	-	62	-	3	-	1	336
2005	94	3.30%	38	18.75%	5	25.00%	18	-5.26%	119	9.17%	19	26.67%	61	-1.61%	3	0.00%	1	358
2006	74	-21.28%	37	-2.63%	5	0.00%	19	5.56%	124	4.20%	23	21.05%	57	-6.56%	4	33.33%	1	344
2007	68	-8.11%	33	-10.81%	6	20.00%	22	15.79%	134	8.06%	24	4.35%	52	-8.77%	4	0.00%	1	344
2008	83	22.06%	42	27.27%	8	33.33%	24	9.09%	129	-3.73%	25	4.17%	62	19.23%	4	0.00%	1	378
2009	106	27.71%	76	80.95%	9	12.50%	25	4.17%	124	-3.88%	34	36.00%	91	46.77%	9	125.00%	1	475
2010	110	3.77%	77	1.32%	9	0.00%	27	8.00%	129	4.03%	34	0.00%	96	5.49%	9	0.00%	1	492
2011	94	-14.55%	76	-1.30%	9	0.00%	33	22.22%	127	-1.55%	37	8.82%	94	-2.08%	9	0.00%	2	481
2012	89	-5.32%	80	5.26%	9	0.00%	35	6.06%	133	4.72%	39	5.41%	96	2.13%	17	88.89%	1	499
2013	94	5.62%	82	2.50%	12	33.33%	40	14.29%	138	3.76%	39	0.00%	93	-3.13%	18	5.88%	1	517
2014	92	-2.13%	86	4.88%	14	16.67%	44	10.00%	153	10.87%	45	15.38%	107	15.05%	20	11.11%	1	562
2015	103	11.96%	99	15.12%	19	35.71%	42	-4.55%	158	3.27%	50	11.11%	113	5.61%	29	45.00%	2	615
2016	94	-8.74%	101	2.02%	19	0.00%	41	-2.38%	160	1.27%	50	0.00%	106	-6.19%	33	13.79%	3	607
2017	100	6.38%	104	2.97%	19	0.00%	43	4.88%	165	3.13%	57	14.00%	115	8.49%	37	12.12%	2	642
2018	96	-4.00%	110	5.77%	14	-26.32%	47	9.30%	164	-0.61%	55	-3.51%	114	-0.87%	34	-8.11%	2	636
2019*	86	-10.42%	102	-7.27%	14	0.00%	45	-4.26%	152	-7.32%	51	-7.27%	104	-8.77%	24	-29.41%	0	578
Average	92	0.42%	73	9.65%	11	10.02%	33	6.19%	139	2.36%	37	9.08%	89	4.32%	16	19.84%	1	492

** The numbers are based on the data until the third quarter of 2019 and do not represent the whole year of 2019.*

Table 4: Addition to summary statistics of the Morningstar Categories

This table summarised the key characteristics of the individual bond fund categories within the combined dataset from Morningstar and the Mergent Fixed Income Securities Database, including 949 US bond funds that hold at least 20 per cent of the portfolio for one year during the sample period from 2004 until 2019 in corporate bonds. The portfolio share, years until maturity, quarterly return, coupon and net flow are calculated based on the Morningstar dataset. The rating is calculated based on the Mergent Fixed Income Securities Database matched on the bond level with the Morningstar dataset. The quarterly return and net flow ratio are winsorised at a 1 and 99 per cent level.

