Macro-Active Bond Mutual Funds

Claire Yurong Hong, Jun Pan, and Shiwen Tian*

May 6, 2022

Abstract

We document significant outperformance by government bond funds on important macro announcement days such as FOMC and GDP. The macro-day outperformance is persistent, larger during times of high macro disagreement and surprise, and stronger for active funds with larger idiosyncratic volatility. Their macro activeness also led them into record loss on September 16, 2008, when the FOMC kept the rate unchanged despite the Lehman default. Attributing the macro-day alpha to fund managers' macro-timing skills, we provide evidence that fund managers do actively trade on their predictions of macro news, and their portfolio duration change can predict announcement-day yield curve change.

*Hong (yrhong@saif.sjtu.edu.cn) and Tian (swtian.18@saif.sjtu.edu.cn) are from the Shanghai Advanced Institute of Finance at Shanghai Jiao Tong University. Pan (junpan@saif.sjtu.edu.cn) is from the Shanghai Advanced Institute of Finance at Shanghai Jiao Tong University and CAFR. We benefited from discussions with Jingzhi Huang, Alex Zhou, Jaewon Choi, Bing Han, Shiyang Huang, Dun Jia, and Julia Juric. We thank seminar participants at SAIF at Shanghai Jiao Tong University, Shanghai University of Finance and Economics, Fudan University, China-ASEAN Institute of Financial Cooperation, Xi'an Jiaotong-Liverpool University, and conference participants at CICF 2021, World Finance Conference 2021, FMA Annual Meeting 2021, World Symposium on Investment Research 2022.

1 Introduction

A central question in the study of delegated portfolio management is whether fund managers possess superior skills to outperform a passive benchmark. While this question has been examined quite extensively in the literature for equity funds, we offer in this paper a fresh and unique perspective by focusing on the performance of actively-managed government bond funds on days of important macroeconomic news.

As price movements in the Treasury market are known to be influenced in an important way by the market-moving macroeconomic news (e.g., Fleming and Remolona (1999), Balduzzi, Elton, and Green (2001)), such macro announcement days should be the most important moment for bond fund managers to exercise their skills, if any, in timing the Treasury bond market. By focusing on government bond funds, we can also answer the question of performance attribution in the cleanest way possible as the investment vehicles of such funds are driven almost exclusively by the risk factors influencing the term structure of interest rates, and are free of the liquidity issues that have long plagued the corporate bond funds.[1]

Overall, we find strong evidence of macro-active bond funds with outperformance only on macro announcement days. Relative to the prior literature that finds the bond funds to underperform the benchmark and exhibit no performance persistence (e.g., Blake, Elton, and Gruber (1993)), we find that, on important macro announcement days, actively-managed government bond funds do overperform their benchmark, and the macro-day outperformance is persistent – past macro-day outperformers continue to outperform on future macro announcement days. Relative to the literature that provides mixed evidence on the market timing ability of government bond funds (e.g., Chen, Ferson, and Peters (2010) and Huang and Wang (2014)), by focusing on the most informationally sensitive events for bond funds, we provide a more direct test on their timing ability. We find that, consistent with anecdotal evidences, fund managers do time the bond market prior to important macro announcements such as the FOMC decisions and the release of the GDP numbers, and, importantly, the significant macro-day alpha is the outcome of their macro-timing ability.

Estimating the Macro-Day Alpha – We start our analysis by evaluating fund per-

[1] Unlike corporate bonds, US Treasury bonds are highly liquid and essentially default free. We also exclude from our analysis government bond funds specializing in inflation-protected securities (TIPS), as, unlike other Treasury securities, TIPS are of lower liquidity and add another layer of risk factor to our analysis.

formance on days with and without macro announcements, using a four-factor model that takes into account of the first three principal components in the bond market and the aggregate risk factor in the stock market. For actively-managed equity funds, we do not find significant performance difference on macro and non-macro days, indicating that, although large equity market returns have been documented on FOMC announcement days (Savor and Wilson (2013)), equity fund managers do not lever up prior to such announcements. By contrast, we find that government bond funds earn positive and significant four-factor alpha on days scheduled with important macroeconomic announcements, while exhibiting no outperformance on non-macro days.

Moreover, we find that the outperformance of government bond funds is predominantly concentrated on FOMC and GDP announcement days. For GDP, government bond funds are able to generate an alpha of 3.83 bps (t-stat=6.81) on the day of the announcement, followed by another outperformance of 4.82 bps (t-stat=7.35) on the day after the announcement. For FOMC, the four-factor alpha is 1.56 bps (t-stat=2.53) on the announcement day, followed by another alpha of 1.44 bps (t-stat=2.20) on the day after. Consistent with the hypothesis that such macro-day alpha's are linked to the bond market's reaction to the release of macro news, there is no evidence of abnormal outperformance by government bond funds prior to the actual release of the macro news.[2]

The economic significance of a daily alpha of a few basis points, small for equity funds, are large and significant for government bond funds, whose average daily return is 1.65 bps and daily standard deviation is 22.42 bps. Summing up the 8 FOMC and 12 GDP announcement days in a year, the government bond funds offer a total alpha of 0.58%, and, adding the alpha earned on the day after the announcement, the total outperformance doubles to 1.27%, realized over just 40 days in a year. A portfolio that captures this outperformance – buying into the aggregate government bond funds one day before the GDP and FOMC announcements and exiting one day after, would generate an annualized Sharpe ratio of 2.34, substantially larger than the Sharpe ratio of 0.86 when holding the government bond funds

[2]To show that the macro-day alpha's are uniquely linked to macro announcements, we use non-macro days to create placebo macro-days, matching each GDP and FOMC announcements with the closest bond factor returns, and find no outperformance on such placebo days. Our results are also robust to how the factor exposures are estimated and, using each fund's prospectus benchmark and computing its excess returns non-parametrically, the macro-day outperformance remains. As government bond funds also invest in TIPS, agency bonds and mortgage backed securities, we add such factors to our four-factor model and the results remain robust.

unconditionally throughout the year.[3]

Explaining the Macro-Day Alpha – We next focus our analysis on explaining the significant macro-day outperformance, using its cross-fund and time-series variations. Our hypothesis is that fund managers actively time the bond market using their predictions on macro announcements. Anticipating an FOMC decision or a GDP release that has not been fully priced in the bond market, fund managers adjust their bond-market exposures accordingly and the macro-day outperformance is the result of their macro-timing ability.

Macro-Active Funds – Exploring the cross-fund variation in macro-day outperformance, we are able to identify macro-active funds that can consistently generate positive and significant macro-day alpha. Estimating a fund's activeness using its four-factor idiosyncratic volatility, we find that active funds with higher idiosyncratic volatility outperform the less active funds only on macro announcement days – a one standard deviation increase in fund activeness results in a macro-day alpha of 0.79 bps (t-stat=2.88) for FOMC and 1.33 bps (t-stat=5.37) for GDP, respectively. On non-macro days, however, fund activeness does not generate any difference in fund performance, consistent with our hypothesis that the macro-day alpha stems uniquely from funds' macro-timing skills.[4]

Exploring the cross-fund variation from the perspective of performance persistence, we find that, consistent with the long literature documenting the lack of performance persistence among equity and bond fund managers (Carhart (1997), Brown and Goetzmann (1995), Blake, Elton, and Gruber (1993)), there is no performance persistence on non-macro days. Contrary to the same literature, however, we find the macro-day outperformance to be persistent at the fund level – funds that outperform in past FOMC announcements continue to outperform in future FOMC announcements, and likewise for GDP announcements. Using the past 24-month macro-day alpha to measure past performance, one standard deviation increase in funds' past-macro day alpha leads to a daily average four-factor excess return of 0.78 bps (t-stat=3.09) on FOMC and 1.82 bps (t-stat=7.59) on GDP announcements over the next quarter.

Misprediction at the Lehman Moment – Exploring the time-series variations of the macro-day outperformance, we find that macro-timing is imperfect and misprediction can lead to

[3]To implement this trading strategy from an investor's perspective, we further use net-of-fee fund returns and focus on funds that do not charge front- or back-end loads. The economic magnitude and statistical significance remain similar.

[4]Exploring other characteristics of macro-active funds, we find that funds with shorter management tenure, larger family size, and non-bank affiliation exhibit stronger activeness and macro-day performance.

severe macro-day underperformance, of which the pre-scheduled FOMC announcement on Tuesday, September 16, 2008 is a poignant example. Following the Lehman default on Monday, this particular FOMC meeting is known for Fed's inaction when the policy-making committee voted unanimously against cutting the Fed funds target rate.[5] On this day, the government bond funds in aggregate suffered a four-factor adjusted loss of 24.30 bps, an over 3-sigma event and by far their largest FOMC-day loss, occurring most likely due to their misprediction of FOMC's decision. As further support of their macro activeness, we find that, because of their misprediction of the FOMC announcement on September 16, 2008, the most active funds in the top-quintile incurred the largest loss with a four-factor adjusted return of -48 bps, compared with the -16 bps for the least active funds in the bottom-quintile. The presence of such macro mispredictions, though damaging to funds' macro-day alpha, serves as a direct evidence that fund managers do actively trade using their predictions on macro announcements.[6]

Time-Series Determinants – Though macro-active funds mispredicted the Fed's decision at the Lehman moment, for majority of the FOMC and GDP announcements, they are able to outperform the market. Examining the time-series determinants of the macro-day outperformance, our hypothesis is that fund managers' macro-day alpha should be larger when their opportunity to excel is higher. This includes times when economists have strong disagreements in forecasting the respective macro announcements, and when the macro announcements are more likely to introduce large shocks to the bond market. Using proxies of macro disagreement and macro surprises, we find that this is indeed the case. A one standard deviation increase in macro disagreement is associated with an increase in macro-day alpha of 0.66 bps (t-stat=2.29) for FOMC and 1.52 bps (t-stat=3.13) for GDP, respectively. For macro surprises, the corresponding economic and statistical significance are of similar magnitudes: 0.97 bps (t-stat=2.16) for FOMC and 0.96 bps (t-stat=1.72) for GDP. Interestingly, though not surprising, it is the magnitude of the macro surprise that matters, while the direction of the macro surprise is unimportant, suggesting that fund managers can outperform with both positive and negative news.

