Skill Across Actively Managed Bond Funds Revisited: Distinguishing best from worst managers

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This version: 10-01-2025

Abstract

The mutual funds literature is heavily concerned with the ability of fund managers to add value to their managed portfolios. We show that momentum strategies help distinguishing best from worst managers in the US bond funds market. Employing portfolio analysis and robust multi-factor evaluation models, we document a short-lived, risk-adjusted return spread of 3.43% between top and worst managers for the universe of US bond funds. This spread is mainly driven by the winners' side. Further analysis reveals a significant performance gap within Municipal and Corporate bond funds. Our findings, which are robust to several tests, have significant implications for investors, fund management companies, and the mutual fund industry as a whole.

JEL classification: G11, G12, G23

Keywords: Bond funds; Momentum strategies; Factor model; Fund characteristics

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1. Introduction

'*Bond Investors Are Paying Up Again for Active Fund Managers. About 74% of active funds beat their benchmarks in the past 12 months. About $105 billion has flowed into actively managed fixed-income funds on a net basis this year, compared with $74 billion for funds that choose investments by tracking an index, according to Morningstar Direct data as of April 30.', WSJ,11/6/2024*

Mutual funds are in the epicentre of a voluminous literature for more than five decades that attempts to shed light on different aspects of professional money management industry in the US or outside US (Bessimbinder, Cooper and Zhang, 2023). The ability of mutual fund managers to outperform passive benchmarks remains a puzzle with contradictory results. For example, the seminal paper of Berk and Green (2004) suggests that a large fraction of fund managers fail to outperform their benchmarks after fees while Fama and French (2010) conclude that funds fail to beat passive benchmarks even before fees. Kacperczyk et al. (2014; 2016) observe that a small subset of managers consistently outperforms by employing a dynamic strategy that alternates between market timing during recessions and stock picking during expansions. This outcome is facilitated by the presence of uninformed mutual fund managers and retail traders, enabling it to persist as an equilibrium phenomenon (Stambaugh, 2014).

Managerial performance, in general, is derived by means of an 'alpha' and a 'timing component (see inter alia Jensen 1968, Carhart 1997, Fama and French, 2010, Cao, Simin and Wang, 2013). However, the majority of mutual fund studies focus on the behaviour of equity funds leaving bond funds a fairly underexplored field.[1]

[1] Early studies of fixed income funds performance evaluation date include Cornell and Green (1991), Blake, Elton and Gruber (1993) and Elton, Gruber and Blake (1995), Detzler (1999) and continue with those of Ferson, Henry and Kisgen (2006), Huij and Derwall (2008), Chen, Ferson and Peters (2010), Moneta (2015), Clare, Cuthbertson, Nitzsche and O'Sullivan (2021).

A related issue is whether performance of funds persists (Huij and Derwall, 2008, Clare, O'Sullivan, Sherman and Zhu., 2019) and whether investors that chase fund performance achieve superior returns (Goldstein, Jiang and Ng, 2017). Other studies in the field focus on the relationship between performance and various organizational aspects such as fund size, flows, age, manager turnover etc and whether these characteristics can help differentiate top from worst performers either in equity or bond funds (Blake, Elton and Gruber, 1993, Khorana, Servaes and Wedge 2007, Dietze, Entrop and Wilkens, 2009, Clare, Motson, Sapuric and Todorovic, 2014, Bessimbinder, Cooper and Zhang, 2023).

Therefore, in the context of the present study, we set out to build our analysis on the grounds of relevant studies of equity funds' return predictability such as Kacperczyk et al. (2008), Cremers and Petajisto (2009) and more recently Kaniel, Lin, Pelger and Van Nieuwerburgh (2023). In particular, Kaniel, Lin, Pelger and Van Nieuwerburgh (2023) showed that various fund characteristics such as fund momentum (previous month fund return and 12 to 2 months previous fund return) and fund flow are useful to distinguish best from worst performers in the equity mutual fund industry.

A closely related study to our paper that focuses on bond funds is that of Huij and Derwall (2008). Huij and Derwall (2008) provide robust evidence of performance persistence in US bond funds and consistently observe that past fund performance, measured by the alpha of a number of factor models, reliably predicts future outcomes. Funds with strong (or weak) past performance tend to replicate their results in subsequent periods.

However, we depart from their work on four grounds. First, we employ cross-sectional predictability portfolio based on the past cumulative returns, instead of past alpha, which suffers from estimation error and is sensitive to the model selection. Second, we explore whether the documented evidence is due to several characteristics of the bond funds. Third, we provide a thorough analysis by investigating the performance predictability effect under several

holding and formation periods. Fourth, our out-of-sample period coincides with (i) the "new era" of trading, during which the improvement in algorithmic trading and information quality decreased the equity factor premia (Chordia, Subrahmanyam and Tong 2014, Chen and Velikov, 2023) and (ii) the post-publication period in which equity momentum, amongst other equity factor premia renders insignificant (McLean and Pontiff, 2016).

Based on the above, we attempt to answer three prominent questions: (a) can we distinguish between top and bottom performing funds employing fund momentum, (b) is there a return gap between best and worst performers that is concentrated in a specific segment of the bond fund market, and (c) are various funds' characteristics i.e., size, age, expense ratio, turnover ratio, past alpha and funds flow, related to superior fund performance.

We proceed our empirical analysis in four steps. First, in the spirit of Asness, Moskowitz and Pedersen (2013), we construct a long/short portfolio based on the cumulative excess returns from the prior 1, 3, 6, and 12 months. To do so, we first rank the bond funds monthly based on the cumulative excess returns and then form five Total Net Assets (TNA) and equal-weighted portfolios. This portfolio of interest is long in past winners and short in past losers.[2] We then monitor this portfolio based on the risk-adjusted performance stemming from the nine-factor model of Chen, Ferson and Peters (2010). Our empirical evidence suggests a significant, albeit short-lived (up to 3 months ahead) return differential between top and bottom performers irrespective of the formation period across all US bond funds. However, this return spread seems to fade away for the more extended holding periods. The risk-adjusted alpha for the portfolio of interest with a formation period of three months and a holding period of one month under the TNA-weighting and equal-weighting scheme is statistically significant and equal to 3.43% and 2.95% per annum, respectively. Clearly, the previous findings suggest an

[2] Kaniel, Lin, Pelger and Van Nieuwerburgh (2023) state convincingly: 'As most of the predictability is in the extreme deciles, we propose a long-short prediction portfolio of the top and bottom decile as a measure for the spread in skill.'

economically significant difference between top and bottom performers in the actively managed bond funds that is consistent with the finding of Kaniel, Lin, Pelger and Van Nieuwerburgh (2023) for equity mutual funds.

Second, we investigate whether there is a performance gap between best and bottom managers in certain categories of bond funds, i.e., Government, Municipal, and Corporate funds.[3] As mentioned earlier, the performance of actively managed fixed-income funds has attracted less attention than their equity counterparts. Clare, Cuthbertson, Nitzsche and O'Sullivan (2021) point out that there are several reasons for the limited interest. The slow adjustment of market prices (Rosa, 2014) characterizes the municipal bond market. Municipal and high-yield bond funds usually invest in more thinly traded assets (Choi, Kronlund and Oh, 2022), which might be responsible for predictability patterns observed in this market segment. We document a statistically and economically significant effect in bond fund returns across Municipal and Corporate bond funds for relatively short-term periods, while this effect appears weak within Government bond funds.

Third, we examine whether various fund characteristics such as size, age, expenses that appear in the relevant literature can differentiate the best from worst performing funds. We sort the bond funds based on the median of the characteristics, and within the two groups (low and high median of the characteristics), we group the bond funds into quintiles based on the cross-sectional performance. In the spirit of the Fama and French (1993) methodology, we construct double-sorted portfolios to control for bond-fund characteristics. We find that controlling for size, flows, age, expense ratio, turnover ratio, and past performance does not affect our main finding that fund momentum strategies help distinguish best from worst managers.

[3] Bessembinder, Spatt and Venkataraman (2020) highlight key issues of trading and regulation in US fixed income markets focusing on four distinct market segments: Treasury, Corporate, Municipal and Structured products.

Fourth, we provide a battery of additional tests on the validity of our results. Our results remain intact when we group bond funds into deciles instead of quintile portfolios (Herskovic, Kelly, Lustig and Van Nieuwerburgh, 2016). We also employ alternative performance factor models, i.e., the standard market model and Clare, O'Sullivan, Sherman and Zhu (2019) model to evaluate the risk-adjusted return of bond funds' long/short portfolios. We confirm that the documented superior performance is not compensation for the systematic risk factors considered in these models. The effect is present across all formation periods but is concentrated in short-term holding periods. We pursue a sub-sample period analysis and find that return differential is more significant in the second period (2011-2022), which implies that the return spread between the two extremes of bond fund managers increased. We also examine the ability of bond characteristics to identify the most skilled managers using bond-level cross-sectional regressions. The Fama and MacBeth (1973) regression results echo the portfolio sorting analysis, indicating that the momentum characteristic of bond funds cross-sectionally predicts their future bond funds returns. After simultaneously accounting for bond momentum and several bond characteristics in the Fama and MacBeth regressions, the predictive power of momentum remains economically and statistically significant.

Our empirical evidence suggests that the observed bond fund momentum effect cannot be adequately explained by the rational model proposed by Berk and Green (2004). According to their framework, investors rationally allocate more capital to winning funds, but these funds' alphas diminish rapidly due to diseconomies of scale. Additionally, any observed outperformance should be absorbed by fund managers through higher fee revenues, leaving investors with zero abnormal returns after fees. Contrary to this prediction, our findings reveal that approximately 10% of funds outperform after fees.

We posit that our findings can be interpreted within the framework proposed by Kaniel et al. (2023). According to their framework, fund management companies leverage superior past performance through extensive marketing campaigns to expand their asset management base (see, for example, Roussanov et al., 2021). In this scenario, increased fund inflows are expected to elevate the demand for investment assets. Assuming downward-sloping demand curves for various assets (see, for instance, Gabaix & Koijen, 2021), this mechanism ultimately drives asset prices and fund returns to higher levels

Our findings have important implications for fixed-income portfolio management. First, US bond funds are key market players in the asset management industry. According to official data nearly 116 million individual US investors own a mutual fund. In particular, US bond funds are key market players in the asset management industry since: (a) the combined assets in all types of bond mutual funds doubled from $2.6 trillion in 2010 to $5.2 trillion in 2020 (Investment Company Institute Factbook, 2022) and (b) bond funds held 21 percent of fund net assets (Investment Company Institute 2021 Factbook). Second, using actively managed funds to capture bond fund performance predictability has the advantage that the transaction costs (loads, annual expenses, and redemption fees) are fully known in advance. Third, our empirical evidence suggests that investors should consider bond fund managers that have performed well in the past when they make their investment decision. Many fund management companies have devoted effort and resources in designing and launching investment products that exploit momentum investing strategies (see Banegas and Rosa, 2022). Finally, the profitability from our proposed performance-based long/short portfolio stems primarily from the long-only leg. For instance, a long-only strategy built on a 3-month formation period with a 1-month holding period yields an average risk-adjusted return of 4.23% per annum.

The rest of the paper is organized as follows. Section 2 presents the employed dataset, the methodology of portfolio construction and the evaluation models. Section 3 analyzes main

results while robustness tests can be found in Section 4. Section 5 concludes. The appendix provides additional empirical results.

2. Dataset

In this section, we describe the dataset we use in this study, the construction of the cross-sectional predictability measure, and the factor model that evaluates the performance of the long/short predictability portfolios.

2.1 Bond Funds

We use monthly net of fees and gross returns on US fixed income mutual funds sourced from CRSP Survivorship-bias free US Mutual Fund Database. We calculate the gross returns by adding 1/12 of the fund's total expense ratio to the net of returns in line with the work of Fama and French (2010) and Hunter, Kandel, Kandel and Wermers, (2014). Our sample is free of survivorship bias since we include both surviving and non-surviving funds and runs from January 2001 through June 2022.

We consider four categories of bond funds to explore the performance of long/short portfolios in the US bond fund market: (a) the All in which we use all the bond funds, (b) the Government bond funds as defined by CRSP style code where the first two letters are “IG” (Choi, Kronlund and Oh, 2022), (c) the Municipal bond funds as defined by CRSP style code where the first two letters are “IU” (Choi, Kronlund and Oh, 2022), and (d) the Corporate bond funds which either defined by CRSP objective code where the first two letters are “IC” or the Lipper objective code is “A” or “BBB” or “HY” or “SII” or “SID” or “IID” (Choi, Kronlund and Oh, 2020). We exclude from the universe of bond funds any fund whose name contains the words “index” or “ETF” (Choi, Kronlund and Oh, 2022). We also apply the following filters to improve the quality of our dataset:

1. We remove the first two years of return data to eliminate incubation bias (Evans, 2010, McLemore, Sias, Wan and Yüksel, 2022).
2. We do not include in the sample the funds with total net assets below $15 million (McLemore, Sias, Wan and Yüksel, 2022).
3. We winsorize the monthly returns and the monthly total net assets at the 0.1% and 99.9% levels to eliminate the possibility of data peculiarities (Choi, Kronlund and Oh, 2022).
4. We combine the multiple share classes into a single fund (Yan, 2008).

Table 1 presents summary statistics of the monthly returns net of fees (Panel A), the monthly returns gross of fees (Panel B), and funds' characteristics, i.e., TNA, turnover ratio, expense ratio, age in years, and past alpha (Panel C) for the US fixed income mutual funds and the four bond-fund categories. Table A1 of the Appendix provides a detailed description of the characteristics we use. The mean net return across all bond funds is 0.29%. The Corporate bond funds exhibit the highest average monthly net returns (0.31%), followed by the Municipal (0.29%) and the Government (0.25%). We document the same pattern when we consider returns gross of management fees. The three types of bond funds exhibit similar volatility, ranging from 1.30% (Government) to 1.49% (Corporate).