	Intermediate Core Bond	**Intermediate Core-Plus Bond**	**Long-Term Bond**	**Corporate Bond**	**High Yield Bond**	**Multisector Bond**	**Short-Term Bond**	**Non-traditional Bond**	**Bank Loan**
	p50	**p50**	**p50**	**p50**	**p50**	**p50**	**p50**	**p50**	**p50**
Portfolio Share	0.32	0.34	0.53	0.75	0.79	0.37	0.40	0.39	0.52
Rating	14.61	13.25	14.93	13.76	7.71	10.43	14.82	11.92	7.32
Years until Maturity	7.87	9.47	22.78	10.12	6.82	8.54	2.91	6.60	5.97
Quarterly Return	0.01	0.01	0.02	0.01	0.02	0.01	0.01	0.01	0.01
Coupon	0.05	0.05	0.06	0.05	0.07	0.06	0.04	0.05	0.06
NetFlow Ratio	0.00	0.01	0.01	0.00	-0.01	0.00	0.01	0.02	-0.03

Table 5: Regression results for hypothesis 1

This table reports the results from the fixed effect regression of the return across the corporate bond funds, testing the intensity of the credit risk exposure over time. The observations are at the fund-quarter level. The dependent variable is the quarterly return of the individual bond funds. The independent variables are rating upgrades, rating downgrades and the rating, which are each divided into three variables representing the period before the GFC, the GFC, and the period after the GFC. The controls, including the net flow ratio, expense ratio, portfolio weight, logarithmical market value, logarithmical maturity, and logarithmical age, are lagged by one quarter. Respectively, these variables are described in the variable directory. Model (2), (3), and (4) are equivalent to model (1) with a reduced dataset. The standard errors are clustered at the fund and time level presented in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Regression results for Hypothesis 1

	Dependent variable:			
	Return			
	Overall Market	Investment Grade Funds	High Yield Funds	BBB and BB rated Funds
	(1)	(2)	(3)	(4)
Δ Rating Upgrade pre-GFC	-0.001	-0.002	-0.001	0.001
	(0.002)	(0.001)	(0.002)	(0.002)
Δ Rating Upgrade GFC	-0.009***	-0.009*	0.006*	-0.002
	(0.002)	(0.005)	(0.003)	(0.003)
Δ Rating Upgrade post-GFC	-0.002	-0.001	-0.002	-0.001
	(0.001)	(0.001)	(0.002)	(0.001)
|Δ Rating Downgrade pre-GFC|	-0.001	0.00005	-0.0003	-0.0001
	(0.001)	(0.001)	(0.001)	(0.001)
|Δ Rating Downgrade GFC|	-0.015**	-0.012*	-0.007	-0.013
	(0.007)	(0.006)	(0.005)	(0.009)
|Δ Rating Downgrade post-GFC|	-0.003**	-0.002***	-0.006***	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
Rating pre-GFC	-0.001*	0.0003	-0.001	-0.001
	(0.0005)	(0.001)	(0.001)	(0.0005)
Rating GFC	0.002	0.001	-0.0004	0.001
	(0.002)	(0.002)	(0.001)	(0.002)
Rating post-GFC	-0.001**	-0.001***	-0.001	-0.001*
	(0.001)	(0.0004)	(0.001)	(0.0005)
Net Flow Ratio (t-1)	-0.001	-0.002	0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Expense Ratio (t-1)	-0.004***	-0.004***	-0.001	-0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
Portfolio Weight (t-1)	0.001	0.002	-0.001	0.001
	(0.001)	(0.001)	(0.002)	(0.002)
Ln Market Value (t-1)	0.0001	0.0001	-0.0001	0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Ln Maturity (t-1)	0.001	0.002*	0.003*	0.002
	(0.001)	(0.001)	(0.002)	(0.001)
Ln Age (t-1)	-0.0002*	-0.001***	0.00005	-0.0005***
	(0.0001)	(0.0001)	(0.0002)	(0.0002)
Observations	27,430	17,038	10,392	12,801
R^2	0.607	0.651	0.890	0.714
Adjusted R^2	0.606	0.649	0.889	0.712
Residual Std. Error	0.016 (df = 27344)	0.012 (df = 16952)	0.011 (df = 10306)	0.012 (df = 12715)
Significance Levels				*p<0.1; **p<0.05; ***p<0.01

Note: All models include style (Morningstar category) as well as time fixed effects. In each regression model, the standard errors are clustered at the fund and time level.