Although announcements with high disagreement and large surprises often occur when

[5] See, for example, "Fed Misread Crisis in 2008, Records Show," *New York Times*, Feb 21, 2014.

[6] The fund managers' call, though mispredicting the Fed's decision at the time, turned out to be prescient, as the Fed later cut the rate by 50 bps through an unscheduled emergency meeting on October 8, after having observed the rapidly weakening economy.

markets are more volatile, we find the market-level indices such as VIX or Treasury VIX to be unimportant for the macro-day outperformance. Instead, lacking a common driver, the time-series variations of the macro-day alpha for FOMC and GDP are indicator specific, driven by the macro disagreement and surprises that are specific to FOMC and GDP. From this perspective, the macro-day alpha documented in our paper is linked more closely to the macro-timing abilities of the fund managers and is unlikely to be driven by risk or risk premium.[7]

Adding further evidence on the macro-timing abilities of bond fund managers, we examine the magnitude of macro-day alpha conditional on the absolute value of announcement-day factor returns (Treasury, Level, Slope30, and Slope10), similar in spirit to the classical market timing test of Treynor and Mazuy (1966). Intuitively, the return of a successful market-timing fund goes up with the factor return by a disproportionate larger amount than when it goes down with the factor return. Relative to the literature that performs the market-timing test using all trading days (Chen, Ferson, and Peters (2010) and Huang and Wang (2014)), we differentiate the macro days from the non-macro days. Consistent with our findings that bond funds outperform only on macro days, we find evidence of market-timing by bond funds on macro days but not on non-macro days.

Macro-Day Yield Curve Prediction – While the contrast between bond funds' macro and non-macro day performance is indicative of their market-timing ability, it does not offer any evidence on predictability. In particular, prior to an FOMC announcement day, as macro-active funds increase their duration exposure relative to the less active funds, can this action on average predict a reduction in interest rates on the announcement day? We answer this question using a difference-in-difference approach, and find that the duration change of the macro-active funds relative to their inactive counterparts can indeed predict the incoming announcement-day return of the Treasury market. A one standard deviation increase in the change of duration exposure can predict 1.5 bps decrease in the 2-year Treasury yield on the FOMC announcement day. Overall, our evidence indicates that, prior to the FOMC announcement, macro-active funds on average do time the market with success. Moreover, the predictability of manager duration change dominates the existing yield-curve predictors in the literature, including the forward-spot spread from Fama and Bliss (1987), the γ factor

[7] As shown in Hu, Pan, Wang, and Zhu (2021), large and positive pre-announcement equity returns arise out of the heightened uncertainty induced by the market-moving macro announcements including FOMC, GDP, and non-farm payrolls, and are positively linked to the VIX index.

from Cochrane and Piazzesi (2005), as well as forecasted Fed Funds Rate changes from Bloomberg economists survey and Fed Funds Futures.

Related Literature – Our paper belongs to the literature that studies the trading skills, especially the market timing ability, of bond mutual funds.[8] As documented by Blake, Elton, and Gruber (1993), Elton, Gruber, and Blake (1995), Ferson, Henry, and Kisgen (2006), and Cici and Gibson (2012), bond mutual funds in general underperform the benchmark. Chen, Ferson, and Peters (2010) further show that bond funds in general do not possess positive timing abilities, while Huang and Wang (2014) document positive timing abilities using the holdings data of government bond mutual funds. Against this general finding and motivated by the importance of macro announcements, we offer a more direct test on the market timing ability of government bond mutual funds by focusing on the days that are most informationally sensitive to bond funds. We are the first study documenting the sharp contrast of macro and non-macro days for the purpose of performance evaluation and attribution. Our findings of macro-active funds with macro-timing skills and macro-day outperformance set our paper apart from the existing literature in an important way and adds to the ongoing discussions on the value of active portfolio management.[9]

Our paper also contributes to the literature on yield curve predictability by offering a unique perspective from actively-managed bond funds. Fleming and Remolona (1997), Balduzzi, Elton, and Green (2001), and Green (2004) show that periodically scheduled macroeconomic announcements explain the largest daily price movements in the US Treasury market. Our findings complement this literature by showing that changes in bond funds' interest-rate exposure right before the FOMC announcement can be used to forecast the announcement-day yield curve change. It is worth pointing out that government bond fund returns are updated publicly on a daily basis, and their interest-rate exposure, estimated in real-time, can be used to infer the fund managers' prediction of the FOMC outcome.[10]

Relative to the emerging literature on the asset-pricing implications of pre-scheduled

[8]In addition, there is a parallel literature examining the outperformance of equity mutual funds. See for example, Carhart (1997), Fama and French (2010), Kacperczyk, Sialm, and Zheng (2005, 2008), Amihud and Goyenko (2013), Cremers and Petajisto (2009), Kacperczyk, Nieuwerburgh, and Veldkamp (2014).

[9]Focusing on corporate bond funds, Amihud and Goyenko (2013) and Choi, Cremers, and Riley (2021) find that fund activeness can be a significant predictor of overperformance.

[10]Using the aggregate order flows of hedge funds and mutual funds, Czech, Huang, Lou, and Wang (2020) find predictability for subsequent gilts (UK government bond) returns. Brandt and Kavajecz (2004) find that order flow imbalances account for up to 26% of the daily yield variations on days without macro announcements.

macro announcements,[11] we show that although large equity market returns have been documented on FOMC announcement days, equity fund managers do not lever up prior to such announcements to generate FOMC-day alpha. By contrast, although Treasury securities exhibit a weaker announcement-day premium, bond managers do generate positive FOMC-day alpha. Adding to the debate on the driver of the pre-FOMC drift – whether it is information leakage (Cieslak, Morse, and Vissing-Jorgensen (2019)) or risk premium for heightened uncertainty (Hu, Pan, Wang, and Zhu (2021)), the absence of the FOMC-day alpha for equity funds is more consistent with the risk premium explanation.

Finally, our paper is also related to the literature on macro attention. Using counts of macro-related news articles, Fisher, Martineau, and Sheng (2020) show that attention rises around macroeconomic announcements.[12] Consistently, we find bond fund managers actively manage their portfolio to time factor returns before macroeconomic news release. Echoing the theoretical work by Kacperczyk, Van Nieuwerburgh, and Veldkamp (2016) on fund managers' endogenous attention allocation, our evidence is consistent with the argument that bond fund managers rationally allocate their attention to trade on macroeconomic announcements and the macro-day outperformance is stronger when the announcement is accompanied with higher disagreement and surprises.

The rest of the paper is organized as follows. Section 2 summarizes the data used in the paper. Section 3 documents the macro-day alpha of government bond funds. Section 4 explains the cross-fund and time-series variations of macro-day alpha, identifies the macro-active funds, and provides evidence of their macro-timing abilities. Section 5 exploits fund duration change to predict announcement-day yield curve change. Section 6 concludes the paper.

[11]Savor and Wilson (2013, 2014) show that equity returns behave differently on days with and without macroeconomic announcements. Lucca and Moench (2015) document that the average excess return on US equities is higher before the announcement of FOMC and there is no such effect in U.S. Treasury securities. Hu, Pan, Wang, and Zhu (2021) further document pre-announcement returns for other important macro announcements including GDP.

[12]Andrei, Friedman, and Ozel (2021) develop a multi-firm equilibrium model to show that heightened economic uncertainty motivates investors to allocate attention to firm-level announcements.

2 Data

2.1 Data on Mutual Funds

We focus our main analysis on actively managed government bond mutual funds, as the price movements of US government bonds are mostly driven by market-wide systematic news, and is less affected by firm idiosyncratic news (Fleming and Remolona (1999) and Balduzzi, Elton, and Green (2001)). As a highly liquid interest rate instrument, it enables fund managers to trade actively and express their views along the yield curve. Unlike high yield corporate bond funds, government bond funds are also less subject to the problem of stale pricing (Choi, Kronlund, and Oh (2020)). Taking into account the above reasons, we use the daily returns of government bond funds, a timely reflection of their performance, to infer funds' macro-investing ability. For comparison purposes, we also collect data for equity mutual funds, investment grade bond funds, high yield bond funds, and municipal bond funds.

The data on mutual fund daily returns, total net assets (TNA), age, monthly flow, and expense ratio are collected from the survivor-bias free Center for Research in Security Prices (CRSP) mutual fund databases. The sample period is from September 1998 to December 2019, as CRSP starts to cover fund daily return only after September 1998. Funds' investment styles are identified based on the objective codes provided by CRSP, following Choi, Kronlund, and Oh (2020) and Goldstein, Jiang, and Ng (2017). We also exclude from our analysis government bond funds specializing in inflation-protected securities (TIPS), as, unlike other Treasury securities, TIPS are of lower liquidity and add another layer of risk factor to our analysis.[13] Since we focus our analysis on actively managed mutual funds, we further drop index funds, ETF funds and ETN funds.[14] Fund daily raw return is calculated as fund daily net return plus annual expense ratio/252. For information on fund daily flows, prospectus benchmark, and manager characteristics, we collect them from Morningstar, by matching the fund from CRSP with Morningstar using the CUSIP of each fund share class. To further ensure data quality, we remove fund records with a total assets under management of less than $1 million and an age of less than one year.

[13]Government bond funds are funds that have the first two letters of CRSP style code "IG". Funds that mainly trade on TIPS, with a CRSP style code of "IGT", are excluded.

[14]Passive funds are the ones whose share class is flagged with index fund flag of B, D, E, or ET flag of F, N.

After applying all these screening procedures, we end up with a sample of 846 unique actively managed government bond mutual funds. Table 1 shows the summary statistics for government bond mutual funds in our sample by year from 1998 to 2019. Over the years, the number of government bond mutual funds decreases from 495 in year 1998 to 317 in year 2019. However, the average size of government bond funds increases from an average TNA of \$178 million in 1998 to \$390 million in 2019. The total size of actively managed government bond funds add up to an asset under management of 0.12 trillion in 2019, which is equivalent to 0.8% of the outstanding amount of US Treasury and represents around 4% of actively managed bond funds (including all types of funds) in 2019. As a substantial fraction of balanced funds, investment grade corporate funds, and target date funds also rely on active trading of interest rates for alpha, the macro-skill examined in this paper has implications for a much broader fund category. However, in our main analysis, we focus only on this small but clean government bond fund sample as a testing ground for fund macro-activeness.