The TNA across all funds is, on average, 1318 million. The TNA of the Corporate bond funds (1955 million) is the highest amongst funds, followed by the Government (1220 million) and the Municipal (761 million). The turnover ratio across all funds is, on average, 0.89. The Municipal funds possess a low turnover ratio (0.28) compared to the Government bond funds (1.68) and the Corporate bond funds (1.37). The expense ratio of All funds is, on average, equal to 0.66 basis points. Municipal bonds have the highest expense ratio (0.69 basis points),

followed by Corporate (0.65 basis points) and Government (0.59 basis points). All three types of funds have similar age, with an average of around 21.78 years.[4]

2.2 Factor Model

We use the nine-factor model of Chen, Ferson and Peters (2010) to investigate whether differences of performance between the top and bottom past performers generate positive risk-adjusted returns. Chen, Ferson and Peters (2010) propose a multi-factor model in the spirit of Elton, Gruber and Blake (1995) that captures the effects of the term structure, credit, liquidity, currency, and equity market. We evaluate the performance of predictability portfolios by estimating the following equation:

$$r_t - r_{f,t} = a + b_1 Yield\_3M_t + b_2 Term_t + b_3 Curvature_t + b_4 Credit_t + b_5 Mortgage_t + b_6 Liquidity_t + b_7 Currency_t + b_8 Equity_t + b_9 Volatility_t + \varepsilon_t, \quad (1)$$

where r_t denotes the return of the bond fund predictability portfolio, $r_{f,t}$ is the monthly risk-free rate, $Yield\_3M$ is the yield of 3-month Treasury Bills, $Term$ is the difference between the 10-year yield and the 1-year yield, $Curvature$ equals to $\frac{(y_7 1+2y_1)}{3}$, where y_j is the j-year fixed maturity yield, $Credit$ is the yield difference between Baa corporate bonds and Aaa bonds, $Mortgage$ is defined as the difference between the average contract rate on new conventional mortgages and the yield on a 3-year, fixed-maturity Treasury bond, $Liquidity$ is the yield difference between 3-month nonfinancial corporate commercial paper rates and the 3-month Treasury yield, $Currency$ is the value of the US dollar, relative to a trade-weighted average of major trading partners, $Equity$ is the cyclically adjusted P/E for stocks included in the Standard

[4] Our sample includes 1420 bond funds, in which 189 are Government, 606 are Municipal and 625 are Corporate (Panel A). When employing gross returns (Panel B) our bond funds sample decreases slightly due to data availability constraints on the expense ratio (used in the calculation of the gross returns).

& Poor's 500, and $Volatility$ is the CBOE implied volatility index.[5] In line with the work of Chen, Ferson and Peters, (2010), we use the monthly first differences of the explanatory variables to mitigate the persistence effect. [6]

2.3 Cross-Sectional Momentum

The cross-sectional momentum has been well documented across different asset classes, i.e., *equities* (Jegadeesh and Titman, 1993, Asness, 1994, Fama, French, 1996, Grinblatt, and Moskowitz, 2004), Treasury *bonds* (Asness, Moskowitz and Pedersen, 2013, Brooks, Palhares and Richardson, 2018), *currencies* (Okunev and White, 2003, Menkhoff, Sarno,Schmeling, Schrimpf and 2012) and *commodities* (Miffre and Rallis, 2007, Fuertes, Miffre and Fernandez-Perez., 2015, Bakshi, Gao and Rossi, 2019, Boons and Prado, 2019).

Following Asness, Moskowitz and Pedersen, (2013), we construct a cross-sectional momentum measure based on the cumulative excess returns from the prior s months. Cross-sectional momentum is defined as follows:

$$Momentum_t^{CS} = \prod_{t-s}^{t-1}(1 + R_{t,s}) - 1, \tag{2}$$

where $R_{t,s}$ denotes the excess returns (of the risk-free rate[7]) of the bond funds, and $s \in \{3, 6, 9, 12\}$ denotes the previous months we used to construct the cumulative returns. We skip

[5]We obtain the Yield_3M, Term, Curvature, Credit, Mortgage, and Liquidity from the website of Federal Reserve Bank of St. Louis (https://www.stlouisfed.org/). The Currency variable is sourced from the Bank for International Settlements (https://www.bis.org/). The source for the Equity is Shiller's website (http://www.econ.yale.edu/~shiller/data.htm) and for Volatility is the website of CBOE (https://www.cboe.com/).
[6] The alpha of a bond fund estimated from the Chen, Ferson and Peters (2010) model reflects the risk-adjusted performance of the fund in the spirit of the APT of Ross (1976) in which the factors are proxies for the underlying risks in the economy (Huij and Derwall (2008).
[7] As for the risk-free rate we employ the 1- month T-bill rate from Kenneth French's library.

the most recent month, which is standard in the momentum literature, following Asness, Moskowitz and Pedersen (2013). [8]

To construct our long/short portfolios, we first rank all bond funds on a monthly frequency based on the cross-sectional funds' past return and then form five TNA and equally weighted portfolios. The return of the portfolio of interest equals the return of the high-performance portfolio minus the return of the low-performance portfolio.

3. Empirical Results

In this section, we track the performance of a portfolio that is long in past winners and short in past losers for various time and formation periods. First, we examine the ability to distinguish between top and worst performers employing momentum strategies. In effect, as in Kaniel, Lin, Pelger and Van Nieuwerburgh (2023) we test our conjecture that skill varies among US bond fund managers and examine whether the returns of long/short portfolio can predict significant risk-adjusted returns in certain market segments namely Government, Municipal, and Corporate bond funds.

The single sorting analysis, however, ignores several effects related to bond fund characteristics. Philpot, Hearth, Rimbey and Schulman (1998) and Khorana, Servaes and Wedge (2007) document a positive relationship between bond fund size and subsequent performance. Blake, Elton and Gruber (1993) conclude that expenses negatively affect the performance of US domestic bond funds, and Detzler (1999) also reveal an inverse relationship between the performance of global bond funds and their expense ratios. Chen, Hong,Huang and Kubik (2004) examine the effect of various fund characteristics on equity funds' performance, such as expense ratio, age, and turnover ratio. They reveal an adverse effect of

[8] In the equity space we skip the most recent month to avoid the 1-month reversal in stock returns, which might be related to liquidity and/or microstructure issues (Jegadeesh, 1990, Lo and Mackinlay, 1990, Boudoukh, Richardson, and Whitelaw, 1994, Asness, 1994, Grinblatt and Moskowitz, 2004).

expense ratio and a positive effect of turnover ratio on funds' performance while age exhibits a neutral effect. However, Dietze, Entrop and Wilkens (2009) report a positive relationship between fund performance and fund age for European corporate bond funds. Huij and Derwall (2008) demonstrate that fund performance persistence of US bond funds is not sensitive to funds' expenses. Finally, Huij and Derwall (2008) empirically show a strong, statistically and economically, significant persistence effect for US bond funds for a period from 1990 to 2003 based on past fund alphas.

Hence, as a second step, we extend our analysis by examining the ability of various bond funds' characteristics, such as size (TNA), age, expense ratio, turnover ratio, and past alpha to predict superior performance as in Kaniel, Lin, Pelger and Van Nieuwerburgh (2023) for US equity funds.

3.1 Single-Sorted Predictability Portfolios

We first examine the risk-adjusted return of portfolios constructed after ranking funds on cross-sectional performance and employing the entire sample of US bond funds. The construction of the portfolios is based on the cumulative return of the bond funds for 3, 6, 9, and 12 past months (formation period). The evaluation period runs 1, 3, 6, and 12 months (holding period). We group funds into quintile portfolios, with the top (bottom) quintile portfolio containing past winners' bond funds (losers) for the formation period. Next, our strategy consists of going long past winners and going short past losers and monitoring the abnormal performance of this long-short portfolio for 1, 3, 6, and 12 months ahead. We calculate both TNA- and equal-weighted returns. Table 2 presents the results that are derived using funds' net returns, whereas Table A2 in the Appendix reports the results from gross returns. We evaluate the performance of the portfolios by using the model described in Equation (1).

Panel A, B, C, and D of Table 2 present the results of the portfolios applied for All, Government, Municipal, and Corporate bond funds, respectively. Our results from Panel A reveal significant evidence of return differential among US bond funds. We confirm that the documented economically significant alpha of the long/short portfolio is not compensation for systematic risk since we regress the long/short portfolio returns on common risk factors identified in the literature. In particular, the effect is present across all past formation periods, but it is concentrated for short holding periods, namely 1 and 3 months, and then fades away. For example, the multi-factor alpha for the portfolio with a formation period of 3 months and a holding period of 1 month under TNA-weighting is 3.43% per annum (2.95% for equal weighted) and strongly statistically significant, and it turns out to be insignificant for the 6 and 12 holding periods.[9]

We reach some interesting results when we attempt to further explain the economically significant alpha of the portfolio by comparing the behaviour of a long-only strategy against a short-only strategy. Table A4 in the Appendix reports the results. A long-only strategy built on a 3-month formation period with a 1-month holding period yields a significant alpha of 4.23% per annum on average whereas the short leg alone yields an insignificant alpha of 0.8% per annum. The above finding supports the argument that the economically significant effect of performance predictability is mainly attributable to the long side of the strategy, namely the winners' side. This finding is consistent with the empirical evidence by Jostova, Nikolova, Philipov and Stahel (2013) in the corporate bond market. However, Kaniel, Lin, Pelger and Van Nieuwerburgh (2023) report significant predictability for both legs. The significant alpha of the long/short portfolio again indicates that the cross-sectional performance predictability

[9] We repeated our analysis in Table 2 by using the raw (model-free) returns instead of the risk-adjusted ones. The results remain qualitatively intact. Table A3 in the Appendix tabulates the results.

across bond funds is not attributable to mechanical investment strategies that load on specific risks and can be implemented in the bond market.

In summary, we document significant cross-sectional performance predictability for one to three months with slight variation across the formation periods. However, in the context of more extended holding periods such as six months or twelve months, our results indicate significantly lower alpha, suggesting that performance predictability is mainly a short-lived phenomenon. The only exception is observed for a strategy that employs a 6-month formation period that delivers a significant abnormal return of 1.84% (1.82%) measured for a TNA (equal) weighting scheme. Our finding regarding the time length of performance predictability is consistent with relevant literature such as Wang, Yan and Zheng (2020) for stock market momentum anomaly and previous studies that document strong momentum effects from a three to twelve-month time horizon (Jegadeesh and Titman, 1993). However, Kaniel, Lin, Pelger and Van Nieuwerburgh (2023) for equity funds report a predictability that lasts at least for 36 months. Moreover, we note that that if we extend the formation period from 6 to 9 and 12 months, the abnormal return of the portfolio for a one-month holding period shrinks from 3.67% for the 6-1 period to 2.18% for the 12-1-month period. We also observe the same pattern under the equally weighting scheme.[10]

Turning our attention to Panels B, C, and D, which present the results for categories (Government, Municipal, and Corporate) of US bond funds, we reach some interesting conclusions. The return gap between top and worst performers in bond funds is strong across Municipal and Corporate bond funds for relatively short-term periods and is weak across Government bond funds.

[10] We repeated our analysis using gross returns. Our results remain intact. In our main analysis we focus on the net returns (Table A2 of the Appendix).

Specifically, we find that a long/short portfolio of bond funds that invest in Treasury securities (Panel B) exhibits a significant short-term alpha for 3-1 and 6-1 periods, especially in the former case, which amounts to 1.81%. However, across Government bond funds, we also note a significant reversal effect observed for 9-6 and 12-6 periods, and for the 9-6 periods, the long/short strategy yields a negative and significant alpha of -1.86%. Observing Municipal bond funds in Panel C, we document substantial short-term persistent alphas across all formation periods, though the outperformance of winners against losers assumes its highest value for the 3-1-month period, namely 3.05%. Our finding for substantial short-lived performance predictability within Municipal bond funds could be attributed to thinly traded assets included in bond funds' assets, as Choi, Kronlund and Oh (2022) claim. Likewise, the municipal bond market is characterized by slow adjustment of market prices (Rosa, 2014).

We document a short-term significant risk-adjusted return for our long/short portfolio employing Corporate bond funds in Panel D that is stronger than the two previous categories. For example, for the 3-1-month period, the alpha of the long/short portfolio for the Corporate bond funds is 4.78% and highly significant. As stated earlier, the resulting alpha of the portfolio of winners minus losers is composed of a long leg and a short leg. Therefore, the behavior of long-short returns could be attributed to the long leg, short leg, or both. According to results shown in Table A4 of the Appendix, for the 3-1-month period, we observe the highest alpha for the long side of the strategy is 5.36% and highly significant, while for the short side, the alpha is 0.57% and insignificant. We, therefore, conclude that the profit of the long/short portfolio across Corporate bond funds for the 3-1 period is attributable to the long side of the strategy.

The analysis in Table 2 is based on the filters described in Section 2.1. We have repeated the analysis by removing filters 1 and 2, described in Section 2.1, and present the results in Table A5 of the Appendix. In line with the evidence shown in Table 2, we document the

presence of a significant short-term (i.e., holding periods 1 and 3 months ahead) economically significant effect across all US bond funds across all formation periods, with the effect in Municipal and Corporate bond funds being more pronounced. We also document a short-term significant profit delivered at the 1-month holding period in Government bond funds across all formation periods, not evident when employing the first two filters in our analysis.

3.2 Double-Sorted Predictability Portfolios

In this section, we examine the behavior of long/short portfolios relative to several bond fund characteristics. To do so, we group funds into quintile portfolios with the top (bottom) quintile portfolio based on the median of the fund characteristics (TNA, turnover ratio, expense ratio, age, past alpha, and flow). Next, our strategy consists of going long the high characteristic portfolio and going short the low characteristic portfolio and monitoring the abnormal performance of this long-short portfolio for 1, 3, 6, and 12 months ahead. We calculate both TNA- and equal-weighted returns of our characteristics-based portfolios.

Table 3 tabulates the results. We document that TNA, expense ratio, flow and past alpha across all bond funds can explain the cross-section of bond funds returns. Looking into the different types of bond funds, we observe the following: (a) TNA, Expense Ratio and Flow can explain the cross-section of Government bond fund returns; (b) TNA, Turnover Ratio, and past alpha can explain the cross-section of Municipal bond fund returns and (c) Turnover Ratio, age, and past alpha can explain the cross-section of Corporate bond fund returns.

We continue our analysis by examining the excess returns of the double-sorted portfolios. The double-sorted portfolios' returns are constructed as the TNA or equal-weighted returns on the four predictability (M), characteristic (C) sorted portfolios. Following the Fama and French (1993) methodology, the long/short double-sorted portfolio is the TNA or equal-weighted return on the two high p portfolios minus the TNA or equal-weighted return on the two low

portfolios, defined as follows: $\frac{1}{2}\left(R_{HM,HC} + R_{HM,LC}\right) - \frac{1}{2}\left(R_{LM,HC} + R_{LM,LC}\right)$, where HM and LM stand for the High and Low Predictability, respectively; HC and LC stand for the High and Low Characteristic, respectively.