Table 6: Regression results for hypothesis 2

This table reports the results from the fixed effect regression of the net flow ratio across the corporate bond funds, testing the intensity of the credit risk exposure over time. The observations are at the fund-quarter level. The dependent variable is the net flow ratio of the individual bond funds. The independent variables are rating upgrades, rating downgrades and the rating, which are each divided into three variables representing the period before the GFC, the GFC, and the period after the GFC. The controls, including the positive and negative return, net flow ratio, expense ratio, portfolio weight, logarithmical market value, logarithmical maturity, and logarithmical age, are lagged by one quarter. Respectively, these variables are described in the variable directory. Model (2), (3), and (4) are equivalent to model (1) with a reduced dataset. The standard errors are clustered at the fund and time level presented in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Regression results for Hypothesis 2

	Dependent variable:			
	Net Flow Ratio			
	Overall Market	Investment Grade Funds	High Yield Funds	BBB and BB rated Funds
	(1)	(2)	(3)	(4)
Δ Rating Upgrade pre-GFC	0.054**	0.025	0.107***	0.025
	(0.026)	(0.031)	(0.029)	(0.032)
Δ Rating Upgrade GFC	-0.016	-0.018	0.008	-0.014
	(0.014)	(0.011)	(0.034)	(0.044)
Δ Rating Upgrade post-GFC	0.071***	0.058***	0.100***	0.073***
	(0.017)	(0.018)	(0.032)	(0.021)
|Δ Rating Downgrade pre-GFC|	-0.012	-0.046***	0.019	-0.004
	(0.018)	(0.017)	(0.025)	(0.025)
|Δ Rating Downgrade GFC|	-0.147***	-0.152***	-0.101***	-0.178***
	(0.023)	(0.026)	(0.035)	(0.030)
|Δ Rating Downgrade post-GFC|	-0.049***	-0.044*	-0.043**	-0.048***
	(0.017)	(0.023)	(0.018)	(0.017)
Rating pre-GFC	-0.002	-0.008**	0.001	-0.001
	(0.002)	(0.003)	(0.005)	(0.004)
Rating GFC	-0.003	-0.0005	0.0003	-0.011**
	(0.003)	(0.003)	(0.005)	(0.005)
Rating post-GFC	-0.0003	0.001	0.001	-0.001
	(0.002)	(0.002)	(0.004)	(0.003)
Pos. Quarterly Return (t-1)	0.454	1.033**	0.910***	1.104**
	(0.305)	(0.485)	(0.299)	(0.450)
|Neg. Quarterly Return| (t-1)	-0.454	-1.257**	-0.763**	-0.685*
	(0.368)	(0.517)	(0.315)	(0.367)
Net Flow Ratio (t-1)	0.421***	0.407***	0.439***	0.470***
	(0.017)	(0.019)	(0.031)	(0.022)
Expense Ratio (t-1)	-0.005	-0.004	-0.021	-0.010
	(0.009)	(0.012)	(0.017)	(0.012)
Portfolio Weight (t-1)	0.064***	0.052**	0.077***	0.086***
	(0.020)	(0.025)	(0.023)	(0.026)
Ln Market Value (t-1)	0.002	0.004**	-0.003*	0.002
	(0.001)	(0.001)	(0.002)	(0.001)
Ln Maturity (t-1)	0.001	0.001	-0.002	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Ln Age (t-1)	-0.002***	-0.002***	-0.001***	-0.001***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)

Table 6: Regression results for hypothesis 2
(continued)

Observations	27,430	17,038	10,392	12,801
R2	0.239	0.234	0.294	0.293
Adjusted R2	0.236	0.230	0.288	0.289
Residual Std. Error	0.185 (df = 27342)	0.199 (df = 16950)	0.155 (df = 10304)	0.190 (df = 12713)
Significance Levels				*p<0.1; **p<0.05; ***p<0.01

Note: All models include style (Morningstar category) as well as time fixed effects. In each regression model, the standard errors are clustered at the fund and time level.