Turning to other fund characteristics in Table 1, on average, government bond funds in our sample has an age of 18 years, annual turnover rate of 2.08, and an expense ratio of 0.99%. An annual turnover rate of 2.08 is high, benchmarking to the turnover rate of 0.9 for equity, 0.8 for high-yield, 1.7 for investment-grade, and 0.3 for muni funds, as reported in Appendix Table A1. It suggests that government bond funds actively manage their interest rate exposure, and this is especially true for the most active quintile group of funds with an turnover rate of 2.69.

Since the focus of the paper is to examine the macro-investing ability of fund managers, we use funds' raw returns or gross return in majority of our analysis. Moreover, by comparing funds' macro-day performance with their non-macro day performance, the effect of fee cancels each other out. To formally evaluate the trading profitability of investing in macro-active government bond funds, we conduct our main analysis using the net-fee returns of funds and restrict the sample to those that do not charge any front- or back-end loads. The details are discussed in Appendix B.1.

There are flows in and out the government bond fund industry throughout our sample period, largely coincides positively with the performance of bond funds and negatively with the performance of stock market. Funds on average have a daily raw return of 1.65 basis points, which is comparable to the 1.71 bps of daily return earned by a passive benchmark of Barclay US Treasury index. The standard deviation of fund daily return is 22.4 bps, similar in magnitude to the standard deviation of US Treasury index return, but significantly less than the standard deviation of 118 bps for stock market.

2.2 Factor Construction

To measure funds' abnormal return or alpha on macro and non-macro days, we need to control for the factor exposure of fund returns. Litterman and Scheinkman (1991) show that the shape and day-to-day variation of the yield curve can be well captured by three factors in the yield space. We construct the three government bond factor portfolios based on the principal component analysis (PCA) of 2-, 5-, 10-, and 30-year Barclay US Treasury return indices. Unlike PCA conducted in the yield space, PCA conducted in the return space has the benefit that the resulting factors can be directly used as actual portfolio returns. In particular, after conducting the PCA on the daily returns of the 2-, 5-, 10-, and 30-year Barclay US Treasury indices for the period from September 1998 to December 2019, we then use the eigenvectors for each principal component to construct the respective bond portfolio, normalized so that each portfolio is a net long position of a dollar investment.

Our first bond factor portfolio, R_t^{Level}, captures the parallel shift in the yield curve, with a respective portfolio weights of 3.95%, 14.26%, 27.63% and 54.16% on the 2-, 5-, 10-, and 30-year index returns. Since we are applying PCA in the return space, the longer duration bonds carry higher weights, as the same unit change in yields would result in a larger price movements for long-duration bonds. The second and third bond factor portfolios, which we refer to as R_t^{Slope30} and R_t^{Slope10}, both capture relative trades (or slope trades) on the yield curve. The respective portfolio weights for R_t^{Slope30} are 28.54%, 62.68%, 55.84%, and -47.07%, and the weights for R_t^{Slope10} are 104.19%, 86.25%, -122.80%, and 32.35% on the 2-, 5-, 10-, and 30-year bond indices return. As detailed in Appendix A, both R_t^{Slope30} and R_t^{Slope10} carry information about the yield curve slope, with "Slope30" concentrated more on the difference in yield between the 30-year and the short-end, while "Slope10" more on the difference in yield between the 10- and 2-year. Although the third principal component is usually called the curvature factor, we refer to it as Slope10 as it is more related to the slope of 10- minus 2-year yield.[15] By construction, all the three bond factor portfolios are orthogonalized. The first factor portfolio, R_t^{Level}, explains 95.32% of the variations in bond returns, followed by R_t^{Slope30} and R_t^{Slope10} accounting for another 4.25% and 0.35% respectively. Adding all the

[15] Appendix A describes in detail how we construct the three bond factor portfolios and the mapping from return space to yield space.

three bond factors together, they can explain 99.92% of the variations in 2-, 5-, 10-, and 30-year Barclay US Treasury index returns. The Level, Slope30, and Slope10 factors are then calculated as the corresponding bond factor portfolio return minus the risk free rate, where risk free rate is measured by one-month Treasury bill.[16]

To capture the risks in the equity market, we further construct a stock factor, calculated as CRSP value weighted market return index (VWRETD) minus the risk free rate. Panel B of Table 1 shows the distribution of R_t^{Level}, R_t^{Slope30} , and R_t^{Slope10} at the daily frequency, together with the stock market and Treasury market returns. Overall, Treasury returns are negatively correlated with stock market returns, with a correlation around -0.33. Among the three bond factor portfolios, R_t^{Level} plays the most important role in explaining the Treasury price movements, as captured by the highest correlation of 0.95, followed by R_t^{Slope30} with a correlation of 0.26 and then R_t^{Slope10} with a correlation of 0.04. Consistently, R_t^{Level} also exhibits the highest daily average return of 2.23 bps with a standard deviation of 63.3 bps.

2.3 Macro Announcements

The information on scheduled macro announcements dates are collected from Bloomberg Economic Calendar.[17] Based on Bloomberg relevance score, we focus on ten major U.S. macro announcements, including scheduled announcements by the Federal Open Market Committee (FOMC), GDP, the Institute for Supply Management manufacturing index (ISM), Conference Board Consumer Confidence Index (CCI), total nonfarm payroll employment (NFP), Consumer Price Index (CPI), the preliminary release of the Michigan Consumer Sentiment Index (CSI), Durable Goods Orders (DGO), Retail Sales (RS), and New Home Sales (NHS). During our sample period, we have 171 FOMC announcements, 255 GDP announcements, 247 CSI announcements, 223 RS announcements, 254 NHS announcements, and 256 announcements for CPI, NFP, ISM, CCI and DGO, respectively. For announcements that fall into holidays, we use the next trading day as the announcement day. It is worth noticing that some of the Macro announcements are regularly scheduled at the turn of the month, especially the case for ISM and CCI. To avoid our results being driven by the cash needs and liquidity-related trading at the turn of the months (Etula, Rinne, Suominen, and Vaittinen (2020)), we control for turn of month and turn of year effects when evaluating

[16]The data on risk free rate is from Kenneth French Website.

[17]We include only scheduled macroeconomic announcements, as for unscheduled announcements, fund managers do not have the time and room to actively adjust portfolio beforehand.

fund performance. Turn of month (TOM) is a dummy that equals one if the day falls into the last two trading days at the end of a month or the first two trading days at the beginning of a month. Turn of year (TOY) is a dummy that equals one for January and December.

To capture the information content of each macro announcement, we construct macro disagreement and macro surprise measures based on data from the Bloomberg Economists Survey. The disagreement is constructed as the 75th percentile forecast minus the 25th percentile forecast by Bloomberg economists on each macro announcement. The surprise for macro announcements except FOMC is constructed as the realized value minus the median forecast of Bloomberg economists for each corresponding macro announcement. Because the FOMC's target federal funds rate remained unchanged during 2009 to 2015, we compute FOMC surprise from the 1-day change in the spot-month Fed funds futures rate following Kuttner (2001).

A motivating question for our research is that bond and equity market react differently to macroeconomic news, which creates differential incentive for equity and bond fund managers in the trading of macro-news. Using intra-day data, Fleming and Remolona (1999) and Balduzzi, Elton, and Green (2001) show that price movements in the Treasury market almost instantaneously respond to the announcements of macroeconomic news in less than 30 minutes. In our paper, since we rely on the daily return of funds to identify their macro-investing skills, it is important to confirm that at the daily frequency, the movements of Treasury price are still dominated by the information contained in the announcement, not contaminated by non-announcement related noise. We follow the methodology in Balduzzi, Elton, and Green (2001) to examine the effect of macro surprise on stock and bond market respectively.

For each type of macro announcement i, we regress the announcement-day asset returns or changes in Treasury yields on the announcement surprise, and control for all the other macro announcement surprises on the announcement day. The regression specification is as below:

$$R_t - r_t^f (or\, YldChg_t) = \beta_0 + \beta^i \cdot S_t^i + \sum_{j=1, j\neq i}^{10} \beta^j \cdot S_t^j + \varepsilon_t^i, \qquad (1)$$

where R_t refers to market returns, including stock market return, government bond market return, and the three bond factor portfolios returns (R_t^{Level}, R_t^{Slope30}, and R_t^{Slope10}) on the announcement day t of macro event i. r_t^f is the day-t riskfree return. $YldChg_t$ denotes changes in announcement-day 2-, 5-, 10-, and 30-year yields. S_t^i is the macro surprise for macro announcement type i. S_t^j refers to the macro surprise for other types of macro announcements.

The results are summarized in Appendix Table A2. As shown in column (1), stock market is only responsive to the macro surprises contained in the announcement of ISM and Retail Sales, which are likely to contain information about fundamental growth in the economy. While for government bond market returns, as shown in column (2), it reacts strongly to eight macro announcements out of the total ten announcements, including GDP, FOMC, ISM, CCI, NFP, CSI, RS, and NHS. In columns (3) to (9), we further examine the effect of macro surprise on the term structure of interest rates. We find that majority of the announcements have the largest impact on the level and slope of the yield curve, concentrated on the maturity bracket between 2 to 10 years. Overall, the findings confirm our hypothesis that macro-economic news play important role in explaining the price movements in government bond market at daily frequency.

3 Macro-Day Alpha

To study the performance of actively managed mutual funds, we focus on days with pre-scheduled macroeconomic announcements. Such macro days are known to be informationally rich and thus offer a fertile ground for fund managers to exercise their skills in predicting as well as processing the information that is vital to the capital markets. The relative simplicity of the investment vehicles deployed by the government bond funds further allows us to focus directly on the link between macroeconomic announcements and the term-structure of interest rates.