As in the construction of the single sorted portfolio, the formation period is based on the past 3, 6, 9, and 12 months, and the holding periods are 1, 3, 6, and 12 months ahead. We also consider the four categories of bond funds. Based on our previous findings that there is a short-lived momentum-related return spread among US bond funds, we limit our attention to 1- and 3-month holding period returns across various formation periods. Tables 4 – 8 report the results for each characteristic.

3.2.1 Size (TNA)Adjusted Predictability Portfolios

We start our analysis by examining the sensitivity of our documented return gap to a potential size effect of US bond funds as measured by total net assets under management. Table 4 reports the results of the size-adjusted portfolio analysis.

The results of the performance of the single sorted portfolio and the size (TNA) adjusted returns are qualitatively the same, albeit slightly weaker for the size adjusted portfolio. Looking at all bond funds, for a 3-month (6-month) formation and 1-month holding period, the abnormal performance of the long/short size adjusted portfolio stands at 3.07% (3.31%) per annum (Panel A of Table 4) compared to the relevant abnormal performance across all bond funds of 3.43% (3.67%) per annum (Panel A of Table 2).

If we look at the subsamples based on the stated objective of bond funds, we document that abnormal profits of the long/short portfolio are again short-lived and follow the same pattern as in the previous analysis. For example, for a 3-month (6-month) formation and 1-month holding period, the superior risk-adjusted return of the long/short, size adjusted Government bond funds portfolio stands at 1.71% (1.75%) per annum (Panel B of Table 4)

compared to the relevant abnormal return across Government bond funds of 1.81% (1.77%) per annum (Panel B of Table 2).

Similarly, for a 3-month formation and 1-month (3-month) holding period, the risk-adjusted alpha of the long/short size adjusted Municipal bond funds portfolio stands at 2.41% (2.06%) per annum (Panel C of Table 4) compared to the relevant abnormal return across Municipal bond funds of 3.05% (2.48%) per annum (Panel C of Table 2).

We draw similar conclusions for the corporate bond funds portfolios whose abnormal performance between high TNA funds (Panel D of Table 4) and all Corporate bond funds (Panel D of Table 2) is almost identical. Finally, we document similar empirical evidence when we look at the equal weighting scheme.

3.2.2 Age Adjusted Portfolios

We continue our analysis by investigating the sensitivity of our documented performance gap to a potential age effect of US bond funds. Table 5 reports the results of the age-adjusted predictability analysis.

The results of the performance of the single sorted predictability portfolios and the age-adjusted predictability one based on TNA or equal weighting schemes are qualitatively and quantitatively the same. Looking at all bond funds, for a 3-month formation and 1-month holding period, the annualized abnormal performance of the long/short age-adjusted predictability portfolio is equal to 3.55% and 3.15% for TNA and equal weighting schemes, respectively (Panel A of Table 5), compared to the annualized abnormal performance across all bond funds of 3.43% and 2.95% for TNA and equal weighting schemes (Panel A of Table 2).

We document similar abnormal performance between government, municipal, and corporate age-adjusted long/short predictability portfolios (Panels B, C, and D of Table 5,

respectively) with the corresponding single sorted predictability portfolios (Panels B, C, and D of Table 2). For example, for a 3-month formation and 1-month holding period, the abnormal performance of the long/short age-adjusted equal-weighted Government, Municipal, and Corporate bond funds predictability portfolio stands at 1.52%, 2.33% and 4.85% per annum, respectively, compared to the abnormal performance of 1.62%, 2.19% and 4.82% per annum for long/short single sorted equal weighted Government, Municipal and Corporate bond funds predictability portfolios, respectively (Panels B, C, D of Table 2).

3.2.3 Expense Ratio Adjusted Predictability Portfolios

In this section, we study the sensitivity of predictability portfolios to the expense ratio. Table 6 reports the results of the expense ratio-adjusted predictability portfolios analysis.

The performance of the expense ratio adjusted predictability portfolios and single sorted predictability portfolios is comparable, slightly weaker for the former strategies. In the sample of all bond funds, for a 3-month formation and 1-month holding period, the annualized abnormal performance of the long/short expense ratio adjusted predictability portfolios is equal to 3.29% and 2.61% for TNA and equal weighting schemes, respectively (Panel A of Table 6), compared to the annualized abnormal performance across all bond funds of 3.43% and 2.95% for TNA and equal weighting schemes (Panel A of Table 2).

Consistent with the prior evidence, we document a slightly weaker abnormal performance between Government, Municipal, and Corporate expense ratio adjusted long/short predictability portfolios (Panels B, C, and D of Table 6, respectively) with the corresponding single sorted predictability portfolios (Panels B, C and D of Table 2). For example, for a 6-month formation and 1-month holding period the abnormal performance of the long/short expense ratio-adjusted equal-weighted Government, Municipal, and Corporate bond funds predictability portfolios stands at 1.62%, 2.09% and 4.04% per annum, respectively, compared

to the abnormal performance of 1.93%, 2.00% and 4.75% per annum for long/short single sorted TNA weighted Government, Municipal and Corporate bond funds predictability portfolios.

3.2.4 Turnover Ratio Adjusted predictability portfolios

Table 7 reports the results of the turnover ratio adjusted predictability portfolios analysis. The results of the performance of the single sorted predictability portfolios and the turnover ratio adjusted predictability portfolios one based on TNA or equal weighting schemes remain qualitatively and quantitatively almost intact for the whole sample of bond funds (Panel A), Municipal bond funds (Panel C) and corporate bond funds (Panel D). For government bond funds, controlling for the turnover ratio, the risk-adjusted performance of the predictability portfolios is statistically insignificant in both weighting schemes.

3.2.5 Past Alpha Adjusted predictability portfolios

An additional characteristic is the past alpha and the t-stat of the alpha. We estimate bond fund alpha from the nine-factor model of Chen, Ferson and Peters, (2010) by using a rolling sample of 60 months. Alpha and the t-statistic of the alpha measures the bond fund adjusted performance after accounting for a large number of systematic factors and can be interpreted as the bond fund manager skill following the literature in the mutual fund space (Kosowski, Timmermann, Wermers and White, 2006, Fama and French, 2010, and Barras, Scaillet and Wermers, 2010, Cao, Simin and Wang, 2013).

We posit that the fund alpha and t-statistic of alpha, which capture the fund manager skill, do not necessarily convey the same information with the momentum characteristic based on the past performance of the fund measured as the cumulative excess returns from the prior s months, where $s \in \{3, 6, 9, 12\}$. As a preliminary analysis, we calculate the correlation between alpha and the different momentum measures, and in untabulated results, we document a low

correlation between alpha and the different momentum measures. The correlation between alpha and the cumulative excess performance 3, 6, 9, and 12 months ago equals 0.12, 0.17, 0.21, and 0.26, respectively.

Table 8 tabulates the results from the double-sorting analysis. The results of the performance of the single sorted predictability portfolios and the past alpha-adjusted predictability portfolios one based on TNA or equal weighting schemes remain qualitatively and quantitatively almost intact (albeit slightly lower) for the whole sample of bond funds (Panel A). For instance, for a 3-month formation and 1-month holding period, the abnormal performance of the long/short past alpha adjusted predictability portfolios is equal to 3.22% and 2.86% for TNA and equal weighting schemes respectively (Panel A of Table 8), compared to the annualized abnormal performance across all bond funds of 3.43% and 2.95% for TNA and equal weighting schemes respectively (Panel A of Table 2). [11]

The results remain intact for Municipal bond funds (Panel C) and Corporate bond funds (Panel D). For Government bond funds, controlling for the past alpha, the risk-adjusted performance of the predictability portfolios is less pronounced and is statistically insignificant in both weighting schemes.

3.2.6 *Funds Flow Adjusted predictability portfolios*

Mutual fund literature presents significant evidence in favour of a positive relationship between fund flows and subsequent performance. Two competing theories for this empirical pattern have been put forward: the 'smart money' hypothesis and the 'persistent-flow' hypothesis. In the former case, the main idea behind this assumption is that investors can differentiate best from poor fund performance and invest accordingly by moving money from

[11] We repeated our analysis using the t-statistic of alpha instead the alpha and our findings remain qualitatively and quantitatively similar. Table A6 in the Appendix tabulates the results.

underperformers to overperformers (see inter alia Gruber, 1996, Zheng, 1999, Keswani and Stolin, 2008). On the other hand, the 'persistent-flow hypothesis' rests on a price-pressure mechanism that works through repeatedly higher inflows. Winning funds that receive these higher inflows are expected to buy more assets resulting in higher prices for the assets and the portfolio of funds that owns these assets (see inter alia Wermers, 2003, Lou, 2012). Most recently, Jiang and Yuksel (2017) and Kaniel et al. (2023) provide evidence in favor of strong predictive ability of fund flows for future performance employing equity funds. However, this issue among bond funds is understudied (Chen & Qin, 2017).

From Panel A of Table 9 we observe a significant abnormal performance for 1 month ahead regardless of the formation period and for 3 months ahead when the formation period is 3 and 6 months. Results are robust across the weighting scheme (value or equal weighting) of the portfolios. For example, the 1 month-ahead abnormal performance of high-flow portfolio ranges from 3.42% p.a. under 3-month formation period to 2.29% p.a. to 12-month formation. Next, we turn our attention to the variation of the effect depending on funds' investment style in Panels B, C, and D. It is noteworthy, that the effect is similar for Municipal and Corporate bond funds as for the whole sample while in case of Government bond funds the abnormal performance of high-flow portfolio is weaker.

4. Additional Analysis

Our results provide evidence of economically significant although short-lived return differential employing cross-sectional tests for a large sample of US bond funds. In this section, we test the validity of our results by undertaking several additional tests. First, we repeat our portfolio analysis employing decile rather than quintile portfolios when constructing portfolios. Second, we employ alternative performance models to evaluate the abnormal return of bond funds' portfolios. In particular, we use a single index model where the returns of portfolios are compared against the value-weighted average returns of all bond funds in our sample minus

the one-month Treasury bill rate and the Clare, O'Sullivan, Sherman and Zhu (2019) model to measure the abnormal performance. Third, we employ a sub-sample analysis to investigate whether the ability of fund momentum to disentangle best from worst managers is time-dependent. Finally, we conduct a Fama and MacBeth (1973) regression analysis as an alternative test to portfolio sorting analysis.

4.1 Decile portfolios

Following Herskovic, Kelly Lustig and Van Nieuwerburgh (2016), we group bond funds into deciles instead of quintile portfolios. Table 10 reports the results of the long/short strategy employing the entire sample of US bond funds and the multi-factor model of Chen, Ferson and Peters (2010). A portfolio constructed using a 3-month formation period and 1-month holding period yields a significant alpha of 4.54%, whereas for a 3-month formation and 3-month holding period, the portfolio's profit shrinks to a significant 3.11%. For 3-month formation periods and 6- and 12-month holding periods, the abnormal performance of the long/short portfolio fades away. The abnormal return of our long/short portfolio is evident for short-term horizons across the Municipal and Corporate segments of US bond funds.

4.2 Other Factor Models

In this section, we examine the sensitivity of our results regarding the risk-adjusted return of momentum portfolios to different formulations of risk factors. To this end, we follow Clare, Cuthbertson, Nitzsche and O'Sullivan (2021) and estimate the abnormal performance of our long/short portfolios employing a single-factor model that takes the following form:

$$r_t - r_{f,t} = a + \beta_1\left(R_{mt} - r_{ft}\right) + \varepsilon_{it} \quad (4)$$

where R_m is the return on a broad bond market index (Bloomberg Barclays US Aggregate Bond index).

Panel A of Table 11 presents the estimation results of single index momentum alphas. A first comment is that these results do not deviate significantly from our baseline results presented earlier. A short-term profit resulting from winners minus losers strategy exists across all bond funds for the 3-6 and 9-month formation period and for one-month holding period. This abnormal return is more pronounced for a 6-month formation period and 1-month holding period and amounts to 3.43%, which is slightly smaller than the 3.67% when the multi-factor model of Chen, Ferson and Peters (2010) is in place.

Next, we follow Clare, Cuthbertson, Nitzsche and O'Sullivan (2021), and we estimate a four-factor model in the following form:

$$r_t - r_{f,t} = a + \beta_1\left(R_{mt} - r_{ft}\right) + \beta_2\left(R_{HYt} - r_{ft}\right) + \beta_3\left(R_{Mor} - r_{ft}\right) + \beta_4 TEDSpread_t + \varepsilon_{it} \quad (5)$$

where R_m is the return on a broad bond market index (Bloomberg Barclays US Aggregate Bond index), R_{HY} is the end-month return on the Bloomberg Barclays US High Yield index; R_{Mor} is the end-month return on the Bloomberg Barclays US MBS index, and the $TEDSpread$ is the month-end percentage change in the difference between three-month dollar LIBOR and the yield on a three-month US T-Bill.

Panel B of Table 11 presents the estimation results from the four-factor model of Clare, Cuthbertson, Nitzsche and O'Sullivan (2021). We observe that estimated alphas derived from the four-factor model reveal significant profits for formation periods of 3, 6, 9, and 12 months and 1 and 3 months ahead, consistent with our baseline results for the whole universe of bond funds. For example, a 6-1-month strategy yields 5.95%, which is highly significant and is substantially larger than the 3.67% under the Chen, Ferson and Peters (2010) model (Panel A of Table 2).

4.3. Sub-sample analysis

In our main analysis, we present the risk-adjusted performance of the long/short portfolios based on the entire sample period (January 2001– June 2022). In this section, we assess whether the performance of the portfolios is time-dependent. To do so, we split equally our sample period into two subsample, non-overlapping periods, i.e., January 2001 to December 2010 and January 2011 to June 2022, respectively.