Table 7: Regression results for hypothesis 3

This table reports the results from the fixed effect regression of the return across the corporate bond funds, testing the intensity of the credit risk exposure on each bond fund type in the period after the GFC. The observations are at the fund-quarter level. The dependent variable is the quarterly return of the individual bond funds. The independent variables are rating upgrades, rating downgrades and the rating. The controls, including the net flow ratio, expense ratio, portfolio weight, logarithmical market value, logarithmical maturity, and logarithmical age, are lagged by one quarter. Respectively, these variables are described in the variable directory. Model (2) to (8) are equivalent to model (1) with a differently filtered dataset. The standard errors are clustered at the fund and time level presented in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Regression results for Hypothesis 3

	Dependent variable:							
	Return							
	Intermediate Core Bond	Intermediate Core-Plus Bond	Long-Term Bond	Corporate Bond	High Yield Bond	Multisector Bond	Short-Term Bond	Non-traditional Bond
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δ Rating Upgrade	-0.002	-0.002**	-0.001	0.003	-0.004	0.002	-0.0002	-0.001
	(0.002)	(0.001)	(0.007)	(0.002)	(0.003)	(0.001)	(0.001)	(0.002)
|Δ Rating Downgrade|	-0.001**	-0.002*	0.012	-0.002	-0.006*	-0.001	-0.001**	0.002
	(0.001)	(0.001)	(0.010)	(0.002)	(0.003)	(0.001)	(0.001)	(0.002)
Rating	-0.001***	-0.001*	-0.0003	-0.001**	-0.001	-0.001*	-0.001*	-0.0002
	(0.0004)	(0.0005)	(0.001)	(0.001)	(0.001)	(0.0004)	(0.0003)	(0.0003)
Net Flow Ratio (t-1)	-0.001*	0.0003	-0.001	-0.001	-0.0001	0.0001	-0.001	-0.002
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)
Expense Ratio (t-1)	-0.004**	-0.001	0.013	-0.003	-0.001	-0.0003	-0.002	-0.001
	(0.001)	(0.002)	(0.009)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)
Portfolio Weight (t-1)	0.005**	0.003	0.003	0.001	0.0001	0.003	0.002*	0.0004
	(0.002)	(0.002)	(0.004)	(0.002)	(0.003)	(0.003)	(0.001)	(0.002)
Ln Market Value (t-1)	0.0002***	0.0002	0.001***	0.0004*	0.0001	0.0003	0.0001	0.0003
	(0.0001)	(0.0001)	(0.0003)	(0.0002)	(0.0001)	(0.0003)	(0.0001)	(0.0002)
Ln Maturity (t-1)	0.002***	0.002**	0.006	0.004***	0.004*	0.004**	0.002***	0.003***
	(0.001)	(0.001)	(0.003)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)
Ln Age (t-1)	-0.0005**	-0.0001	-0.001	-0.001**	-0.00005	-0.001*	-0.0003*	-0.001
	(0.0002)	(0.0002)	(0.001)	(0.0003)	(0.0002)	(0.0003)	(0.0002)	(0.001)
Observations	3,490	3,358	505	1,504	5,660	1,693	3,896	724
R^2	0.897	0.871	0.939	0.868	0.900	0.816	0.643	0.593
Adjusted R^2	0.896	0.869	0.933	0.864	0.899	0.810	0.639	0.563
Residual Std. Error	0.005 (df = 3440)	0.006 (df = 3308)	0.011 (df = 455)	0.008 (df = 1454)	0.010 (df = 5610)	0.011 (df = 1643)	0.006 (df = 3846)	0.012 (df = 674)
Significance Levels								*p<0.1; **p<0.05; ***p<0.01

Note: All models include time fixed effects. In each regression model, the standard errors are clustered at the fund and time level.