3.1 Estimating the Macro-Day Alpha

We begin our analysis by estimating the macro-day alpha of government bond funds. We restrict the sample to government bonds with liquid underlying assets, hence, funds specializing in inflation-protected securities (TIPS) are excluded. Let R_t be the day-t value-weighted return of government bond mutual funds, and let Macro_t be a dummy that equals one if day t is an announcement day for the ten major U.S. macro events selected based on Bloomberg's relevance score. Using the one-month T-bill rate as the risk-free rate, and letting r_t^f be the day-t riskfree return, we estimate the macro-day alpha by

$$\begin{aligned} R_t - r_t^f = &\alpha^{\text{non-Macro}} + \alpha^{\text{Macro+}} \text{Macro}_t + \beta^{\text{L}} \left(R_t^{\text{Level}} - r_t^f \right) + \beta^{\text{S}} \left(R_t^{\text{Slope30}} - r_t^f \right) \\ &+ \beta^{\text{C}} \left(R_t^{\text{Slope10}} - r_t^f \right) + \beta^{\text{Stock}} \left(R_t^{\text{Stock}} - r_t^f \right) + \varepsilon_t, \end{aligned} \tag{2}$$

where, using a four-factor model, the fund performance is evaluated against the risk factors in the US Treasury and equity markets. For the equity market, we use the daily excess returns of the CRSP value-weighted index. For the bond market, we use the daily excess returns associated with the first three principal components of the bond market. More details about the construction of these four factors are discussed in Section 2.2 and Appendix A.[18] Given that government bond funds may also invest in agency bonds, MBS, and TIPS, we further add the corresponding factors to form a seven-factor model in our robustness tests.

Central to the regression in Equation (2) is the coefficient $\alpha^{\text{Macro+}}$ on the macro-day dummy, which captures the extra alpha earned by mutual funds on macro announcement days. The performance on the non-macro days is captured by $\alpha^{\text{non-Macro}}$. As reported in Table 2, government bond funds generate significantly larger alpha on the pre-scheduled macro announcement days than the non-macro days. The estimated macro-day alpha is 0.69 bps (t-stat=3.65) higher than the mostly negligible non-macro alpha of 0.085 bps (t-stat=0.79).

Since the distribution of some announcements exhibits strong seasonality, we further include dummy variables to capture the effect associated with the turn of the month (TOM) and the turn of the year (TOY). To further take into account of the time-varying market conditions, we also include the VIX index and the TED spread as the control variables.[19] Table 2 shows that the extra alpha earned on macro announcement days remain strong with a magnitude of 0.73 bps (t-stat=3.77) when the control variables are included.

As the market-moving power varies for the ten macro indicators, the economic significance of the macro-day alpha can be further improved as we attribute the macro-day alpha to

[18]To construct the three bond factor portfolios, we apply the principal component analysis(PCA) on the daily returns of the 2-, 5-, 10-, and 30-year Barclay US Treasury indices and use the eigenvectors for each principal component to construct the respective bond portfolio, normalized so that each portfolio is a net long position of a dollar investment. Relating to PCA in the yield space, R_t^{Level} corresponds to a parallel shift in the yield space. R_t^{Slope30} and R_t^{Slope10} both capture relative trades on the yield curve, with "Slope30" concentrated more on the difference in yield between the 30-year and the short-end, while "Slope10" on the difference in yield between the 10- and 2-year.

[19]After adding the VIX index and the TED spread, the intercept of the regression specified in Equation 2 no longer captures the non-macro day alpha.

the specific macro news by replacing the Macro dummy in Equation (2) by the respective macroeconomic indicators.[20] As reported in Table 2, the government bond mutual funds can generate an extra daily alpha of 2.46 bps (t-stat=4.65) on GDP announcements and 1.1 bps (t-stat=2.06) on FOMC announcements. For the other macro releases, we do not find evidence of superior macro-day performance. Our results indicate that, while fund managers are successful in exploiting the information releases associated with FOMC and GDP, they are either unsuccessful or do not take advantage of the information releases associated with other macro announcements.

The difference in performance between the macro and non-macro days is further illustrated by the time-series plot in the upper left graph of Figure 1. The blue bars represent the average daily alpha earned on FOMC and GDP announcement days for a given year, contrasted with the green bars for the other 8 macro days and the red bars for the non-macro days. Consistent with the regression result, the macro-day alpha is stronger for the FOMC and GDP announcements. Moreover, the positive macro-day alpha is relatively evenly distributed over time and is not driven by any specific years with outsized macro-day alpha's.[21]

By comparison, for actively managed equity funds, we find no evidence of alpha – the macro-day alpha is statistically indifferent from their non-macro alpha, which is itself small and insignificant, and the difference in macro and non-macro alpha is 0.38 bps, economically trivial compared with the 118.1 bps of daily volatility of the US equity market. By contrast, the extra macro-day alpha of 0.69 bps is economically meaningful for the actively managed government bond funds, whose average daily return is 1.65 bps and daily standard deviation is 22.4 bps.

By focusing on government bond funds, we are picking up the asset-pricing impact of macro releases through the one and only vehicle – government bonds. From this unique perspective, the macro-day alpha's of the other bond funds are interesting for us to compare and contrast. Extending the analysis to other types of bond funds, Table 2 reveals an interesting difference between the macro-day alpha for GDP and FOMC. While only government bond funds can generate significant FOMC-day alpha, the skills of processing GDP announce-

[20]Since all the announcements of ISM manufacturing index are released at the turn of the month, ISM is omitted when controlling for the turn of month effect.

[21]We observe a slightly weakened macro-day alpha in the post-2010 period. This may be partially related with the increasing popularity of passive investing in the mutual fund industry. Restricting the sample to macro-active funds (Figure 4), we find a comparable and visible magnitude of macro-day alpha in the post-2010 period.

ments are common to all other funds, especially the investment-grade and high-yield bond funds. High-yield bond fund generates a sizable GDP-day alpha of 5.29 bps, followed by 2.77 bps for investment-grade fund, and 1.94 bps for municipal bond fund. For the government bond fund, the only channel for the positive GDP-day alpha is through investing in government bond funds, while multiple channels exist for other fund styles. Nevertheless, given the interest-rate exposures of the other bond funds, they could very well share the same channel. For the equity fund, it could be through the differing interest-rate exposures of various stocks, although the magnitude is too small to warrant further study.

Finally, in the last two columns of Table 2, we replace fund returns with the daily returns of passive indices as a placebo test. Examining the performance of Barclays US Treasury and Barclays aggregate bond indices on macro announcement days, we fail to find any significant macro-day alpha. This contrast between bond funds and passive indices point to the important role of fund managers in explaining their macro-day outperformance.

3.2 Robustness of the Macro-Day Alpha

Our measure of macro-day alpha relies on a four-factor model with constant risk exposures and risk premiums. As macro announcement days could be uniquely different from the non-announcement days, it is important for us to show that our findings of macro-day alpha are indeed robust. To show that the macro-day alpha is not driven by the unique announcement-day distributions of bond market returns, we use non-announcement days to form a sample of placebo days with matching distributions and demonstrate the absence of macro-day alpha in the placebo test. To address the potential concern with respect to the factor model, we estimate the macro-day alpha using alternative benchmarks, including the benchmark reported in the fund's prospectus.

We start by comparing the stock and bond return distributions using macro and non-macro day returns. As reported in Panel A of Table 3, stock returns are on average significantly higher on the FOMC announcement day, consistent with the findings of Savor and Wilson (2013). Interestingly, our result shows that the average stock market return is also larger on GDP announcement days. For the bond market, we find that the macro-day returns and volatilities of the Level factor differ markedly from those on non-macro days. For example, on FOMC announcement days, the Level factor has a daily standard deviation of 72.64 bps, higher than the 59.9 bps on non-macro days. On GDP announcement days, the average daily return of the Level factor is 10.16 bps, much higher than the value of 2.36 bps for non-macro days. In addition, the Slope30 and Slope10 factors are also more volatile on macro announcement days, though the difference is milder than that of the Level factor. Consistent with the findings for the three bond factors, the overall Treasury market return (i.e., Treasury) exhibits higher volatility and higher premium on macro announcement days, calling for the importance of controlling for factor exposures in the estimation of fund alpha.

To attribute the macro-day alpha uniquely to macro announcements, we select non-macro days with similar factor returns as the macro days and create a sample of non-macro days that are similar in return distribution as the macro-day sample, except that they do not have the actual macro announcements. For example, we match each of the FOMC announcement days with a non-macro day that has the closest Level, Slope30, and Slope10 return in Row (a) of Panel B. On those placebo FOMC announcement days, funds are only able to generate a negative and insignificant alpha of -0.32 bps with a t-stat of -0.58. The placebo macro days for GDP generate a similar pattern with an insignificant negative alpha of -0.41 bps (t-stat=-1.03). Overall, the absence of alpha on the placebo macro days, constructed using days without actual news release, suggests that the funds' outperformance relies on the actual occurrence of macro announcements. It also alleviates the concern that our results are driven by any mis-specification in factor models, as using the same factor model and same estimation methodology, we fail to find any alpha on those placebo macro days.

To further investigate the robustness of the macro-day alpha, we compare the fund alpha estimated using our baseline specification (Equation (2)) with those using alternative benchmarks. As reported in Panel C of Table 3, the macro-day alpha remains positive and significant, regardless of the alternative benchmarks; while for non-macro days, funds on average earn an insignificant and even negative alpha. Row (a) uses the same four-factor model specified in Equation (2), but different from the baseline result reported in Table 2, the macro-day alpha is estimated using the announcement-day returns only, allowing for event-specific factor exposures (β's). Row (b) replaces the Level, Slope30, and Slope10 factors with Barclay US Treasury 2-year, 10-year and 30-year index excess returns. Row (c) and row (d) add a mortgage factor and a TIPS factor to our baseline specification to take into account of the fact that government bond funds can also invest in mortgage backed securities and TIPS. Row(e) further adds the agency factor to form a seven-factor model in the estimation of fund alpha. Finally, row (f) and row (g) replace fund raw returns with prospectus benchmark adjusted returns and net-fee returns,[22] and row (h) estimates funds' macro-day alpha using equal weighted fund returns. Across the various alternative specifications, the extra alpha earned on FOMC and GDP days remain robust, with the magnitude on FOMC ranges from 0.91 bps to 1.84 bps and the magnitude on GDP ranges from 3.64 bps to 3.99 bps.