Panels A and B of Table 12 present the results of the cross-sectional performance long/short portfolio applied for All, Government, Municipal, and Corporate bond funds for the two sub-sample periods, respectively. Our results reveal a larger economically significant alpha of long/short portfolios in the second sub-period, showing that the predictive ability of momentum strategies using US bond funds has improved over time. Our evidence is consistent with the evidence of Jostova, Nikolova, Philipov and Stahel (2013), who document that momentum profitability in the corporate bond momentum has increased over time. Grinblatt et al. (1995) concluded that the strategy of trading on stock momentum is very common among US mutual fund managers. Franck et al (2013) provide evidence in favour of momentum-trading behaviour for German mutual funds that invest in Europe or Asia in particular and not for funds that invest in domestic equities. However, they found that funds employing momentum strategies do not overperform for the following six months. In a related study, Wang & Zheng (2022) examine the ability of managers to trade based on historical stock returns using US mutual fund and hedge fund returns. Their findings confirm the hypothesis that managers of mutual funds indeed follow momentum strategies and they deliver a higher risk-adjusted performance of 1.3% per year. In 2011 - 2022, the risk-adjusted return for the long/short portfolio with a formation period of 3 months and a holding period of 1 month under TNA-weighting was 3.32% per annum (3.04% for equal weighted) and strongly statistically significant. In addition, while factor premia in the equity space have decreased over time due to the improvement in algorithmic trading and information (Chordia, Subrahmanyam and Tong

2014, Chen and Velikov, 2023), our sub-sample evidence suggests that the momentum premium in the bond fund space has increased over time.

In addition, our sub-sample analysis shows that fund momentum exhibits predictive ability mainly across Municipal and Corporate bond funds, consistent with our full-sample analysis. We note that the existence of superior performance in these two bond fund types remains strong in both sub-periods. For instance, in the period spanning January 2001 to December 2010, we find that the multi-factor alpha for the Municipal (Corporate) bond portfolio with a formation period of 3 months and a holding period of 1 month under TNA-weighting is 2.20% (4.62%) per annum. From January 2011 to June 2022, the multi-factor alpha for the Municipal (Corporate) bond portfolio with a formation period of 3 months and a holding period of 1 month under TNA-weighting is 3.00% (3.58%) per annum.

4.4 Fama and MacBeth (1973) regressions

Until this point, our double portfolio sorting analysis provides evidence that a strategy based on a winner minus losers portfolio could predict future performance even when controlling for size, age, expense ratio, turnover ratio, flow or past alpha as in Kaniel, Lin, Pelger and Van Nieuwerburgh (2023). In this section, we run Fama and MacBeth's (1973) regressions to investigate further the cross-sectional relationship between funds' characteristics and fund returns. Fama and MacBeth's (1973) regressions have the advantage over the portfolio sorting analysis in that they can simultaneously account for the effects of multiple characteristics.

We concentrate our analysis on the performance portfolios with a formation period of 3 months and using all bond funds. We perform Fama and MacBeth's (1973) regressions by examining nine specifications. The first seven specifications use the seven characteristics separately, the eighth specification includes all funds characteristics apart from performance

predictability, and the last one includes performance predictability, in addition to the six characteristics considered in the previous specification.

Specifically, we fit the following cross-sectional regression model on each month:

$$R_{i,t+1} = \alpha_{\mathrm{t}} + \beta_{1,t} Momentum_{i,t}^{CS} + \beta_{j,t} \boldsymbol{C}_{i,j,t} + \varepsilon_{it} \quad (6)$$

where R_{it} is the excess returns for bond fund i on month t+1, $Momentum_{i,t}^{CS}$ denotes the momentum characteristic for bond fund i on month t, and $\boldsymbol{C}_{i,t}$ is a vector of the characteristics for bond fund i on month t. The intercept, α_{t} is the excess return on an equally weighted portfolio of the bond funds. The slope estimates are the returns of zero-investment portfolios with exposure equal to one to the factor (characteristic) j and have no exposure to all other factors (Fama and French, 2020). Following Lewellen (2002), we standardize the characteristics each month by subtracting the characteristic's cross-sectional average and dividing by the characteristic's cross-sectional standard deviation.

Table 13 reports the results. We estimate Equation (6) each month using each characteristic as an independent variable. Columns (1) - (7) of Table 13 present the estimated slopes of the FM regressions, which represent the annualized average factor premia that have exposure to each of the characteristic variables and the corresponding t-statistics are estimated using Newey and West (1987) standard errors. Our evidence suggests that the average factor premia with exposure to the predictability, TNA, past alpha and flow is equal to 1.20%, 0.10%, 0.60% and 0.20% per annum, respectively, and statistically significant at 5% level for predictability and 10% level for TNA, past alpha and flow. On the contrary, the average factor premia with exposure to the rest of the characteristic variables is not statistically distinguishable from zero.

When we perform a multivariate cross-sectional regression at each month t where the fund excess returns are regressed against all the characteristic variables, without performance

predictability, we document that only past alpha can explain the cross-section of bond-fund excess return (see column 8). The average factor premium with exposure to the past alpha equals 0.70% and is statistically significant at 5% level. When we also account for our predictability characteristic (see column 9), we document that only predictability effect and past alpha can explain the cross-section of bond fund return. Performance predictability is a stronger, economically and statistically, predictor than past alpha. The average factor premia with exposure to the predictability and past alpha, accounting for all characteristics collectively, is equal to 0.90% (statistically significant at 5% level) and 0.50% (statistically significant at 10% level).

Our empirical evidence confirms the solid cross-sectional predictability of the momentum characteristic on the bond fund excess returns based on the univariate and multivariate Fama-MacBeth (1973) regressions. The significance of most of the characteristics apart from past alpha is subsumed by the momentum characteristics, as shown in the multivariate Fama-MacBeth (1973) regressions.

4.5 Understanding the fund momentum 'return gap'

Our empirical analysis has revealed an economically significant return gap related to momentum strategies in the US bond fund market. This effect is short-lived (up to 6 months ahead) and irrespective of the formation period. The positive alpha of the long/short bond fund portfolio suggests that skill might be present among bond fund managers.

Previous studies in the equity fund space, such as Carhart (1997), provide limited evidence of performance persistence in equity funds that is either explained by stock holdings' characteristics such as momentum or funds' operational characteristics such as expenses. Other studies, focusing on a more accurate fund performance measurement such as, Cremers & Petajisto (2009) and Kacperczyk et al. (2008), offer compelling evidence of significant fund

performance predictability. Most recently, Kaniel et al. (2023) combining the use of modern techniques with traditional portfolio analysis conclude that superior equity fund performance is present for longer horizons that exceed three years while fund momentum and fund flow offer significant predictability power of future risk-adjusted fund performance.

Berk and Green (2004) propose a model where fund performance does not persist due to investors pursuing high-performing funds and the impact of decreasing returns to scale. Empirical findings by Chen et al. (2004) further demonstrate that equity fund performance diminishes as fund size increases, reinforcing the concept of diseconomies of scale. However, our cross-sectional analysis in Section 4.4 and Table 13 provides no evidence that bond fund size negatively impacts bond fund performance, indicating that bond funds are not significantly affected by diseconomies of scale, as opposed to equity mutual funds, consistent with the findings by Chen and Qin (2015) in the corporate bond fund space.

Our empirical evidence suggests that our observed bond fund momentum effect cannot be explained in a context similar of the rational model proposed by Berk and Green (2004). Under their explanation, investors rationally allocate more capital to winning funds, but the alphas of these funds diminish quickly due to diseconomies of scale. Moreover, any observed outperformance should be captured by fund managers as they charge higher fee revenues, leaving zero abnormal returns after fees for investors. However, our findings indicate that approximately 10% of funds outperform after fees. The observed outperformance could point to the existence of market frictions, whereas the documented underperformance aligns with the behavior of unsophisticated investors who fail to adequately account for risk-adjusted returns after fees and do not withdraw their investments (Ben-David et al., 2022).The fund flow has been found a key predictor of equity mutual fund performance (Kaniel, Lin, Pelger and Van Nieuwerburgh, 2023). Our cross-sectional analysis in Table 13, Column 7 confirms the

findings of Kaniel, Lin, Pelger and Van Nieuwerburgh (2023) in the bond space and shows that the fund flow is a statistically significant predictor of the bond mutual fund performance.

Our results could be explained in light of the proposed framework by Kaniel et al. (2023). According to Kaniel et al. (2023) fund management companies advertise superior previous performance engaging into large scale marketing campaigns to increase their asset management base (see inter alia Roussanov et al., 2021). In this context, as funds receive higher inflows we expect funds' demand for investment assets to rise and if we consider downward-sloping demand curves for various assets (see inter alia Gabaix & Koijen, 2021), this mechanism ultimately drives asset prices and fund returns to higher levels. [12]

Therefore, we hypothesize that a plausible explanation for the documented fund momentum is the significant positive flow-performance relationship coupled with a persistence in marketing-induced flows. In simple words, when a fund achieves superior performance during a period receives more capital in the next period. New money that flows in the fund creates buying pressure that in turn increases asset prices further, generating momentum in fund returns.

5. Conclusions

Our paper attempts to offer fresh evidence on the long-standing debate whether fund managers add value to their managed portfolios and if this superior management can be identified in advance. To this end, we employ monthly returns of a large sample of US bond funds and a long period of analysis from 2001 through 2022. Our analysis consists of cross-

[12] In addition, our cross-sectional analysis provides also no evidence that fund flow negatively impacts bond fund performance, reinforcing hence our argument that that our observed bond fund momentum effect cannot be explained with the rational model of Berk and Green (2004). Evidence of skill persists as fund return momentum, allowing investors to capitalize on it in subsequent periods.

sectional and time-series performance predictability tests that provide interesting results. The dominating pattern of our results that survives several robustness tests is the existence of a substantial short-lived (up to 3 months ahead) return differential between past winners and past losers. In particular, the multi-factor risk-adjusted alpha for the past winners minus losers portfolio with a formation period of 3 months and a holding period of 1 month under TNA-weighting is 3.43% per annum (2.95% for equal weighted) and strongly statistically significant. Our results relating to the predictability of bond funds' returns stand in contrast to that of equity funds market as reported by Kaniel, Lin, Pelger and Van Nieuwerburgh (2023) who reported predictability of at least 36 months. Most interestingly, the risk-adjusted return of our winner-loser portfolio appears to originate from the winners' side. A long-only portfolio constructed with a 3-month formation period and with a 1-month holding period provides an average alpha of 4.23% per annum, while the short leg alone delivers an insignificant alpha of 0.8% per annum. However, Kaniel, Lin, Pelger and Van Nieuwerburgh, (2023) report predictability for both legs (long and short) in equity funds. Our subsample analysis based on bond funds' stated objective reveals that winner funds in the Municipal and Corporate segment offer consistently superior risk-adjusted returns than loser funds for relatively short-term periods while this case is fairly present across Government bond funds. A series of robustness tests employing portfolio analysis under two-way sorting reveals that none of the bond fund characteristics that relevant literature (Malhotra and McLeod, 1997, Philpot, Hearth, Rimbey and Schulman, 1998, Budiono and Martens, 2010) identifies as important for distinguishing bond fund managers including size, age, expense ratio, turnover ratio and fund' s past return. The results of a multivariate cross-sectional analysis in the spirit of Fama and MacBeth (1973) further provides support to our findings.

Our findings align with the framework proposed by Kaniel et al. (2023). This framework suggests that fund management companies capitalize on strong past performance by conducting

extensive marketing campaigns to grow their asset management base (see, e.g., Roussanov et al., 2021). As a result, increased fund inflows are expected to boost demand for investment assets. Given the assumption of downward-sloping demand curves for various assets (see, e.g., Gabaix & Koijen, 2021), this process ultimately leads to higher asset prices and fund returns.

The findings of our paper enhance our understanding of the bond fund markets and entail significant implications for investors and fund management companies. Fund management companies could find our results useful for developing products such as portfolios of funds based on winner funds, while investors interested in bond funds could consider forming portfolios of winner funds to achieve above-average returns. As Banegas and Rosa (2022) point out, fund management companies tend to introduce products that allow investors to exploit momentum-related profits since money flows in those funds have grown through the past decade.

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Tables

Table 1. Summary Statistics of US Bond Funds

The Table presents summary statistics of the monthly net of fees (Panel A) and gross returns (Panel B). It also reports the average of the characteristics (total net assets (TNA) (in millions), turnover ratio, expense ratio, age (in years), past alpha (Panel C) across the fixed-income funds and the mean of the characteristics within each of the five portfolios (Panel D). The US fixed-income mutual funds sourced from CRSP Survivorship-bias free US Mutual Fund Database. The gross returns are calculated by adding 1/12 of the fund's total expense ratio to the net of returns. We consider four categories of bond funds: (a) the All, in which we use all the bond funds, (b) the Government bond funds, which are based on CRSP style code the first two letters are "IG" (Choi, Kronlund and Oh, 2022), (c) the Municipal bond funds which based on CRSP style code the first two letters are "IU" (Choi, Kronlund and Oh, 2022), and (d) the Corporate bond funds which either based on CRSP objective code the first two letters are "IC" or the Lipper objective code is "A" or "BBB" or "HY" or "SII" or "SID" or "IID" (Choi, Kronlund and Oh, 2022). We did not include in the universe of bond funds any fund whose name contains the words "index" or "ETF" (Choi, Kronlund, Oh, 2022). The sample period is from January 2001 to June 2022.