Table 8: Regression results for hypothesis 4

This table reports the results from the fixed effect regression of the net flow ratio across the corporate bond funds, testing the intensity of the credit risk exposure on each bond fund type in the period after the GFC. The observations are at the fund-quarter level. The dependent variable is the net flow ratio of the individual bond funds. The independent variables are rating upgrades, rating downgrades and the rating, which are each divided into three variables representing the period before the GFC, the GFC, and the period after the GFC. The controls, including the positive and negative return, net flow ratio, expense ratio, portfolio weight, logarithmical market value, logarithmical maturity, and logarithmical age, are lagged by one quarter. Respectively, these variables are described in the variable directory. Model (2) to (8) are equivalent to model (1) with a differently filtered dataset. The standard errors are clustered at the fund and time level presented in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Regression results for Hypothesis 4

	Dependent variable:							
	Net Flow Ratio							
	Intermediate Core Bond	Intermediate Core-Plus Bond	Long-Term Bond	Corporate Bond	High Yield Bond	Multisector Bond	Short-Term Bond	Non-traditional Bond
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δ Rating Upgrade	-0.023	0.078*	-0.027	0.207***	0.089***	0.062*	0.022	0.086
	(0.046)	(0.041)	(0.071)	(0.061)	(0.026)	(0.037)	(0.028)	(0.051)
|Δ Rating Downgrade|	-0.128***	-0.024	-0.206*	-0.007	-0.034	-0.045**	-0.091***	0.026
	(0.045)	(0.030)	(0.112)	(0.029)	(0.032)	(0.019)	(0.033)	(0.051)
Rating	0.0002	-0.002	-0.006	0.005	0.0004	-0.007	-0.005	0.003
	(0.004)	(0.005)	(0.006)	(0.005)	(0.003)	(0.004)	(0.004)	(0.005)
Pos. Quarterly Return (t-1)	-0.253	1.513	-0.617***	2.167***	0.743**	1.778**	0.715	4.472**
	(0.840)	(1.026)	(0.208)	(0.640)	(0.311)	(0.815)	(0.951)	(1.663)
|Neg. Quarterly Return| (t-1)	-3.614**	-3.882***	0.513	-1.888***	-1.192***	-0.889	-4.557***	-3.149*
	(1.661)	(1.107)	(1.274)	(0.538)	(0.355)	(0.859)	(1.471)	(1.615)
Net Flow Ratio (t-1)	0.309***	0.478***	0.231***	0.358***	0.300***	0.581***	0.360***	0.476***
	(0.031)	(0.035)	(0.073)	(0.053)	(0.034)	(0.054)	(0.038)	(0.070)
Expense Ratio (t-1)	-0.0003	-0.049	0.155*	0.059	-0.019	-0.103**	0.006	0.029
	(0.042)	(0.030)	(0.081)	(0.038)	(0.022)	(0.038)	(0.025)	(0.040)
Portfolio Weight (t-1)	-0.021	0.165***	-0.122	0.045	0.068**	0.077	0.108*	-0.021
	(0.071)	(0.046)	(0.105)	(0.061)	(0.030)	(0.053)	(0.058)	(0.051)
Ln Market Value (t-1)	0.008*	0.004	-0.008	0.003	-0.001	-0.007**	0.004	-0.005
	(0.004)	(0.003)	(0.009)	(0.003)	(0.002)	(0.003)	(0.003)	(0.005)
Ln Maturity (t-1)	0.001	0.001	-0.003	-0.001	-0.004**	-0.003	0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Ln Age (t-1)	-0.003***	-0.001***	-0.0003	-0.001***	-0.001***	-0.001**	-0.003***	-0.005***
	(0.001)	(0.0004)	(0.0005)	(0.0004)	(0.0002)	(0.001)	(0.001)	(0.001)
Observations	3,490	3,358	505	1,504	5,660	1,693	3,896	724
R^2	0.172	0.319	0.219	0.258	0.206	0.448	0.261	0.429
Adjusted R^2	0.159	0.309	0.131	0.232	0.199	0.430	0.251	0.386
Residual Std. Error	0.210 (df = 3438)	0.188 (df = 3306)	0.171 (df = 453)	0.131 (df = 1452)	0.137 (df = 5608)	0.174 (df = 1641)	0.205 (df = 3844)	0.255 (df = 672)
Significance Levels								*p<0.1; **p<0.05; ***p<0.01

Note: All models include time fixed effects. In each regression model, the standard errors are clustered at the fund and time level.