3.3 Event Window Surrounding Macro Announcements

Using an event study approach, we further extend our analysis of the macro-day alpha to an event window that includes [-6, +6] trading days around the macro announcements, approximately one week before and one week after the news release. A narrow window of two weeks' time makes it unlikely for the event days to be affected by nearby announcement. The left panels of Figure 2 plot the daily returns of government bond funds in excess of risk free rate and the right panels further plot the event-day alphas. As shown in Figure 2, within the respective event day windows of FOMC and GDP, the daily fund excess returns and alpha's are large and significant around the announcement day and falling off precipitously when moving away from the announcement day. As the event-day alpha's are estimated via the four-factor setting of Equation (2) using only the respective event-day returns, this exercise again adds robustness to the macro-day alpha reported in Table 2, where the factor exposures (β's) are estimated using all trading day returns. Regardless of how the outperformance is measured – raw excess return, benchmark adjusted return, or four-factor alpha, the performance within the event window shares the same pattern of large macro-day outperformance for FOMC and GDP announcements.

To formally test the performance of the government bond fund around the macro announcement windows and control for risk factors, we focus on the same event window and replace the macro dummy in Equation (2) by the respective announcement event-day dummies. Take GDP as an example, we add a dummy for each of the three trading day before the GDP announcement [-3, -1] and the three trading days after the GDP announcement [0, +2]. For example, the dummy for the day before the GDP announcement is D($t = -1$)

[22] The magnitude of macro-day alpha under benchmark adjusted specification is smaller because, by assuming a factor loading of 1 on the benchmark, the benchmark adjusted returns bias the outperformance downward. In our sample, government bond funds on average have a factor loading of around 0.89 on their prospectus benchmark.

and the dummy for the day of announcement is D($t = 0$).[23] In the even columns, we further control for seasonality and market conditions, by including TOM, TOY, VIX, and TED rate.

The results in Table 4 present the same unique pattern observed in Figure 2. The abnormal return earned by government bond funds is 1.56 bps (t-stat=2.53) higher on t=0 of FOMC announcement and 1.44 bps (t-stat=2.20) higher on t=1 of FOMC announcement and then falls off rather quickly for other days in the event window. For GDP, we observe a similar and even stronger pattern. The abnormal return of government bond funds are 3.83 bps (t-stat=6.81) and 4.82 bps (t-stat=7.36) higher on the announcement day (t=0) and one day after (t=1) the announcement of GDP. For other 8 macro announcements, there is no significant outperformance for any event day in the [-6, 6] event window.[24]

3.4 Investing with Macro-Day Alpha

One direct consequence of the results of Table 4 is that the outperformance of government bond funds is not only concentrated on the day of announcement, but also extends to one day afterwards. It therefore offers a promising trading strategy for investors to precisely target the mutual fund returns, earned around the macro announcements. For example, a portfolio that buys into the aggregate government mutual funds one day before the announcements of GDP and FOMC, and exits one day after the news releases, generates an alpha of 1.27% in a year with a Sharpe ratio of 2.34, which is substantially larger than the Sharpe ratio of 0.86 when holding the government bond funds unconditionally throughout the year.

The cumulative abnormal return of such a strategy is plotted in the upper right panel of Figure 1 for our sample period from September 1998 through December 2019. Using the four-factor model of Equation (2) as the benchmark performance, an investment in this two-day strategy per FOMC and GDP announcement generates an additional cumulative return of 29%, while the announcement-day only strategy generates an additional cumulative return of 12.6%. In both strategies, the investors are invested in the government bond funds for relatively short period: 40 days per year for the two-day strategy and 20 days per year for the announcement-day only strategy. By comparison, over the same time period, the

[23]GDP are normally announced at 8:30 am and FOMC are normally announced at 2:15 pm on the announcement day t=0.

[24]In Table 4, we observe a significant under-performance by government bond funds on the one day before FOMC announcement (t=-1), however, such under-performance is not observed when estimated allowing for event-day specific risk exposures, as demonstrated in Figure 2. The reason is because funds load slightly less on Level factor and Stock factor on t=-1, while the factors exhibit higher returns on those days.

additional cumulative return excluding the announcement-day performance is a mere 6.7%. In other words, out of the 252 days per year, a disproportional amount of alpha is generated on the 20 announcement days and the 20 post-announcement days of FOMC and GDP.

Moreover, compared with the announcement-day returns, the cumulative abnormal return excluding the announcement-day performance (realized around 232 days per year) is much more volatile. This is especially true around the 2008-09 financial crisis, when fund-level liquidity might have an adverse impact on the fund alpha. By investing in government bond funds only when they are more likely to offer superior returns, investors can avoid such unwanted and uncompensated volatility. To implement this trading strategy, however, one should further consider the frequent entry and exits costs, in addition to the management fees charged when holding the funds. Appendix B.1 formally considers the profitability of this macro-announcement trading strategy. Restricting the sample to funds that do not charge any front-end loads or back-end loads and using the net-of-fee returns of funds to calculate the portfolio return, we find the economic magnitude and statistical significance are similar. In particular, by investing in macro-active bond mutual funds that do not charge any front- or back-end loads, investors could obtain 43.3% abnormal return following this two-day strategy from 1998 to 2019.

4 Understanding the Macro-Day Alpha

Focusing on macroeconomic announcements, our empirical evidences have so far shown that the government bond mutual funds in aggregate exhibit sizable outperformance. To better understand the nature of such outperformance, in this section, we explore both the cross-fund and time-series variations in macro-day alpha to identify who are the macro-active funds and on what type of macro announcements they are able to outperform. By examining funds' trading behavior during the 2008 great financial crisis, we provide further evidence that government bond funds are active traders on macroeconomic news.

4.1 Cross-Fund Variation: Identifying Macro-Active Funds

Exploring the cross-fund variation in macro-day alpha, we identify in this section funds that can consistently generate positive and significant macro-day alpha, using information on their past macro-day performance and past risk-taking.

4.1.1 Performance Persistence: Past Macro-Day Alpha

The lack of performance persistence among fund managers has long been studied and debated as evidence of lack of superior skill (Carhart (1997), Brown and Goetzmann (1995), Blake, Elton, and Gruber (1993)). Having documented that government bond funds are able to generate macro-day alpha via their active interest rate management, we further investigate whether such macro-day alpha is persistent at the fund level, i.e. funds with positive macro-day alpha in the past continue to produce positive macro-day alpha in the future. If funds' macro-activeness reflects the skills they possess in trading macro-relevant news, we shall expect such skills to be persistent over time.

Under a Fama-MecBeth regression framework, Table 5 reports the predictability of government bond funds' past macro-day performance on their future FOMC and GDP announcement day alpha. For each macro announcement and for each fund, we estimate fund's risk exposures (β's) under the four-factor model using a rolling window of past 24 months. The dependent variable is fund's macro-day alpha in the upcoming announcement. The independent variables, funds' past macro-day alpha and non-macro alpha, are the average daily alpha earned on the macro (FOMC and GDP) and non-macro days respectively in this past 24 months window.[25] For easiness of interpretation, the independent variables are standardized with mean zero and standard deviation of one, event by event for each announcements.

It is evident from the regression estimates that funds' past macro-day performance significantly predicts its future announcement-day performance (columns (1) and (5)). When the past macro-day alpha increases by one standard deviation, fund's incoming FOMC-day alpha increases by 0.78 bps with a t-stat of 3.09, and its GDP-day alpha increases by 1.82 bps with a t-stat of 7.59.[26]

The upper panel of Figure 3 further reports the macro-day performance persistence using a portfolio sorting approach. At the beginning of each quarter, we form value-weighted fund portfolio by sorting all government bond funds into quintile groups based on their past 24-months macro-day alpha. The graph plots the portfolio daily alpha for the coming FOMC, GDP, and non-macro days in the quarter. We see a monotonic increasing pattern of fund

[25] We use a rolling window of 24 months in the estimation of fund risk exposure, so that the estimated macro-day alphas are not subject to look-ahead bias.

[26] In untabulated results, we find some evidence that funds' past FOMC alphas are able to predict their future GDP alpha, and vice versa. Because of this cross-predictability, we use their past macro-day alpha instead of event-specific alpha, as predictive regressors to capture performance persistence.

macro-day alpha when moving from the bottom quintile to the top quintile, though the pattern is slightly nosier for FOMC. In the lower graph, we repeat the same exercise using funds' past non-macro day alpha as the sorting variable. We find that past non-macro day alpha fails to predict future macro-day performance. Moreover, the alpha spread between top quintile and bottom quintile funds on non-macro days is only 0.52 bps with a weak statistical significance.

Overall, in contrast to the existing literature which often find little outperformance and performance persistence for government bond mutual funds, we find the performance of bond funds exhibits a tale of two-day effect: Not only do funds outperform the market on the announcements of GDP and FOMC, their past macro-day alpha also positively and significantly predicts their future macro-day alpha. The findings suggest that macro-day alpha may indeed reflect managers' skills in processing macro relevant information, as their macro-investing abilities can carry forward. Non-macro days, as dominated by less macro relevant news (or noise for managers), leave little room for managers to exert their skills, hence weaker performance and performance persistence.

4.1.2 Fund Activeness: Past Idiosyncratic Risk-Taking

We next examine how funds' activeness, reflected in their idiosyncratic risk taking, predicts their performance on FOMC and GDP announcements. Funds' interest rate risk taking is estimated under the four-factor model, using daily return observations in the previous quarter. The regression simultaneously generates the systematic and idiosyncratic volatility, computed as the standard deviation of the fitted values and the residual values of daily returns. Total volatility is the standard deviation of the excess returns, or the summation of systematic and idiosyncratic volatility. For easiness of interpretation, the volatility measures are also standardized with mean zero and standard deviation of one, event by event for each announcements.