Category	#funds	mean	std	min	max	skew	kurtosis
Panel A. Net Returns							
All	1420	0.29%	1.36%	-11.11%	7.91%	-0.85	10.01
Government	189	0.25%	1.30%	-8.65%	9.50%	0.01	10.81
Municipal	606	0.29%	1.26%	-7.86%	6.65%	-0.92	7.11
Corporate	625	0.31%	1.49%	-13.84%	8.29%	-1.14	13.36
Panel B. Gross Returns							
All	1399	0.37%	1.33%	-11.07%	8.01%	-0.76	10.17
Government	187	0.32%	1.28%	-8.61%	9.56%	0.07	10.91
Municipal	599	0.36%	1.25%	-7.80%	6.73%	-0.9	7.31
Corporate	613	0.40%	1.45%	-13.77%	8.38%	-1.05	14.05
	Panel C. Characteristics across fund categories						
Category	TNA	Turnover ratio	Expense ratio	Age in years	Past alpha (monthly)	Flow	
All	1318	0.89	0.0066	21.78	0.0021	0.14%	
Government	1220	1.67	0.0059	21.01	0.0012	0.30%	
Municipal	761	0.28	0.0069	23.70	0.0015	-0.02%	
Corporate	1955	1.37	0.0065	20.25	0.0029	0.27%	

Table 2. Single-Sorted Momentum Portfolios

The table presents the alpha from the nine-factor model of Chen, Ferson and Peters (2010), which is defined as: $r_t = a + b_1 Yield\_3M_t + b_2 Term_t + b_3 Curvature_t + b_4 Credit_t + b_5 Mortgage_t + b_6 Liquidity_t + b_7 Currency_t + b_8 Equity_t + b_9 Volatility_t + \varepsilon_t$. The variables of the model are described in Section 3.2. To construct the momentum long/short portfolios, we first rank all bond funds based on the cross-sectional momentum $\left(\prod_{t-s}^{t-1}(1 + R_{t,s}) - 1\right)$, where $R_{t,s}$ denotes the excess *net of fees* returns of the bond funds, and then we form five TNA and equally weighted portfolios. The return of the momentum strategy equals the return of the high-momentum portfolio minus the return of the low-momentum portfolio. The formation period is based on the past 3, 6, 9, and 12 months, and the holding periods are 1, 3, 6, and 12 months ahead. We consider four categories of bond funds to explore the performance of momentum strategies in the bond fund market: (a) the All bond funds (Panel A), (b) the Government bond funds (Panel B), (c) the Municipal bond funds (Panel C), and (d) the Corporate bond funds (Panel D). The significance of alpha is based on HAC standard errors. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

TNA Weighted Returns					Equally Weighted Returns			
Panel A. All Bond Funds								
Holding period (in months)								
Formation period	1	3	6	12	1	3	6	12
3	0.0343***	0.0253**	0.0019	0.0017	0.0295***	0.0228**	0.0066	0.0024
6	0.0367***	0.0237**	0.0184**	0.0064	0.0322***	0.0228**	0.0182**	0.0039
9	0.0281***	0.0196*	0.0087	-0.0008	0.0281***	0.0183*	0.0099	-0.0023
12	0.0218**	0.0105	0.0062	-0.0013	0.0205**	0.0102	0.0067	-0.0017
Panel B. Government Bond Funds								
Holding period (in months)								
Formation period	1	3	6	12	1	3	6	12
3	0.0181*	0.0079	-0.014	-0.0111	0.0162*	0.0027	-0.0118	-0.0119
6	0.0177*	0.0067	-0.004	-0.0004	0.0193*	0.0064	-0.0053	-0.0021
9	0.0113	-0.0034	-0.0186*	-0.0071	0.0102	-0.0029	-0.0198**	-0.0052
12	0.0062	-0.0098	-0.0151*	-0.002	0.0044	-0.0103	-0.0146*	-0.0021
Panel C. Municipal Bond Funds								
Holding period (in months)								
Formation period	1	3	6	12	1	3	6	12
3	0.0305***	0.0243***	0.0064	-0.0037	0.0219***	0.0186***	0.0038	-0.0043
6	0.0248***	0.0198***	0.009	0.0005	0.02***	0.0175***	0.0081	0.0016
9	0.021***	0.0148*	0.0081	-0.0003	0.0169**	0.0111*	0.0053	-0.0011
12	0.0138*	0.0127	0.0075	0.0027	0.0107	0.01	0.0043	0.0013
Panel D. Corporate Bond Funds								
Holding period (in months)								
Formation period	1	3	6	12	1	3	6	12
3	0.0478***	0.0317**	0.0085	0.0118	0.0482***	0.0341**	0.0114	0.0125
6	0.0465***	0.0191	0.0131	0.0063	0.0475***	0.0239	0.0178	0.0087
9	0.0291**	0.0182	0.0092	0.0029	0.0329***	0.0202	0.0125	0.0025
12	0.0249*	0.0099	0.0037	-0.0035	0.0277**	0.0131	0.0086	0.0018

Table 3. Single-Sorted Characteristics Based Portfolios

The table presents the alpha from the nine-factor model of Chen, Ferson and Peters (2010), which is defined as: $r_t = a + b_1 Yield\_3M_t + b_2 Term_t + b_3 Curvature_t + b_4 Credit_t + b_5 Mortgage_t + b_6 Liquidity_t + b_7 Currency_t + b_8 Equity_t + b_9 Volatility_t + \varepsilon_t$. The variables of the model are described in Section 3.2. To construct the momentum long/short portfolios, we first rank all bond funds based on the past alpha, and then we form five TNA and equally weighted portfolios. The return of the momentum strategy equals the return of the high-momentum portfolio minus the return of the low-momentum portfolio. The formation period is based on the past 3, 6, 9, and 12 months, and the holding periods are 1, 3, 6, and 12 months ahead. We consider four categories of bond funds to explore the performance of momentum strategies in the bond fund market: (a) the All bond funds (Panel A), (b) the Government bond funds (Panel B), (c) the Municipal bond funds (Panel C), and (d) the Corporate bond funds (Panel D). The significance of alpha is based on HAC standard errors. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

	TNA Weighted Returns				Equally Weighted Returns			
Panel A. All Bond Funds								
	Holding period (in months)							
Characteristic	1	3	6	12	1	3	6	12
Total TNA	0.004**	0.0035*	0.0035*	0.0026	0.0029*	0.0026	0.0026	0.002
Flow	0.0064*	0.0079*	-0.0005	-0.0059	0.0055**	0.004	-0.0006	-0.004
Turnover ratio	-0.0003	0.0004	0.0029	0.0042	0.0011	0.002	0.0031	0.0032
Expense ratio	0.0069*	0.0061**	0.0071**	0.0079**	0.0053**	0.0034**	0.0039***	0.0039**
Age in years	0.0012	0.0009	-0.0008	-0.0019	-0.0025	-0.0027	-0.0028	-0.0036
Past alpha	0.0204**	0.0191**	0.0157**	0.0147**	0.0184**	0.0187**	0.0176**	0.0151**
Panel B. Government Bond Funds								
	Holding period (in months)							
Characteristic	1	3	6	12	1	3	6	12
TNA	0.0073***	0.0068***	0.0058**	0.0067***	0.004**	0.0037*	0.003	0.0034*
Flow	0.0097**	0.0017	-0.0017	-0.0051	0.0082***	0.0008	-0.0018	-0.0013
Turnover ratio	-0.0039	-0.0024	-0.0015	-0.0007	-0.0032	-0.0029	-0.0022	-0.0022
Expense ratio	-0.0063***	-0.0033	-0.0037	-0.0043	-0.0048***	-0.0036**	-0.0039***	-0.0043***
Age in years	-0.0031	-0.0053	-0.0052	-0.01**	-0.0045	-0.0051	-0.0049	-0.0072*
Past alpha	0.0045	0.000	-0.0026	-0.0044	0.0097	0.0083	0.0059	0.005
Panel C. Municipal Bond Funds								
	Holding period (in months)							
Characteristic	1	3	6	12	1	3	6	12
TNA	0.0039***	0.0037***	0.0035***	0.003**	0.0037***	0.0034***	0.0032***	0.0027**
Flow	0.0042	-0.0002	-0.0052	-0.0049	0.0037*	0.0008	-0.0018	-0.0031
Turnover ratio	-0.006**	-0.0032	-0.0021	-0.002	-0.0012	0.0002	0.0009	0.0013
Expense ratio	0.0034	0.0038	0.0034	0.003	0.002	0.0022	0.002	0.0016
Age in years	0.0043	0.0041	0.0042	0.0038	0.0008	0.0008	0.001	0.0008
Past alpha	0.013**	0.0108*	0.0102*	0.0086	0.0099*	0.0093*	0.0075	0.0066
Panel D. Corporate Bond Funds								
	Holding period (in months)							
Characteristic	1	3	6	12	1	3	6	12
TNA	0.001	0.001	0.0009	-0.002	0.0009	0.001	0.001	-0.0005
Flow	0.0055	0.0062	-0.0002	-0.0049	0.0052*	0.0063	0.0028	0.0009
Turnover ratio	-0.0122**	-0.0125**	-0.0118**	-0.0121**	-0.0038*	-0.0027	-0.0025	-0.003
Expense ratio	0.0054	0.0074	0.0096*	0.0116*	0.0048	0.0053	0.0071**	0.0081**
Age in years	0.0046*	0.0042	0.0026	0.0018	-0.0007	-0.0003	-0.0008	-0.0003
Past alpha	0.0227**	0.0232***	0.0199**	0.024***	0.0247***	0.0236***	0.0216**	0.0229***

Table 4. Double-Sorted Momentum Portfolios - TNA

The table presents the alpha from the nine-factor model of Chen, Ferson and Peters (2010), which is described in Section 3.2. To construct the momentum long/short portfolios, we first sort the bond funds based on the median total net assets (TNA), and then we group all bond funds into quintiles based on the cross-sectional momentum. The return of the double-sorted momentum strategy equals the return of the high-momentum portfolio minus the return of the low-momentum portfolio. Following the Fama and French (1993) methodology, the long/short portfolio is the TNA or equally weighted return on the two high momentum portfolios minus the TNA or equally weighted return on the two low momentum portfolios, defined as follows $\frac{1}{2}(R_{HM,HC} + R_{HM,LC}) - \frac{1}{2}(R_{LM,HC} + R_{LM,LC})$. The formation period is based on the past 3, 6, 9, and 12 months, and the holding periods are 1, 3, 6, and 12 months ahead. We consider four categories of bond funds to explore the performance of momentum strategies in the bond fund market: (a) the All bond funds (Panel A), (b) the Government bond funds (Panel B), (c) the Municipal bond funds (Panel C), and (d) the Corporate bond funds (Panel D). The significance of alpha is based on HAC standard errors. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

TNA Weighted Returns					Equally Weighted Returns			
Panel A. All Bond Funds								
Holding period (in months)								
Formation period	1	3	6	12	1	3	6	12
3	0.0307***	0.0226**	0.0045	0.0013	0.0291***	0.0224**	0.0065	0.0023
6	0.0331***	0.022*	0.0182**	0.0045	0.0317***	0.0224**	0.0179**	0.0037
9	0.0277***	0.0185*	0.0093	-0.0016	0.0279***	0.018*	0.0097	-0.0024
12	0.0206**	0.01	0.0064	-0.002	0.0204**	0.01	0.0066	-0.0018
Panel B. Government Bond Funds								
Holding period (in months)								
Formation period	1	3	6	12	1	3	6	12
3	0.0171*	0.0057	-0.0131	-0.0123	0.0154	0.0019	-0.0116	-0.0123
6	0.0175*	0.0055	-0.0059	-0.0029	0.0187*	0.006	-0.0051	-0.002
9	0.0104	-0.0028	-0.0219**	-0.0064	0.0099	-0.0032	-0.0213**	-0.0048
12	0.004	-0.011	-0.0169**	-0.001	0.0031	-0.0112	-0.016**	-0.0015
Panel C. Municipal Bond Funds								
Holding period (in months)								
Formation period	1	3	6	12	1	3	6	12
3	0.0241***	0.02***	0.0047	-0.0038	0.0213***	0.0181***	0.0036	-0.0043
6	0.0206***	0.0176***	0.008	0.0011	0.0194***	0.017***	0.0077	0.0016
9	0.0177**	0.0123*	0.0063	-0.0008	0.0164**	0.0108	0.005	-0.0014
12	0.0112	0.0101	0.0048	0.0013	0.0101	0.0094	0.0038	0.0008
Panel D. Corporate Bond Funds								
Holding period (in months)								
Formation period	1	3	6	12	1	3	6	12
3	0.047***	0.0319**	0.0095	0.0118	0.0475***	0.0336**	0.0112	0.0124
6	0.0458***	0.0206	0.0152	0.0069	0.047***	0.0233	0.0175	0.0087
9	0.0297**	0.019	0.0111	0.0034	0.0327***	0.0201	0.0125	0.003
12	0.0256*	0.0115	0.007	-0.0011	0.0276**	0.013	0.0088	0.002

Table 5. Double-Sorted Momentum Portfolios - AGE

The table presents the alpha from the nine-factor model of Chen, Ferson and Peters (2010), which is described in Section 3.2. To construct the momentum long/short portfolios, we first sort the bond funds based on the median age and then group all bond funds into quintiles based on the cross-sectional momentum. The return of the double-sorted momentum strategy equals the return of the high-momentum portfolio minus the return of the low-momentum portfolio. Following the Fama and French (1993) methodology, the long/short portfolio is the TNA or equally weighted return on the two high momentum portfolios minus the TNA or equally weighted return on the two low momentum portfolios, defined as follows $\frac{1}{2}\left(R_{HM,HC}+R_{HM,LC}\right)-\frac{1}{2}\left(R_{LM,HC}+R_{LM,LC}\right)$ The formation period is based on the past 3, 6, 9, and 12 months, and the holding periods are 1, 3, 6, and 12 months ahead. We consider four categories of bond funds to explore the performance of momentum strategies in the bond fund market: (a) the All bond funds (Panel A), (b) the Government bond funds (Panel B), (c) the Municipal bond funds (Panel C), and (d) the Corporate bond funds (Panel D). The significance of alpha is based on HAC standard errors. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

TNA Weighted Returns					Equally Weighted Returns			
Panel A. All Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0355***	0.0264**	0.0021	0.0004	0.0315***	0.024**	0.0065	0.002
6	0.0377***	0.0236**	0.0178*	0.0058	0.0337***	0.0235**	0.0182**	0.0039
9	0.0278***	0.0189	0.0082	-0.0006	0.0286***	0.0188*	0.0096	-0.0024
12	0.0215**	0.0108	0.0062	-0.0005	0.0215**	0.0112	0.0072	-0.0008
Panel B. Government Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0178*	0.0087	-0.0117	-0.0094	0.0152	0.0021	-0.0123	-0.013
6	0.0189*	0.0082	-0.0043	-0.0003	0.0213**	0.0068	-0.0051	-0.0034
9	0.0136	-0.0041	-0.0189*	-0.0067	0.0106	-0.0044	-0.0206**	-0.0059
12	0.0059	-0.0114	-0.0124	0.0006	0.0037	-0.0127	-0.0155*	-0.0029
Panel C. Municipal Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0319***	0.0265***	0.0072	-0.0025	0.0233***	0.02***	0.0045	-0.0038
6	0.0262***	0.0224***	0.01	0.0023	0.0211***	0.0186***	0.0086	0.0019
9	0.023***	0.0167**	0.0098	0.002	0.0177**	0.012*	0.006	-0.0007
12	0.0148*	0.0148*	0.0091	0.0055	0.0113	0.0112	0.0055	0.0023
Panel D. Corporate Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0451***	0.031**	0.0074	0.0106	0.0485***	0.0344**	0.0111	0.0127
6	0.0441***	0.0173	0.012	0.0051	0.0477***	0.0239	0.018	0.009
9	0.027**	0.0159	0.008	0.0009	0.0331***	0.0206	0.0127	0.0023
12	0.0242*	0.011	0.0042	-0.0042	0.0283**	0.0139	0.0091	0.0018