9.3 Figures

Figure 1: Development of the yearly fund numbers per fund

This figure shows the development of the individual Morningstar categories within the Morningstar dataset, including 949 US bond funds that hold at least 20 per cent of the portfolio for one year during the sample period from 2004 until 2019 in corporate bonds. The observations are counted per Morningstar category on a yearly basis and represent all bond funds used for the analysis.

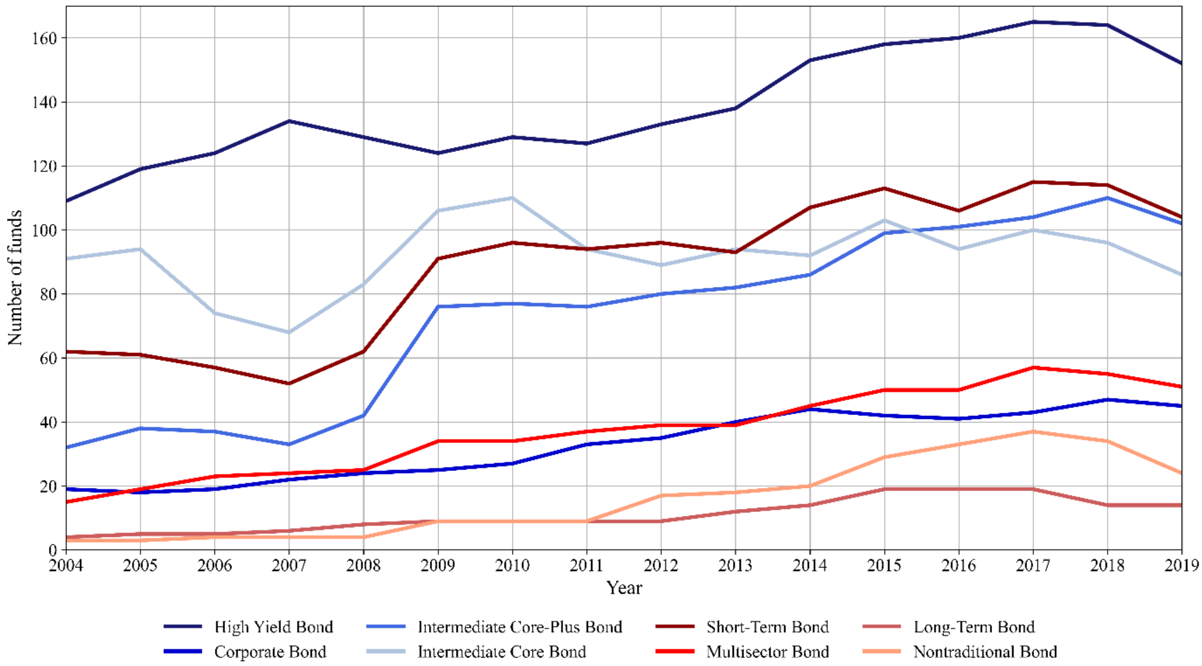

Figure 2: Quarterly rating, maturity and return development of the dataset

This figure demonstrates the development of the rating, maturity, return and net flow ratio within the merged Morningstar and Mergent Fixed Income Securities Database dataset, including 949 US bond funds that hold at least 20 per cent of the portfolio for one year during the sample period from 2004 until 2019 in corporate bonds. The mean, median, 25th and 75th percentile is based on quarterly observations.