Based on the Fama-MacBeth regression estimates in Table 5, we find that funds with higher risk taking (Total Vol) on average exhibit more positive though insignificant macro-day alpha. Decomposing the total volatility into systematic and idiosyncratic components reveals the dominating role played by idiosyncratic volatility. As shown in columns (3) and (7), one standard deviation increase in idiosyncratic volatility predicts 0.79 bps (t-stat=2.88) extra outperformance on FOMC and 1.33 bps (t-stat=5.37) extra outperformance on GDP, amounting to 22.31 bps in a year. The coefficient on systematic volatility, however, is negative and insignificant. The contrast between systematic and idiosyncratic volatility suggests the importance of fund activeness in explaining their macro-day alpha. With passive loading on risk factors, fund managers boost up their systematic risk taking, but fail to generate positive alpha for investors. It is only with dynamic portfolio risk adjustment, reflected in their idiosyncratic or discretionary risk taking, that fund managers are able to achieve better performance on FOMC and GDP announcements.

Though we focus on explaining funds' FOMC-day and GDP-day alpha, one might be curious whether active funds would be successful in trading on other types of macro announcements. Following the specification in column (3) of Table 2, Table 6 reports the macro-day performance for quintile groups of funds with different activeness. Consistent with our previous findings, funds with higher idiosyncratic risk taking exhibit stronger outperformance on the announcement days of FOMC and GDP. When moving from the least active quintile to the most active quintile, the FOMC-day alpha increases from -0.345 bps (t-stat=-0.77) to 3.89 bps (t-stat=3.97). A similar pattern is observed for GDP-day alpha. Turning to other macro announcements, the most active quintile funds are able to gain an extra alpha of 1.73 bps (t-stat=2.15) on the announcement day of consumer confidence index, however, the magnitude of which is less than half of that for FOMC and GDP. For other announcements, we fail to find any macro-day outperformance even when restricting the sample to the most active quintile.[27]

Given the importance of idiosyncratic risk taking, the upper left panel of Figure 4 further demonstrates funds' alpha estimated using a calendar portfolio approach. For each quintile group of funds sorted based on their last quarter idiosyncratic volatility, we form value weighted portfolio and report the fund alpha separately for FOMC, GDP, and non-macro days in the quarter. We observe a monotonically increasing pattern in fund macro-day alpha when moving from the bottom quintile group to the top quintile group. In particular, the "macro-active" fund (top quintile) generates an average alpha of 4.85 bps on FOMC and 5.95 bps on GDP, adding up to 1.10% in a year. The least active fund (bottom quintile), however, only generates 0.13 bps and 1.12 bps macro-day alpha on FOMC and GDP, which add up to 14.5 bps in a year. A 1% return difference for government bond funds is non-trivial, as it is sufficient to move a mediocre funds in the decile group of 4 to decile 8, based on fund

[27] In untabulated results, we compute funds' idiosyncratic risk taking for each type of macro announcements and for non-macro days, we find that active funds' idiosyncratic risk taking is the highest on FOMC and GDP announcements days, suggesting that funds are less active in trading on other types of announcements.

cumulative annual return. Turning to non-macro days (grey bars), we find the level of grey bars is ignorable comparing with that of the blue and red bars, which is consistent with previous findings on the contrast between funds' macro and non-macro day performance.

The strong outperformance of macro-active funds on FOMC and GDP announcements is further illustrated by the time-series plot in the lower graphs of Figure 4. The red and blue lines represent the cumulative four-factor adjusted abnormal return earned by the most active and the least active quintile group of funds. We further include the abnormal performance for all bond funds, captured by the dotted green line, for comparison. Over the period from 1998 to 2019, macro-active funds generate a cumulative abnormal return of 8.57% on FOMC announcements, realized only on the 170 FOMC announcement days, while their least active counterparts and the average bond funds achieve a cumulative abnormal return of 0.2% and 3.16% respectively. A similar pattern is observed for GDP announcements, where macro-active funds generate 16.3% cumulative abnormal return on GDP announcements, standing in contrast to the 2.9% return earned by the least active group. Moreover, benchmarking to the all bond fund sample (green line), the actively managed bond funds (red line) are able to generate a much more smooth and persistent macro-day alpha, especially during the post-2010 sample.

In Section B.2, we further examine what fund characteristics predict their macro-activeness and macro-day alpha. We find some evidence that funds run by managers with shorter tenure, in a big and non-bank affiliated family, are able to outperform more on macro-announcement days. However, the economic importance of fund-level characteristics is rather small, benchmarking to that of fund activeness.

4.2 Time-Series Variation: Macro Timing

In this section, we provide evidence on the macro-activeness of government bond mutual funds via a case study of September 2008 Lehman default. Exploring the time-series variation in funds' macro-day alpha, we further document a stronger macro-day outperformance when the announcements introduce larger shocks to the bond market.

To examine the time-series variation of macro-day alpha, we start by plotting the average FOMC- and GDP-day alpha (blue bars) along with the relevant market conditions (red dashed line) quarter by quarter in the lower two graphs of Figure 1. For FOMC announcements, we summarize the relevant market condition using the volatility of the daily changes in two-year US Treasury yield. As the preferred vehicle to speculate on the FOMC decisions, the two-year Treasury yield contains valuable information of monetary policy, and its volatility could be viewed as a useful proxy for the uncertainty induced by the FOMC decision. As shown in the lower left panel of Figure 1, there is indeed comovement between monetary policy uncertainty and the intensity of FOMC-day alpha. One peak occurs during 2006-09, a period with intensive monetary policy changes. Another peak, though smaller in magnitude, occurs during the fed tapering and the rate lift-off period around 2015-16. In both cases, we observe fund outperformance that is economically meaningful, indicating that the macro skills of government bond funds are not directional and thrive in both up and down markets. Also visible in the plot is the large drawdown of 16 bps during the third quarter of 2008. This episode in fact provides a direct evidence that government bond funds are actively engaged in trading on their predictions of the FOMC outcome, which we discuss in detail in Section 4.2.1.

For GDP announcements, we summarize the market condition using the volatility of the GDP growth rate, estimated using monthly GDP growth rates with a two-year rolling window. As shown in the bottom panel of Figure 1, compared with that for FOMC, the GDP-day alpha is more smooth and persistent. Comparing the time-series variation of the GDP-day alpha with the GDP volatility, we see evidence that the opportunity for government bond funds to generate macro-day alpha is higher when the GDP growths are more volatile, especially during the three peaks of the GDP volatility.

Comparing the time-series variations of FOMC and GDP, we do not see an obvious common driver such as the VIX index, indicating that the macro-day alpha is unlikely to be driven by market-level risk and risk appetite. Instead, the macro-day outperformance seems to be indicator specific, depending on the market condition that is specific to the type of the macro release (e.g., FOMC vs GDP). To better understand the macro-day alpha, we study in Section 4.2.2 the time-series determinants of the macro-day alpha using disagreement as well as surprises with respect to the FOMC and GDP announcements.

4.2.1 Managers' Misprediction at the Lehman Moment

As a direct evidence that the government bond funds do actively trade using their predictions of the FOMC outcome, we examine the case of September 2008, when they mispredicted the FOMC decision. As shown in the lower left panel of Figure 1, the macro-day performance can be severely negative, and the sharp drawdown of FOMC-day alpha in 2008Q3 is the most visible example. There are two scheduled FOMC meetings during that quarter, August 5 and September 16, the latter of which is the day after the Lehman bankruptcy. In both meetings, the FOMC kept the Fed funds target rate unchanged at 2%.

On September 16, the bond market suffered a one-day loss of 18 bps, while the government bond funds in aggregate severely underperformed, suffering a four-factor adjusted loss of 24.30 bps, an over 3-sigma event and by far their largest FOMC-day loss, indicating an overwhelming over-exposure in duration by the bond funds. By contrast, on September 15, among the flight to quality resulted from the Lehman default, the bond market rallied with a one-day return of 131 bps, while the bond fund underperformed with a one-day return of 90 bps, indicating an overall under-exposure in duration by the bond funds. These numbers indicate that, right after the Lehman default on September 15, the government bond funds re-positioned their duration exposure, with the anticipation of a rate cut to be announced by the FOMC at 2:15pm on September 16. Instead, the FOMC's decision was to keep the rate unchanged. It was not until October 8, after having observed the rapidly weakening economy, did the FOMC cut the rate by 50 bps through an emergency unscheduled meeting. With perfect hindsight, the fund managers' call turned out to be prescient, but the Fed seemed too distracted at the time to make the right decision.[28]

This case of misprediction made by the fund managers can further be used as a natural experiment to help us confirm the macro-activeness of fund managers. As shown in the upper right panel of Figure 4, ranking funds by their last quarter idiosyncratic volatility to capture their activeness, the most active funds in the top quintile on average suffer a single-day four-factor excess return of -48 bps, while the number is only -16 bps for the least active funds in the bottom quintile. This mis-prediction by actively managed bond funds offers compelling evidence that bond funds do actively trade on their FOMC predictions.

4.2.2 Announcement Disagreement and Surprise

Using proxies of macro disagreement and macro surprises, we examine in this section the time-series determinants of the macro-day alpha. Suppose that the macro-day outperfor-

[28]Interestingly, on September 16, the equity market shrugs off the disappointing FOMC decision and rebounds with a return of 1.52%, only to be followed by a return of -4.55% on September 17. Even the bond market loss of 18 bps is a mild reaction to the disappointment. This under-reaction can also be observed by how news is reported on September 17, when the front page of Wall Street Journal is over-crowded with the coverage of AIG takeover. By contrast, the mention of the FOMC decision occupies a rather minimal space. This is an interesting case of decision makers as well as market participants being over-loaded with information and failing to process them effectively.

mance is indeed driven by fund managers taking active bond-market positions using their forecasting skills. It then follows that their macro-day alpha should be larger when the opportunity to excel is higher. For example, during times of strong disagreement among the economists' forecasts of the respective macro announcements, fund managers more skilled at forecasting the FOMC decisions or the GDP outcome would have more of an edge in outperforming their benchmark. Likewise, their outperforming opportunity is higher when the macro announcements are more likely to introduce large shocks to the bond market.