Table 6. Double-Sorted Momentum Portfolios – Expense Ratio

The table presents the alpha from the nine-factor model of Chen, Ferson and Peters (2010), which is described in Section 3.2. To construct the momentum long/short portfolios, we first sort the bond funds based on the median expense ratio (ER) and then group all bond funds into quintiles based on the cross-sectional momentum. The return of the double-sorted momentum strategy equals the return of the high-momentum portfolio minus the return of the low-momentum portfolio. Following the Fama and French (1993) methodology, the long/short portfolio is the TNA or equally weighted return on the two high-momentum portfolios minus the TNA or equally weighted return on the two low-momentum portfolios, defined as follows: $\frac{1}{2}\left(R_{HM,HC} + R_{HM,LC}\right) - \frac{1}{2}\left(R_{LM,HC} + R_{LM,LC}\right)$. The formation period is based on the past 3, 6, 9, and 12 months, and the holding periods are 1, 3, 6, and 12 months ahead. We consider four categories of bond funds to explore the performance of momentum strategies in the bond fund market: (a) the All bond funds (Panel A), (b) the Government bond funds (Panel B), (c) the Municipal bond funds (Panel C), and (d) the Corporate bond funds (Panel D). The significance of alpha is based on HAC standard errors. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

TNA Weighted Returns					Equally Weighted Returns			
Panel A. All Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0329***	0.0256**	0.003	0.0031	0.0261***	0.0209**	0.0059	0.0022
6	0.0345***	0.0209*	0.018**	0.0056	0.0294***	0.0208**	0.0175**	0.0043
9	0.0254***	0.0175	0.0077	-0.0029	0.0255***	0.0168*	0.0092	-0.0022
12	0.0212**	0.0105	0.0052	-0.0039	0.0196**	0.0113	0.0064	-0.002
Panel B. Government Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0129	0.0021	-0.0161	-0.0134	0.012	0.000	-0.0135	-0.0128
6	0.0162*	0.0053	-0.0049	-0.0011	0.0167*	0.0042	-0.0062	-0.003
9	0.0119	-0.0015	-0.0215**	-0.0093	0.0088	-0.0052	-0.0241**	-0.0089
12	0.0091	-0.0099	-0.0158*	-0.0031	0.004	-0.0113	-0.0179**	-0.0044
Panel C. Municipal Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0277***	0.0198***	0.0047	-0.006	0.0197***	0.0154***	0.0037	-0.0036
6	0.0209***	0.0151**	0.0066	-0.0001	0.0167***	0.0139**	0.0074	0.0017
9	0.0178***	0.01	0.0041	-0.0016	0.0136**	0.0078	0.0044	-0.0006
12	0.0102	0.0099	0.0046	0.0015	0.0081	0.0082	0.0037	0.002
Panel D. Corporate Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0422***	0.0303**	0.0079	0.0129	0.0429***	0.0324**	0.011	0.012
6	0.0404***	0.0164	0.0119	0.0031	0.0433***	0.0227	0.0179	0.0092
9	0.0227*	0.0139	0.0081	-0.0045	0.0291**	0.0189	0.0131	0.0012
12	0.0218	0.0113	0.0059	-0.0062	0.0259*	0.0158	0.0101	0.0019

Table 7. Double-Sorted Momentum Portfolios – Turnover Ratio

The table presents the alpha from the nine-factor model of Chen, Ferson and Peters (2010), described in Section 3.2. To construct the momentum long/short portfolios, we first sort the bond funds based on the median turnover ratio (TR) and then group all bond funds into quintiles based on the cross-sectional momentum. The return of the double-sorted momentum strategy equals the return of the high-momentum portfolio minus the return of the low-momentum portfolio. Following the Fama and French (1993) methodology, the long/short portfolio is the TNA or equally weighted return on the two high momentum portfolios minus the TNA or equally weighted return on the two low momentum portfolios, defined as follows $\frac{1}{2}\left(R_{HM,HC}+R_{HM,LC}\right)-\frac{1}{2}\left(R_{LM,HC}+R_{LM,LC}\right)$.The formation period is based on the past 3, 6, 9, and 12 months, and the holding periods are 1, 3, 6, and 12 months ahead. We consider four categories of bond funds to explore the performance of momentum strategies in the bond fund market: (a) the All bond funds (Panel A), (b) the Government bond funds (Panel B), (c) the Municipal bond funds (Panel C), and (d) the Corporate bond funds (Panel D). The significance of alpha is based on HAC standard errors. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

TNA Weighted Returns					Equally Weighted Returns			
Panel A. All Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0319***	0.0257**	0.0036	-0.0003	0.0274***	0.0227**	0.0066	0.0005
6	0.0345***	0.022*	0.0174*	0.0039	0.0291***	0.0199*	0.0162*	0.0034
9	0.0275***	0.0183	0.0061	-0.006	0.025***	0.0159	0.0079	-0.0042
12	0.0213**	0.011	0.0049	-0.0037	0.0181**	0.0102	0.0056	-0.0012
Panel B. Government Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0132	0.0085	-0.0112	-0.0098	0.0113	0.0016	-0.0118	-0.012
6	0.0127	0.0058	-0.0049	-0.0028	0.013	0.004	-0.0074	-0.0036
9	0.0091	-0.0047	-0.0201*	-0.0088	0.0067	-0.005	-0.0228**	-0.0076
12	0.0051	-0.0097	-0.0143	-0.0021	0.0029	-0.0108	-0.0169**	-0.0031
Panel C. Municipal Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0273***	0.0209***	0.0057	-0.0056	0.0189***	0.0155***	0.0037	-0.0046
6	0.0223***	0.0167**	0.0091	0	0.0171***	0.0146**	0.0081	0.0016
9	0.0185***	0.0125	0.0081	-0.0004	0.0141**	0.0085	0.005	-0.0012
12	0.012	0.0115	0.0079	0.0028	0.0084	0.0082	0.0041	0.0012
Panel D. Corporate Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0464***	0.0331**	0.0094	0.0104	0.0465***	0.0349**	0.0125	0.0116
6	0.0454***	0.0199	0.0137	0.0027	0.0463***	0.0243*	0.0196	0.0087
9	0.027**	0.0161	0.0072	0.0009	0.0309**	0.0195	0.0117	0.0013
12	0.0218	0.0098	0.002	-0.0046	0.0261*	0.0159	0.0091	0.0022

Table 8. Double-Sorted Momentum Portfolios – Past Alpha

The table presents the alpha from the nine-factor model of Chen, Ferson and Peters (2010), which is described in Section 3.2. To construct the momentum long/short portfolios, we first sort the bond funds based on the past alpha estimated from the nine-factor model of Chen, Ferson and Peters (2010) and then group all bond funds into quintiles based on the cross-sectional momentum. The return of the double-sorted momentum strategy equals the return of the high-momentum portfolio minus the return of the low-momentum portfolio. Following the Fama and French (1993) methodology, the long/short portfolio is the TNA or equally weighted return on the two high momentum portfolios minus the TNA or equally weighted return on the two low momentum portfolios, defined as follows $\frac{1}{2}\left(R_{HM,HC}+R_{HM,LC}\right)-\frac{1}{2}\left(R_{LM,HC}+R_{LM,LC}\right)$.The formation period is based on the past 3, 6, 9, and 12 months, and the holding periods are 1, 3, 6, and 12 months ahead. We consider four categories of bond funds to explore the performance of momentum strategies in the bond fund market: (a) the All bond funds (Panel A), (b) the Government bond funds (Panel B), (c) the Municipal bond funds (Panel C), and (d) the Corporate bond funds (Panel D). The significance of alpha is based on HAC standard errors. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

TNA Weighted Returns					Equally Weighted Returns			
Panel A. All Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0322***	0.0234**	0.0012	-0.004	0.0286***	0.0194*	0.0009	-0.0047
6	0.0357***	0.0272**	0.0161*	-0.0008	0.0317***	0.0237**	0.0129	-0.0034
9	0.0268***	0.0101	-0.0021	-0.0056	0.0258**	0.0111	0.0012	-0.0072
12	0.0126	0.0008	-0.0043	-0.0014	0.0126	0.0024	-0.0017	-0.0031
Panel B. Government Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0258**	-0.0064	-0.0279**	-0.0212*	0.0219*	-0.007	-0.0256**	-0.021*
6	0.015	-0.0091	-0.0141	-0.001	0.0195*	-0.0026	-0.0129	-0.0024
9	-0.008	-0.0101	-0.0203*	-0.0064	-0.0022	-0.0118	-0.0254**	-0.0064
12	-0.0159	-0.0234*	-0.0248**	-0.0088	-0.0098	-0.023*	-0.025**	-0.0097
Panel C. Municipal Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0309***	0.0297***	0.0175***	0.0025	0.0236***	0.0235***	0.0116**	-0.0007
6	0.0259***	0.024***	0.0086	-0.0034	0.023***	0.0224***	0.0075	-0.0023
9	0.0155**	0.012	-0.0002	-0.0012	0.0122**	0.0074	-0.0027	-0.0023
12	0.0050	0.0051	-0.0014	0.0019	0.0024	0.0037	-0.0047	-0.0038
Panel D. Corporate Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0494***	0.0248	-0.0041	-0.0039	0.0475***	0.0243	-0.0063	-0.0058
6	0.0309**	0.0115	0.0051	-0.0134	0.0367***	0.0229	0.0132	-0.0091
9	0.0128	0.0073	-0.0086	-0.0079	0.0209	0.0127	-0.0029	-0.0142
12	0.0112	-0.0082	-0.0089	-0.0038	0.0191	-0.0029	-0.0012	-0.0062

Table 9. Double-Sorted Momentum Portfolios - Flow

The table presents the alpha from the nine-factor model of Chen, Ferson and Peters (2010), which is described in Section 3.2. To construct the momentum long/short portfolios, we first sort the bond funds based on the median flow (FLOW), and then we group all bond funds into quintiles based on the cross-sectional momentum. The return of the double-sorted momentum strategy equals the return of the high-momentum portfolio minus the return of the low-momentum portfolio. Following the Fama and French (1993) methodology, the long/short portfolio is the TNA or equally weighted return on the two high momentum portfolios minus the TNA or equally weighted return on the two low momentum portfolios, defined as follows $\frac{1}{2}(R_{HM,HC} + R_{HM,LC}) - \frac{1}{2}(R_{LM,HC} + R_{LM,LC}) \frac{1}{2}$ The formation period is based on the past 3, 6, 9, and 12 months, and the holding periods are 1, 3, 6, and 12 months ahead. We consider four categories of bond funds to explore the performance of momentum strategies in the bond fund market: (a) the All bond funds (Panel A), (b) the Government bond funds (Panel B), (c) the Municipal bond funds (Panel C), and (d) the Corporate bond funds (Panel D). The significance of alpha is based on HAC standard errors. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

TNA Weighted Returns					Equally Weighted Returns			
Panel A. All Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0342***	0.0248**	0.0029	0.003	0.0298***	0.0224**	0.006	0.0023
6	0.0352***	0.0222*	0.0165*	0.006	0.0319***	0.022**	0.0174**	0.004
9	0.0278***	0.018	0.006	-0.0026	0.028***	0.0177	0.0094	-0.0021
12	0.0229**	0.0102	0.0045	-0.0019	0.0211**	0.01	0.0062	-0.0011
Panel B. Government Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0189*	0.0088	-0.0127	-0.0098	0.0171*	0.0063	-0.011	-0.0126
6	0.0191*	0.008	-0.0037	0.0005	0.0199**	0.0082	-0.0042	-0.0019
9	0.0092	-0.0037	-0.0184*	-0.0061	0.0109	-0.001	-0.0204**	-0.0059
12	0.0028	-0.011	-0.0151*	-0.0013	0.0024	-0.0106	-0.0152*	-0.0024
Panel C. Municipal Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0323***	0.0229***	0.0035	-0.0041	0.0239***	0.0188***	0.0032	-0.0043
6	0.0256***	0.0188***	0.0068	0.0005	0.021***	0.0174***	0.0073	0.0015
9	0.0208***	0.014*	0.007	0.0007	0.018***	0.011	0.0048	-0.001
12	0.0142*	0.0128	0.0073	0.0039	0.0126*	0.0103	0.0043	0.002
Panel D. Corporate Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0464***	0.0316**	0.0069	0.0119	0.0472***	0.0325**	0.0105	0.0118
6	0.0447***	0.0187	0.0123	0.0065	0.046***	0.0222	0.0164	0.0077
9	0.0286**	0.0187	0.0084	0.0015	0.0317**	0.019	0.0113	0.0014
12	0.0244*	0.0107	0.0039	-0.0012	0.0268*	0.0124	0.0068	0.0003

Table 10. Single-Sorted Momentum Portfolios – Decile Portfolios

The table presents the alpha from the nine-factor model of Chen, Ferson and Peters (2010), which is defined as: $r_t = a + b_1 Yield\_3M_t + b_2 Term_t + b_3 Curvature_t + b_4 Credit_t + b_5 Mortgage_t + b_6 Liquidity_t + b_7 Currency_t + b_8 Equity_t + b_9 Volatility_t + \varepsilon_t$. The variables of the model are described in Section 3.2. To construct the momentum long/short portfolios, we first rank all bond funds based on the cross-sectional momentum $\left(\prod_{t-s}^{t-1} \left(1 + R_{t,s}\right) - 1\right)$, where $R_{t,s}$ denotes the excess *net of fees* returns of the bond funds, and then we form 10 TNA and equally weighted portfolios. The return of the momentum strategy equals the return of the high-momentum portfolio minus the return of the low-momentum portfolio. The formation period is based on the past 3, 6, 9, and 12 months, and the holding periods are 1, 3, 6, and 12 months ahead. We consider four categories of bond funds to explore the performance of momentum strategies in the bond fund market: (a) the All (Panel A), (b) the Government bond funds (Panel B), (c) the Municipal bond (Panel C), and (d) the Corporate bond funds (Panel D). The significance of alpha is based on HAC standard errors. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