For macro disagreement, we use the Bloomberg economists forecasts on the FOMC decision and the GDP number, and measure the respective disagreement indicator as the difference between the top and bottom quartiles of the forecasted values. For macro surprises, we have two measures. As a direct measure, we construct the FOMC surprise using the 1-day change in the spot-month Fed Funds futures rate following Kuttner (2001), and the GDP surprise using the realized announcement value minus the median Bloomberg economists forecast. Using the Treasury market reaction on the announcement day, an alternative measure of the macro surprise is via the announcement-day return on the Barclay's Treasury index. We also include the announcement-day factor returns to capture the differential impact of news release on different components of the yield curve. While the disagreement measure is non-negative by construction, the macro surprise measure is directional with both positive and negative values. For ease of comparison, all variables on macro surprise and disagreement are standardized to have mean zero and standard deviation of one.

The time-series determinants of the macro-day alpha in connection with macro disagreement and surprises are reported in Table 7, where we regresses the four-factor adjusted macro-day excess return on the proxies of macro disagreement and macro surprises, estimated separately for the entire government bond mutual funds as well as the most active quintile group of funds. Consistent with our hypothesis, government bond funds as a whole generate significantly larger macro-day alpha when there is more macro disagreement, and the results are consistent for both FOMC and GDP. One standard deviation increase in the economists disagreement on the FOMC decision is associated with an increase in FOMC-day alpha of 0.66 bps (t-stat=2.29) for all funds and 2.74 bps (t-stat=3.17) for macro-active funds, while one standard deviation increase in the economists disagreement in GDP forecast is associated with an increase in GDP-day alpha of 1.52 bps (t-stat=3.13) for all funds and 2.51 bps (t-stat=3.18) for macro-active funds.

In addition to macro disagreement, macro surprises are also found to be important in driving macro-day alpha. Measuring macro surprises via the realized announcement values, we find that one standard deviation increase in the magnitude of macro surprise (i.e., the absolute value of macro surprises) is associated with an increase in macro-day alpha of 0.97 bps (t-stat=2.16) for FOMC and 0.96 bps (t-stat=1.70) for GDP, respectively. Consistent with the finding that more active funds exhibit stronger macro-investing ability, the magnitude increases to 2.23 bps (t-stat=2.27) and 1.49 bps (t-stat=1.70) correspondingly for the most active funds in the top quintile group. Measuring the macro surprises using the realized announcement-day market returns, the positive connection between macro-day alpha and the magnitude of macro surprises remains strong. Interestingly, though not surprising, the direction of the macro surprise is not important for macro-day outperformance, suggesting that government bond funds can outperform with both positive and negative news, and are not constrained by the direction of the announcement outcome. Although announcements with high disagreement and large surprises often occur when VIX is high, our result in Table 7 indicate that VIX is not very important for the macro-day outperformance. The coefficient on VIX is -0.15 bps (t-stat=-0.27) for FOMC and 1.36 bps (t-stat=1.70) for GDP.[29]

Finally, we examine the magnitude of macro-day alpha conditional on the absolute value of announcement-day factor returns (Level, Slope30, Slope10). We find that, for both FOMC and GDP, the macro-day alpha is disproportionately concentrated on days when the level factor is more volatile (i.e., higher absolute value of the level-factor return).[30] Comparing GDP-day alpha with FOMC-day alpha, GDP-day alpha's are on average higher during extreme slope conditions. Such pattern is consistent with the observation that a steep yield curve can predict higher GDP growth while a flat or inverted yield curve predicts recession. The evidence helps shed light on the market timing ability of government bond funds, in a merit similar to the classical market timing test of Treynor and Mazuy (1966). When the factor return goes up, the successful market-timing fund will be up by a disproportionate amount. When the factor goes down, the fund return will be down by a lesser amount.

Panel C of Table 7 further reports the time-series variation of non-macro day alpha following the same regression specification. On non-macro days, the coefficients on the

[29]When controlling for GDP surprise and GDP disagreement, the effect of VIX on GDP-day alpha is insignificant. Replacing VIX with Treasury VIX, we still do not find a strong explanatory power of VIX on macro-day alpha.

[30]The positive results for both FOMC and GDP might raise the concern that the macro-day alpha is the result of macro-day Treasury market returns being more volatile than non-announcement days. This possibility, however, has been ruled out by the placebo test reported in Section 3.2.

absolute value of factor returns are insignificant, suggesting that fund managers fail to time the movements of yield curve in periods with less intensive macro news. The negative and insignificant timing ability on non-macro days is consistent with Chen, Ferson, and Peters (2010) and Huang and Wang (2014), who find that the ability for bond funds to time the fixed-income market is neutral or even slightly negative, once controlling for public information.[31] By separating the macro-days from non-macro days, we help reveal the positive timing ability of bond funds.

5 Predicting FOMC-Day Yield Curve Change

In this section, we infer managers' expectation about the FOMC outcome from their active portfolio adjustment made just before the announcement. We further show that macro-active fund' duration change can predict announcement-day yield curve change.[32]

5.1 Duration Change and Yield Curve Prediction

To infer managers' expectation about the FOMC outcome, we examine their duration change made just before the FOMC announcement. In particular, prior to an FOMC announcement day, as macro-active funds increase their duration exposure relative to the less active funds, can this action on average predict a reduction in interest rates on the announcement day? We use fund daily returns to infer their duration exposure. Managers' pre-announcement duration change ($\Delta\beta_{t-1}$) is calculated as their sensitivity to the Treasury return from window [-30, -16] before the announcement to window [-15, -1] before the announcement.

To verify that $\Delta\beta_{t-1}$ indeed captures managers' duration change, we first investigate funds' macro-day alpha conditional on whether $\Delta\beta_{t-1}$ is in the same direction as announcement-day Treasury return. We expect a fund to generate significantly positive macro-day alpha when the manager bets correctly on the announcement outcome, i.e., increase (decrease) duration in anticipation of Treasury return increase (decrease) on the announcement day. However, if $\Delta\beta_{t-1}$ is dominated by noise, we would fail to detect the above relationship when

[31]Huang and Wang (2014) show that, unconditionally, bond funds possess positive market timing ability, however, once controlling for public news, funds exhibit neutral or even negative timing ability.

[32]We focus on funds' prediction on FOMC announcements, because the GDP announcements affect yield curve indirectly through investors' views on future economic growth prospectus. Conducting the same exercise for GDP announcements, we find consistent evidence though the statistical power is weak.

using $\Delta\beta_{t-1}$ as a proxy for duration change.

The upper graph in Figure 5 provides evidence that $\Delta\beta_{t-1}$ contains useful information about managers' duration change. Dividing funds into three groups based on their activeness and on whether the $\Delta\beta_{t-1}$ is in the same direction as the announcement-day Treasury return, we find that active funds that bet on the correct side generate a FOMC-day alpha of 2.83 bps (t-stat=2.41). For active funds that bet on the wrong side, their performance is comparable to that of an inactive funds, with an FOMC-day alpha of around 0.08 bps. In other words, $\Delta\beta_{t-1}$ does capture managers' duration change before the announcement and it help identify managers' expectation about the FOMC outcome.

Next, we test the predictability of duration change on announcement-day yield curve change using the following regression specification:

$$\text{YldChg}_t^k = a + b \cdot \Delta\beta_{t-1} + \varepsilon_t^i, \tag{3}$$

where YldChg_t^k is the change in k-year Treasury yield on announcement day t, with k ranging from 2 years to 30 years. Table 8 reports the regression results, estimated for funds with different activeness. Focusing on the most active quintile, we find that macro-active funds' duration change significantly and negatively predicts announcement-day yield curve change. One standard deviation increase in active funds' duration change predicts 1.3 bps decrease in announcement-day 2-year yield. For inactive funds, since they fail to outperform on FOMC-days, consistently, we find their duration change also fails to predict announcement-day yield change.[33]

We then construct the abnormal duration change measure for active funds, calculated as the difference in duration change between the most active and the least active quintile groups. Subtracting the duration change of macro-inactive funds helps control for any passive change in $\Delta\beta_{t-1}$ driven possibly by the time-varying interest rate environment.

As reported in the last column of Table 8, one standard deviation increase in active funds' abnormal duration change (STD of 0.199) predicts 1.47 bps decrease in the 2-year yield, with an R-squared of 5.2%. Consistent with the intuition that monetary policy affects mostly the short-end of the yield curve, the predictive power of duration change is strongest at the 3-year horizon with an R-squared of 6.2% and it decreases to 2.1% at the 30-year

[33]The standard deviation of $\Delta\beta_{t-1}$ is 0.215 for the most active quintile and 0.075 for the least active quintile.

horizon. As a graphical illustration, the lower graph in Figure 5 demonstrates a negative relationship between FOMC-day change in 2-year yield and the abnormal duration change of fund managers. In untabulated results, we also examine the predictability of manager duration change on the yield curve for [-2, +2] trading-day window around the announcement. We find that $\Delta\beta_{t-1}$ predicts only the yield change on FOMC announcement day (t=0), but not the yield change on t=-2, -1, 1, 2 around the announcement. Overall, our evidence indicates that, prior to the FOMC announcement, macro-active funds can predict the FOMC-day yield curve change with success.

5.2 Horse-race against Alternative Yield Curve Predictors

Section 5.1 shows that duration change conveys valuable information about manager's view on the FOMC announcement outcome. However, how informative is managers' view when comparing with existing yield-curve predictors documented in the literature? In particular, does duration change capture extra forecasting ability when controlling for the forward-spot spread in Fama and Bliss (1987) and the γ factor in Cochrane and Piazzesi (2005)? And how does managers' view relate to that of other market participants, including the forecasted change from Bloomberg economists and Fed Funds futures?

We compare and contrast the forecasting ability of duration change with other potential FOMC-day yield curve predictors in Table 9. We report the regression estimates when using these alternative predictors alone to forecast the FOMC-day yield, as well as when combining these alternative predictors with managers' duration change. Focusing first on the existing yield curve predictors, we find that neither the 2-year forward-spot spread from Fama and Bliss (1987) nor the γ_{t-1} factor from Cochrane and Piazzesi (2005) predicts FOMC-day change in 2-year yield, though the sign is consistent with the literature. In particular, consistent with Cochrane and Piazzesi (2005), γ_{t-1} factor on average significantly and negatively predicts 2-year yield change during our sample period, but it fails to significantly predict FOMC-day yield change.