	TNA Weighted Returns				Equally Weighted Returns			
Panel A. All Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0454***	0.0311*	0.0004	0.007	0.0391***	0.0295**	0.0066	0.0068
6	0.0492***	0.0299*	0.0227*	0.0075	0.0454***	0.0298**	0.0246**	0.0059
9	0.0352***	0.0228	0.0095	-0.0022	0.0352***	0.024	0.0143	-0.0004
12	0.0246*	0.0143	0.0099	0.0022	0.0268**	0.0168	0.0145	0.0039
Panel B. Government Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0191	0.0065	-0.015	-0.0201	0.0205	0.0009	-0.017	-0.0195
6	0.0208	0.0077	-0.0174	-0.0207	0.0224	0.0023	-0.02	-0.0198
9	0.0161	-0.0011	-0.0078	-0.0112	0.0222	0.0008	-0.0115	-0.009
12	0.0173	0.0003	-0.0092	-0.0093	0.023	0.002	-0.0128	-0.0086
Panel C. Municipal Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.038***	0.0332***	0.0083	-0.0057	0.0286***	0.0253***	0.006	-0.0051
6	0.0302***	0.0235***	0.0101	0.0009	0.0259***	0.022***	0.0099	0.0023
9	0.027***	0.0165*	0.0088	0.0001	0.0222**	0.014	0.006	-0.0005
12	0.0184*	0.0176*	0.0113	0.0049	0.015*	0.0142	0.0064	0.0026
Panel D. Corporate Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0612***	0.0387**	0.0065	0.0122	0.0619***	0.0429**	0.0159	0.0152
6	0.0559***	0.0236	0.0134	0.0067	0.056***	0.0321**	0.0207	0.0104
9	0.0328**	0.023	0.0104	0.0008	0.0396***	0.0256	0.0154	0.003
12	0.0277*	0.0132	0.0046	0.0003	0.0322**	0.0194	0.0123	0.0036

Table 11. Other Factor Models

The table presents the alpha from (a) the market model (Panel A) and (b) the Clare, Cuthbertson, Nitzsche, and O'Sullivan (2021) model (Panel B). The models are described in Section 5.3. To construct the momentum long/short portfolios, we first rank all bond funds based on the cross-sectional momentum $\left(\prod_{t-s}^{t-1}(1+R_{t,s})-1\right)$, where $R_{t,s}$ denotes the excess *net of fees* returns of the bond funds, and then we form five TNA and equally weighted portfolios. The return of the momentum strategy equals the return of the high-momentum portfolio minus the return of the low-momentum portfolio. The formation period is based on the past 3, 6, 9, and 12 months, and the holding periods are 1, 3, 6, and 12 months ahead. We consider All bond funds to explore the performance of momentum strategies in the bond fund market. The significance of alpha is based on HAC standard errors. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

	TNA Weighted Returns				Equally Weighted Returns			
Panel A. Market Model								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0321***	0.0218*	-0.003	-0.0023	0.0265**	0.0182	0.0013	-0.002
6	0.0343***	0.0196	0.0129	-0.0003	0.0288***	0.0186	0.0128	-0.0026
9	0.0263**	0.0151	0.0008	-0.0096	0.0265**	0.0142	0.0021	-0.0109
12	0.0189	0.0048	-0.0012	-0.0092	0.018	0.0052	-0.0005	-0.0089
Panel B. Clare, Cuthbertson, Nitzsche and O'Sullivan (2021) Model								
	Holding periods							
Formation period	1	3	6	12	1	3	6	12
3	0.0507***	0.0445***	0.0178	0.0004	0.0459***	0.0414***	0.025**	0.001
6	0.0595***	0.0474***	0.0343***	0.0136	0.0543***	0.046***	0.0348***	0.0101
9	0.0455***	0.0352***	0.0144	0.0056	0.0458***	0.0322**	0.013	0.0007
12	0.0416***	0.0318**	0.02	0.0112	0.0393***	0.0289**	0.0173	0.0077

Table 12. Single-Sorted Momentum Portfolios – Sub-sample analysis

The table presents the alpha from the nine-factor model of Chen, Ferson and Peters (2010), which is defined as: $r_t = a + b_1 Yield\_3M_t + b_2 Term_t + b_3 Curvature_t + b_4 Credit_t + b_5 Mortgage_t + b_6 Liquidity_t + b_7 Currency_t + b_8 Equity_t + b_9 Volatility_t + \varepsilon_t$. The variables of the model are described in Section 3.2. To construct the momentum long/short portfolios, we first rank all bond funds based on the cross-sectional momentum $\left(\prod_{t-s}^{t-1}(1 + R_{t,s}) - 1\right)$, where $R_{t,s}$ denotes the excess *net of fees* returns of the bond funds, and then we form five TNA and equally weighted portfolios. The return of the momentum strategy equals the return of the high-momentum portfolio minus the return of the low-momentum portfolio. The formation period is based on the past 3, 6, 9, and 12 months, and the holding periods are 1, 3, 6, and 12 months ahead. We consider four categories of bond funds to explore the performance of momentum strategies in the bond fund market: (a) the All bond funds (Panel A), (b) the Government bond funds (Panel B), (c) the Municipal bond funds (Panel C), and (d) the Corporate bond funds (Panel D). The significance of alpha is based on HAC standard errors. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

TNA Weighted Returns					Equally Weighted Returns			
Panel A. All Bond Funds								
Holding period (in months)								
Formation period	1	3	6	12	1	3	6	12
3	0.0189	0.0267*	-0.0012	0.0252	0.0136	0.0233	0.0093	0.025*
6	0.0245	0.0213	0.0191	0.0161	0.0201	0.0203	0.0188	0.0119
9	0.0294**	0.0299*	0.0232	0.0117	0.0288**	0.0286**	0.0246	0.0108
12	0.0288*	0.0244	0.0191	0.0051	0.0261*	0.0228	0.0171	0.005
Panel B. Government Bond Funds								
Holding period (in months)								
Formation period	1	3	6	12	1	3	6	12
3	0.0021	0.0088	-0.017	-0.0082	0.0003	-0.0024	-0.0164	-0.007
6	-0.0003	-0.0007	-0.0098	-0.0087	-0.0001	-0.001	-0.0087	-0.0046
9	0.0037	0.0032	-0.0069	-0.0041	-0.0009	0.0006	-0.0135	-0.0011
12	0.0005	0.0006	-0.0055	-0.0067	-0.003	-0.0002	-0.0112	-0.0069
Panel C. Municipal Bond Funds								
Holding period (in months)								
Formation period	1	3	6	12	1	3	6	12
3	0.0220**	0.0174*	0.0101	0.0123	0.0125	0.0118	0.0064	0.0085
6	0.0135	0.0130	0.0116	0.0101	0.0075	0.0115	0.0102	0.0079
9	0.0216**	0.0193*	0.0226*	0.0151	0.0157*	0.0121	0.0165*	0.0115
12	0.0147	0.0143	0.0153*	0.0133	0.0105	0.0108	0.0097	0.0107
Panel D. Corporate Bond Funds								
Holding period (in months)								
Formation period	1	3	6	12	1	3	6	12
3	0.0462*	0.0492**	0.0163	0.0501*	0.0454*	0.0523**	0.0243	0.0526**
6	0.0431	0.0228	0.006	0.0114	0.0462*	0.0298	0.0168	0.0183
9	0.0322	0.0319	0.0223	0.0147	0.038*	0.0362*	0.0263	0.0121
12	0.035	0.0299	0.0152	-0.004	0.0381*	0.0328	0.0211	0.0056

Sample Period: January 2011 - June 2022								
TNA Weighted Returns					Equally Weighted Returns			
Panel A. All Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0332***	0.0027	-0.0075	-0.0155	0.0304***	-0.0001	-0.0068	-0.0153
6	0.0272*	0.004	0.0035	-0.0098	0.0249*	0.0035	0.0063	-0.0101
9	0.0090	-0.0079	-0.0121	-0.0199	0.0118	-0.006	-0.0091	-0.0206
12	0.0006	-0.0217	-0.0156	-0.0158	0.0026	-0.018	-0.0107	-0.0134
Panel B. Government Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0244*	-0.0070	-0.0202	-0.0231	0.0227*	-0.0096	-0.0184	-0.0244
6	0.0213	0.0022	-0.0027	0.002	0.0246*	0.0023	-0.0063	-0.005
9	0.0113	-0.0158	-0.0306**	-0.015	0.0126	-0.0134	-0.0281**	-0.0173
12	0.0052	-0.0248*	-0.0250*	-0.0053	0.0048	-0.026*	-0.0214	-0.0072
Panel C. Municipal Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0300***	0.0252***	0.0028	-0.0159*	0.0228***	0.0197**	0.0011	-0.0142*
6	0.0292***	0.0213**	0.0048	-0.0076	0.0252***	0.0185**	0.004	-0.0041
9	0.0155	0.0091	-0.0042	-0.0125	0.0125	0.0074	-0.0052	-0.0111
12	0.0085	0.0057	0.0002	-0.0051	0.0059	0.0042	-0.0018	-0.0058
Panel D. Corporate Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0358***	-0.0121	-0.0138	-0.014	0.0383***	-0.0107	-0.0144	-0.0157
6	0.0246	-0.0103	-0.0004	-0.0107	0.0256	-0.0088	-0.0002	-0.0124
9	0.0060	-0.0199	-0.0154	-0.0193	0.0094	-0.0165	-0.0102	-0.0185
12	-0.0028	-0.0301	-0.02	-0.015	0.0001	-0.0265	-0.0157	-0.0132

Table 13. Fama Macbeth regressions

This table performs cross-sectional Fama Macbeth regressions and reports the serial average of the coefficients and the corresponding Newey and West (1987) t-statistics (in parentheses). Columns (1) to (6) report the results for regressing bond funds' excess returns against the fund characteristics: momentum, TNA, AGE, EXP RATIO, Turn Ratio, and past alpha. Column (7) reports the results for multivariate regressions where the bond funds' excess returns are collectively regressed against characteristics apart from momentum. Column (8) reports the results for multivariate regressions where the bond funds' excess returns are regressed against all characteristics, including momentum. The slope coefficients are annualised. The significance of the coefficients is based on HAC standard errors. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

	1	2	3	4	5	6	7	8	9
MOM	0.012**								0.009**
	(2.463)								(2.224)
TNA		0.001*						0.001	0.000
		(1.876)						(0.380)	(0.226)
AGE			-0.001					-0.000	-0.000
			(-1.073)					(-0.318)	(-0.211)
EXPENSE RATIO				-0.007				0.001	0.001
				(-0.839)				(0.771)	(0.441)
TURNOVER RATIO					0.000			0.000	0.000
					(0.374)			(-0.041)	(0.1196)
PAST ALPHA						0.006*		0.007**	0.005*
						(1.764)		(2.189)	(1.664)
FLOW							0.002*	0.000	-0.001
							(1.87)	(0.156)	(-1.191)
R2 adjusted	22.00%	0.47%	1.89%	2.26%	3.08%	12.02%	1.41%	22.65%	37.81%

Appendix.

Table A1. Description of bond fund characteristics

Variable	Definition	Source
Expense ratio	Expense ratio represents the percentage of fund assets paid as management fees, including manager's compensation and operating expenses such as research support, administrative fees, and all other asset-based costs incurred by the fund excluding brokerage charges.	CRSP
Turnover ratio	Turnover ratio is a measure of trading activity or the propensity of a manager to trade. It is calculated as the minimum (of aggregated sales or aggregated purchases of securities), divided by the average 12-month Total Net Assets of the fund. While funds with higher turnover incur greater transaction costs, trading may signal that a manager is gathering and trading on information. Thus, even though it increases costs, turnover may positively impact performance, provided managers are processing reliable information and engaging in trading.	CRSP
Age	Age of the fund provides a measure of the fund's longevity or ability to survive in a highly competitive environment. It is simply the number of years a fund has been operating.	CRSP
Total Fund Assets (TNA)	A proxy for a fund's popularity includes total fund assets (TNA). Total fund assets represent the total dollar value of a single fund's assets. A negative relationship may be indicative of the potentially detrimental impact of fund size on its ability to implement a particular investment style.	CRSP
Past alpha	Bond fund alpha is estimated from the nine-factor model of Chen, Ferson and Peters. (2010) by using a rolling sample of 60 months.	CRSP and authors' calculation

Table A2. Single-Sorted Momentum Portfolios – Gross returns

The table presents the alpha from the nine-factor model of Chen, Ferson and Peters (2010), which is defined as: $r_t = a + b_1 Yield\_3M_t + b_2 Term_t + b_3 Curvature_t + b_4 Credit_t + b_5 Mortgage_t + b_6 Liquidity_t + b_7 Currency_t + b_8 Equity_t + b_9 Volatility_t + \varepsilon_t$. The variables of the model are described in Section 3.2. To construct the momentum long/short portfolios, we first rank every month all bond funds based on the cross-sectional momentum $\left(\prod_{t-s}^{t-1} \left(1 + R_{t,s}\right) - 1\right)$ where $R_{t,s}$ denotes the excess *gross of fees*, and then we form five TNA and equally weighted portfolios. We calculate the gross returns by adding 1/12 of the total expense ratio to the net of returns. The return of the momentum strategy equals the return of the high-momentum portfolio minus the return of the low-momentum portfolio. The formation periods are based on the past 3, 6, 9, and 12 months, and the holding periods are 1, 3, 6, and 12 months ahead. We consider four categories of bond funds to explore the performance of momentum strategies in the bond fund market: (a) the All (Panel A), (b) the Government bond funds (Panel B), (c) the Municipal bond (Panel C), and (d) the Corporate bond funds (Panel D). The significance of alpha is based on HAC standard errors. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

TNA Weighted Returns					Equally Weighted Returns			
Panel A. All Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0328***	0.0248**	0.0042	0.0032	0.0276***	0.0222**	0.0086	0.0035
6	0.0349***	0.0221*	0.0211**	0.0086	0.0303***	0.0211*	0.0209**	0.0061
9	0.0266***	0.0189	0.0129	0.0034	0.0263***	0.0174	0.0139	0.0018
12	0.0212**	0.0113	0.0089	0.0009	0.02**	0.0115	0.0095	0.0008
Panel B. Government Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0149	0.0055	-0.0114	-0.0079	0.0126	0.0009	-0.0091	-0.0089
6	0.015	0.0046	-0.0035	0.0005	0.0158	0.0041	-0.004	-0.0004
9	0.0092	-0.0051	-0.017*	-0.0052	0.0077	-0.0048	-0.0175*	-0.0026
12	0.0054	-0.0105	-0.0156*	-0.0024	0.0036	-0.01	-0.0147*	-0.0024
Panel C. Municipal Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0287***	0.0219***	0.0083	-0.0019	0.0199***	0.016***	0.0058	0.0287***
6	0.023***	0.0176**	0.0094	0.001	0.018***	0.015**	0.0082	0.023***
9	0.019***	0.0126	0.01	0.0016	0.0145**	0.0086	0.0072	0.019***
12	0.012	0.0116	0.0098	0.0047	0.0088	0.0086	0.0062	0.012
Panel D. Corporate Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0471***	0.0328**	0.013	0.0154	0.0466***	0.0346**	0.0157	0.0156
6	0.0453***	0.0187	0.0181	0.0104	0.0458***	0.0229	0.0225*	0.0126
9	0.0277**	0.0187	0.0153	0.009	0.0313**	0.0203	0.0182	0.0084
12	0.0249*	0.012	0.0084	0.0009	0.0275**	0.0154	0.0133	0.0061

Table A3. Single-Sorted Momentum Portfolios – Raw (Model-free) Returns.

The table presents the single-sorted momentum portfolios' raw (model-free) returns. To construct the momentum long/short portfolios, we first rank every month all bond funds based on the cross-sectional momentum, $\left(\prod_{t-s}^{t-1} \ \left(1+R_{t,s}\right)-1\right)$, where $R_{t,s}$ denotes the excess *gross of fees*, and then we form five TNA and equally weighted portfolios. We calculate the gross returns by adding 1/12 of the total expense ratio to the net of returns. The return of the momentum strategy equals the return of the high-momentum portfolio minus the return of the low-momentum portfolio. The formation period is based on the past 3, 6, 9, and 12 months, and the holding periods are 1, 3, 6, and 12 months ahead. We consider four categories of bond funds to explore the performance of momentum strategies in the bond fund market: (a) the All (Panel A), (b) the Government bond funds (Panel B), (c) the Municipal bond (Panel C), and (d) the Corporate bond funds (Panel D). The significance of alpha is based on HAC standard errors. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

TNA Weighted Returns					Equally Weighted Returns			
Panel A. All Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0332***	0.0247**	0.0023	0.0014	0.0274***	0.0219*	0.0067	0.0019
6	0.0360***	0.0221*	0.0188**	0.0059	0.0307***	0.0215*	0.0184**	0.0032
9	0.0273***	0.0182	0.0089	-0.0002	0.0271***	0.0169	0.0099	-0.0022
12	0.0214*	0.0102	0.0067	-0.0009	0.0199*	0.0095	0.0067	-0.0018
Panel B. Government Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0175	0.0073	-0.0122	-0.0103	0.0151	0.0017	-0.0098	-0.0113
6	0.0162	0.0051	-0.0039	-0.0012	0.0185*	0.0049	-0.0047	-0.0017
9	0.0104	-0.0045	-0.0166*	-0.0049	0.0095	-0.0039	-0.0172*	-0.0024
12	0.0059	-0.0086	-0.0131	0.0002	0.0048	-0.0085	-0.0119	0.0005
Panel C. Municipal Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0303***	0.0251***	0.0075	-0.0024	0.0215***	0.0189***	0.0048	-0.0032
6	0.0256***	0.0209***	0.0106	0.0018	0.0204***	0.0182***	0.0091	0.0027
9	0.0218***	0.016*	0.0099	0.0012	0.0176**	0.0118*	0.0068	0.0005
12	0.0150*	0.014	0.0091	0.0042	0.0118	0.0111	0.0058	0.0028
Panel D. Corporate Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0474***	0.0314*	0.0095	0.0098	0.0471***	0.0334**	0.0124	0.0104
6	0.046***	0.0162	0.012	0.005	0.0467***	0.0211	0.0175	0.0076
9	0.0288**	0.0156	0.0085	0.002	0.0319**	0.0174	0.0116	0.0016
12	0.0236	0.0081	0.0029	-0.0046	0.0264*	0.0113	0.0077	0.0005

Table A4. The long and short side of momentum

The table presents the alpha of the long and short side of the momentum from the nine-factor model of Chen, Ferson and Peters (2010), which is defined as: $r_t = a + b_1 Yield\_3M_t + b_2 Term_t + b_3 Curvature_t + b_4 Credit_t + b_5 Mortgage_t + b_6 Liquidity_t + b_7 Currency_t + b_8 Equity_t + b_9 Volatility_t + \varepsilon_t$. The variables of the model are described in Section 3.2. To construct the long and short momentum portfolios, we first rank all bond funds based on the cross-sectional momentum $\left(\prod_{t-s}^{t-1}(1 + R_{t,s}) - 1\right)$, where $R_{t,s}$ denotes the excess *net of fees* returns of the bond funds, and then we form five TNA and equally weighted portfolios. The formation periods are based on the past 3, 6, 9, and 12 months, and the holding periods are 1, 3, 6, and 12 months ahead. We consider four categories of bond funds to explore the performance of momentum strategies in the bond fund market: (a) the All bond funds (Panel A), (b) the Government bond funds (Panel B), (c) the Municipal bond funds (Panel C), and (d) the Corporate bond funds (Panel D). The significance of alpha is based on HAC standard errors. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

	Long Side				Short Side			
Panel A. All Bond Funds								
Holding period (in months)								
Formation period	1	3	6	12	1	3	6	12
3	0.0423***	0.0371***	0.0294***	0.0292***	0.008	0.0118	0.0275***	0.0275***
6	0.046***	0.0404***	0.0365***	0.0328***	0.0093	0.0167*	0.0181**	0.0263***
9	0.0431***	0.0397***	0.034***	0.0289***	0.015*	0.0201**	0.0253***	0.0297***
12	0.0409***	0.0321***	0.0314***	0.0273***	0.0191**	0.0216**	0.0251***	0.0287***
Panel B. Government Bond Funds								
Holding periods								
Formation period	1	3	6	12	1	3	6	12
3	0.022***	0.0201**	0.0061	0.0065	0.0039	0.0122	0.0201***	0.0175**
6	0.0248***	0.0199**	0.0134*	0.0169**	0.007	0.0132	0.0174**	0.0173*
9	0.0232***	0.0158*	0.0076	0.0124	0.0119	0.0192**	0.0262***	0.0195**
12	0.0202**	0.0131	0.0073	0.0102	0.014*	0.023***	0.0224***	0.0122
Panel C. Municipal Bond Funds								
Holding periods								
Formation period	1	3	6	12	1	3	6	12
3	0.0353***	0.0323***	0.0228***	0.0157*	0.0048	0.008	0.0164**	0.0195**
6	0.0314***	0.0298***	0.0244***	0.0182**	0.0066	0.01	0.0155**	0.0176**
9	0.0289***	0.0273***	0.0233***	0.0182**	0.0078	0.0125*	0.0152**	0.0185**
12	0.026***	0.025***	0.0229***	0.0203**	0.0122	0.0123*	0.0154**	0.0176**
Panel D. Corporate Bond Funds								
Holding periods								
Formation period	1	3	6	12	1	3	6	12
3	0.0536***	0.0449***	0.0365***	0.039***	0.0057	0.0133	0.028***	0.0272**
6	0.0562***	0.0407***	0.0376***	0.0381***	0.0097	0.0216**	0.0245**	0.0318**
9	0.0481***	0.045***	0.0391***	0.0322***	0.019*	0.0268**	0.0298***	0.0293**
12	0.0467***	0.0356***	0.0337***	0.0293***	0.0218*	0.0256**	0.03***	0.0328***

Table A5. Single-Sorted Momentum Portfolios- Removing filters 1 and 2 in Section 3.1

This table repeated the analysis shown in Table 2, by removing filters 1 and 2, described in Section 3.1. The alpha stems from the nine-factor model of Chen, Ferson and Peters (2010), which is defined as: $r_t = a + b_1 Yield\_3M_t + b_2 Term_t + b_3 Curvature_t + b_4 Credit_t + b_5 Mortgage_t + b_6 Liquidity_t + b_7 Currency_t + b_8 Equity_t + b_9 Volatility_t + \varepsilon_t$. The variables of the model are described in Section 3.2. To construct the momentum long/short portfolios, we first rank all bond funds based on the cross-sectional momentum $\left(\prod_{t-s}^{t-1}(1 + R_{t,s}) - 1\right)$, where $R_{t,s}$ denotes the excess *net of fees* returns of the bond funds, and then we form five TNA and equally weighted portfolios. The return of the momentum strategy equals the return of the high-momentum portfolio minus the return of the low-momentum portfolio. The formation periods are based on the past 3, 6, 9, and 12 months, and the holding periods are 1, 3, 6, and 12 months ahead. We consider four categories of bond funds to explore the performance of momentum strategies in the bond fund market: (a) the All (Panel A), (b) the Government bond funds (Panel B), (c) the Municipal bond (Panel C), and (d) the Corporate bond funds (Panel D). The significance of alpha is based on HAC standard errors. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

TNA Weighted Returns					Equally Weighted Returns			
Panel A. All Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0301***	0.0234*	0.0023	0.0033	0.0277***	0.0209*	0.0056	0.0014
6	0.033***	0.0251**	0.0035	0.0018	0.0313***	0.0226*	0.0069	0.0002
9	0.0393***	0.0243**	0.0212**	0.0075	0.0333***	0.0219*	0.0191**	0.0036
12	0.0411***	0.0271**	0.0211**	0.0062	0.0361***	0.0244**	0.0196**	0.0029
Panel B. Government Bond Funds								
	Holding periods							
Formation period	1	3	6	12	1	3	6	12
3	0.022*	0.0098	-0.0096	-0.0132	0.0211*	0.0042	-0.01	-0.0164
6	0.0226**	0.0104	-0.0105	-0.0153	0.0219**	0.0049	-0.0111	-0.0182
9	0.0217**	0.015	0.0034	0.0002	0.0269**	0.0156	0.0003	-0.0023
12	0.0226**	0.0162	0.003	-0.0008	0.027**	0.0158	0.0007	-0.0043
Panel C. Municipal Bond Funds								
	Holding periods							
Formation period	1	3	6	12	1	3	6	12
3	0.0297***	0.0257***	0.0081	-0.0046	0.0227***	0.0205***	0.0052	-0.0037
6	0.0306***	0.0256***	0.0082	-0.0058	0.0237***	0.0207***	0.0052	-0.0049
9	0.0273***	0.0233***	0.0126	-0.0009	0.0226***	0.0205***	0.0115*	0.0024
12	0.0284***	0.0235***	0.012	-0.0019	0.0237***	0.0209***	0.0115*	0.0018
Panel D. Corporate Bond Funds								
	Holding periods							
Formation period	1	3	6	12	1	3	6	12
3	0.0443***	0.03*	0.0083	0.0123	0.0446***	0.0301*	0.0113	0.0114
6	0.0468***	0.0316**	0.0087	0.0105	0.0483***	0.0323**	0.0119	0.01
9	0.0451***	0.0155	0.0111	0.0126	0.0464***	0.0216	0.0159	0.0115
12	0.0465***	0.0207	0.0128	0.0124	0.0487***	0.0262*	0.017	0.011

Table A6. Double-Sorted Momentum Portfolios – t-stat of alpha

The table presents the t-stat of the alpha from the nine-factor model of Chen, Ferson and Peters (2010), which is described in Section 3.2. To construct the momentum long/short portfolios, we first sort the bond funds based on the past alpha estimated from the nine-factor model of Chen, Ferson and Peters (2010) and then group all bond funds into quintiles based on the cross-sectional momentum. The return of the double-sorted momentum strategy equals the return of the high-momentum portfolio minus the return of the low-momentum portfolio. Following the Fama and French (1993) methodology, the long/short portfolio is the TNA or equally weighted return on the two high momentum portfolios minus the TNA or equally weighted return on the two low momentum portfolios, defined as follows $\frac{1}{2}\left(R_{HM,HC}+R_{HM,LC}\right)-\frac{1}{2}\left(R_{LM,HC}+R_{LM,LC}\right)$.The formation period is based on the past 3, 6, 9, and 12 months, and the holding periods are 1, 3, 6, and 12 months ahead. We consider four categories of bond funds to explore the performance of momentum strategies in the bond fund market: (a) the All bond funds (Panel A), (b) the Government bond funds (Panel B), (c) the Municipal bond funds (Panel C), and (d) the Corporate bond funds (Panel D). The significance of alpha is based on HAC standard errors. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

TNA Weighted Returns					Equally Weighted Returns			
Panel A. All Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0364***	0.0231**	-0.0043	-0.0078	0.0317***	0.0217*	-0.0018	-0.0071
6	0.0364***	0.0222*	0.0082	-0.0043	0.0335***	0.0223*	0.0081	-0.0069
9	0.0232**	0.0089	-0.0059	-0.0113	0.0245**	0.011	-0.0031	-0.0138
12	0.0107	0.0007	-0.0088	-0.0064	0.0123	0.0037	-0.0058	-0.0098
Panel B. Government Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0226**	-0.0077	-0.0249*	-0.0204*	0.0179*	-0.0057	-0.0203	-0.0181
6	0.0248**	-0.0006	-0.0224*	-0.0179	0.0254**	0.0044	-0.0197	-0.0148
9	0.0059	-0.0184	-0.0383***	-0.0236	0.0069	-0.0144	-0.0357***	-0.0224*
12	0.0004	-0.0165	-0.013	-0.0063	-0.0012	-0.0149	-0.0091	-0.004
Panel C. Municipal Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0351***	0.0278***	0.0118*	-0.0016	0.0294***	0.0251***	0.0099*	-0.0014
6	0.0297***	0.0238***	0.0099	-0.0016	0.0275***	0.0228***	0.0093	0.0014
9	0.0237***	0.0164*	0.0071	-0.0003	0.0202***	0.0131*	0.0045	-0.0009
12	0.0141*	0.0106	0.0058	0.0025	0.011	0.0086	0.0026	0.0008
Panel D. Corporate Bond Funds								
	Holding period (in months)							
Formation period	1	3	6	12	1	3	6	12
3	0.0486***	0.0239	0.0017	-0.0025	0.0474***	0.0253	0.0012	-0.0027
6	0.0411***	0.0179	0.0094	-0.0024	0.0438***	0.0229	0.0106	-0.0038
9	0.0264**	0.013	0.0061	-0.0012	0.0329**	0.0166	0.0071	-0.0059
12	0.0191	0.0044	0.0000	-0.0063	0.0233	0.0089	0.0054	-0.0017