Next, we use the forecasted change in Fed Funds Rate to predict FOMC-day yield change. To capture the forecasted change in Fed Funds Rate, Survey Forecast$_{t-1}$ is calculated as the forecast value from Bloomberg economist survey minus the latest value of Fed Funds Rate. Fed Funds Futures$_{t-1}$ is calculated as the inferred announcement-day Fed Funds Rate change, using the Fed Funds futures price one day before the announcement. Both variables fail to predict announcement-day yield change, perhaps because the forecasted change reflects mostly expected rate change and is well incorporated into the market before the announcement. To confirm that announcement-day yield change is responsive to the surprise component of Fed Funds Rate, in the last row of Table 9, we further include the announcement-day change in the spot-month future rate to capture announcement surprise, calculated following Kuttner (2001). Consistently, we find that announcement-day yield increases significantly in respond to a positive shock from Fed Funds Rate. Controlling for announcement surprise, the predictive power of duration change weakens slightly but remains robust.

6 Conclusions

We investigate in this paper whether or not managers of actively-managed government bond funds possess superior skills in processing macro relevant information and add value for their investors. Prior literature finds that bond mutual funds in general underperform the benchmark and exhibit no performance persistence (e.g. Blake, Elton, and Gruber (1993)). We show that such pattern is a combination of two effects. Bond funds persistently outperform the market on days scheduled with important macro announcements. By contrast, on days without macro announcements, as dominated by less macro relevant news (or noise for managers), there is little room for managers to exert their skills, hence no outperformance or performance persistence. When combined, the number of non-macro days dominates the number of macro-days, resulting in a pattern of no performance persistence that we observe in the literature. We further provide evidence that the nature of fund managers' informational advantage derives, at least in part, from an ability to forecast the content of macro announcements. Macro-active funds' duration exposure change just before the announcement strongly forecasts yield curve change on the FOMC announcement day.

Apart from the differential pattern on macro and non-macro days, bond funds' macro-day performance also contrasts that of their equity counterparts, of which we find no significant macro-day outperformance. Relative to the emerging literature that documents the differential pattern of equity returns on days with and without macroeconomic announcements, equity fund managers do not lever up prior to such announcements to create alpha. By contrast, although Treasury securities do not exhibit strong excess return on scheduled macroeconomic announcements, bond managers do actively adjust duration exposure and are able to time the market with success.

Understanding the source of funds' skills presents a challenge for both academics and practitioners. Importantly, the skills demanded by active management may differ depending on the underlying asset class and across different business cycles. Kacperczyk, Van Nieuwerburgh, and Veldkamp (2016) show that equity fund managers rely on stock picking in booms and market timing in recessions. The absence of macro-day alpha for equity funds suggests that pre-FOMC drift might be driven by heightened uncertainty instead of an investment opportunity in the market. However, the presence of macro-day alpha for government bond funds suggests that bond funds pay special attention to macroeconomic news and are able to outperform the market with their superior macro-investing skills.

References

Amihud, Y. and Goyenko, R. (2013). Mutual fund's R 2 as predictor of performance. The Review of Financial Studies 26(3), 667–694.

Andrei, D., Friedman, H.L., and Ozel, N.B. (2021). Economic uncertainty and investor attention. Available at SSRN 3128673.

Balduzzi, P., Elton, E.J., and Green, T.C. (2001). Economic news and bond prices: Evidence from the US Treasury market. Journal of financial and Quantitative analysis, 523–543.

Blake, C.R., Elton, E.J., and Gruber, M.J. (1993). The performance of bond mutual funds. Journal of business, 371–403.

Brandt, M.W. and Kavajecz, K.A. (2004). Price discovery in the US Treasury market: The impact of orderflow and liquidity on the yield curve. The Journal of Finance 59(6), 2623–2654.

Brown, S.J. and Goetzmann, W.N. (1995). Performance persistence. The Journal of finance 50(2), 679–698.

Carhart, M.M. (1997). On persistence in mutual fund performance. The Journal of finance 52(1), 57–82.

Chen, Y., Ferson, W., and Peters, H. (2010). Measuring the timing ability and performance of bond mutual funds. Journal of Financial Economics 98(1), 72–89.

Choi, J., Cremers, M., and Riley, T.B. (2021). Why Have Actively Managed Bond Funds Remained Popular? Timothy Brandon, Why Have Actively Managed Bond Funds Remained Popular.

Choi, J., Kronlund, M., and Oh, J.Y.J. (2020). Sitting Bucks: Zero Returns and Stale Pricing in Fixed Income Funds. Available at SSRN 3244862.

Cici, G. and Gibson, S. (2012). The performance of corporate bond mutual funds: Evidence based on security-level holdings. Journal of Financial and Quantitative Analysis, 159–178.

Cieslak, A., Morse, A., and Vissing-Jorgensen, A. (2019). Stock Returns over the FOMC Cycle. Journal of Finance 74(5), 2201–2248.

Cochrane, J.H. and Piazzesi, M. (2005). Bond risk premia. American economic review 95(1), 138–160.

Cremers, K.M. and Petajisto, A. (2009). How active is your fund manager? A new measure that predicts performance. The review of financial studies 22(9), 3329–3365.

Czech, R., Huang, S., Lou, D., and Wang, T. (2020). Informed trading in government bond markets. Journal of Financial Economics, forthcoming.

Elton, E.J., Gruber, M.J., and Blake, C.R. (1995). Fundamental economic variables, expected returns, and bond fund performance. The Journal of Finance 50(4), 1229–1256.

Etula, E., Rinne, K., Suominen, M., and Vaittinen, L. (2020). Dash for cash: Monthly market impact of institutional liquidity needs. The Review of Financial Studies 33(1), 75–111.

Evans, R.B. (2010). Mutual fund incubation. The Journal of Finance 65(4), 1581–1611.

Fama, E.F. and Bliss, R.R. (1987). The information in long-maturity forward rates. American Economic.

Fama, E.F. and French, K.R. (2010). Luck versus skill in the cross-section of mutual fund returns. The journal of finance 65(5), 1915–1947.

Ferson, W., Henry, T.R., and Kisgen, D.J. (2006). Evaluating government bond fund performance with stochastic discount factors. The Review of Financial Studies 19(2), 423–455.

Fisher, A.J., Martineau, C., and Sheng, J. (2020). Macroeconomic attention and announcement risk premia. In *5th ASU Sonoran Winter Finance Conference*.

Fleming, M.J. and Remolona, E.M. (1997). What moves the bond market? Economic policy review 3(4).

Fleming, M.J. and Remolona, E.M. (1999). Price formation and liquidity in the US Treasury market: The response to public information. The journal of Finance 54(5), 1901–1915.

Goldstein, I., Jiang, H., and Ng, D.T. (2017). Investor flows and fragility in corporate bond funds. Journal of Financial Economics 126(3), 592–613.

Green, T.C. (2004). Economic news and the impact of trading on bond prices. The Journal of Finance 59(3), 1201–1233.

Hu, G.X., Pan, J., Wang, J., and Zhu, H. (2021). Premium for heightened uncertainty: Explaining pre-announcement market returns. Journal of Financial Economics, forthcoming.

Huang, J.Z. and Wang, Y. (2014). Timing ability of government bond fund managers: Evidence from portfolio holdings. Management Science 60(8), 2091–2109.

Kacperczyk, M., Nieuwerburgh, S.V., and Veldkamp, L. (2014). Time-varying fund manager skill. The Journal of Finance 69(4), 1455–1484.

Kacperczyk, M., Sialm, C., and Zheng, L. (2005). On the industry concentration of actively managed equity mutual funds. The Journal of Finance 60(4), 1983–2011.

Kacperczyk, M., Sialm, C., and Zheng, L. (2008). Unobserved actions of mutual funds. The Review of Financial Studies 21(6), 2379–2416.

Kacperczyk, M., Van Nieuwerburgh, S., and Veldkamp, L. (2016). A rational theory of mutual funds' attention allocation. Econometrica 84(2), 571–626.

Kondor, P. and Pinter, G. (2021). Clients' connections: measuring the role of private information in decentralised markets. Journal of Finance.

Kuttner, K.N. (2001). Monetary policy surprises and interest rates: Evidence from the Fed funds futures market. Journal of monetary economics 47(3), 523–544.

Litterman, R. and Scheinkman, J. (1991). Common factors affecting bond returns. Journal of fixed income 1(1), 54–61.

Lucca, D.O. and Moench, E. (2015). The pre-FOMC announcement drift. The Journal of finance 70(1), 329–371.

Savor, P. and Wilson, M. (2013). How much do investors care about macroeconomic risk? Evidence from scheduled economic announcements. Journal of Financial and Quantitative Analysis, 343–375.

Savor, P. and Wilson, M. (2014). Asset pricing: A tale of two days. Journal of Financial Economics 113(2), 171–201.

Treynor, J. and Mazuy, K. (1966). Can mutual funds outguess the market. Harvard business review 44(4), 131–136.

Figure 1. Bond Fund Return on Macro and non-Macro Days

The upper left graph plots government bond funds' four-factor adjusted daily alpha on FOMC and GDP announcements, other 8 macro announcements, and non-macro announcements days, by year. The upper right graph plots the cumulative abnormal returns of government bond funds, earned on FOMC and GDP announcement day (t=[0] only) and on announcement day and one day after the announcement (t=[0,1] only) respectively. The dotted black line plots the cumulative abnormal return earned on all the other days, excluding the FOMC and GDP announcement day (t=[0]). The lower two graphs plot government bond fund daily alpha on GDP and FOMC announcement days in each quarter. We further include the volatility of 2-year Treasury yield in the lower left figure, calculated as the standard deviation of daily change in 2-year yield in the quarter of announcement. In the lower right graph, we further include the volatility of GDP growth, calculated using a rolling 2-year window, including the announcement quarter itself.

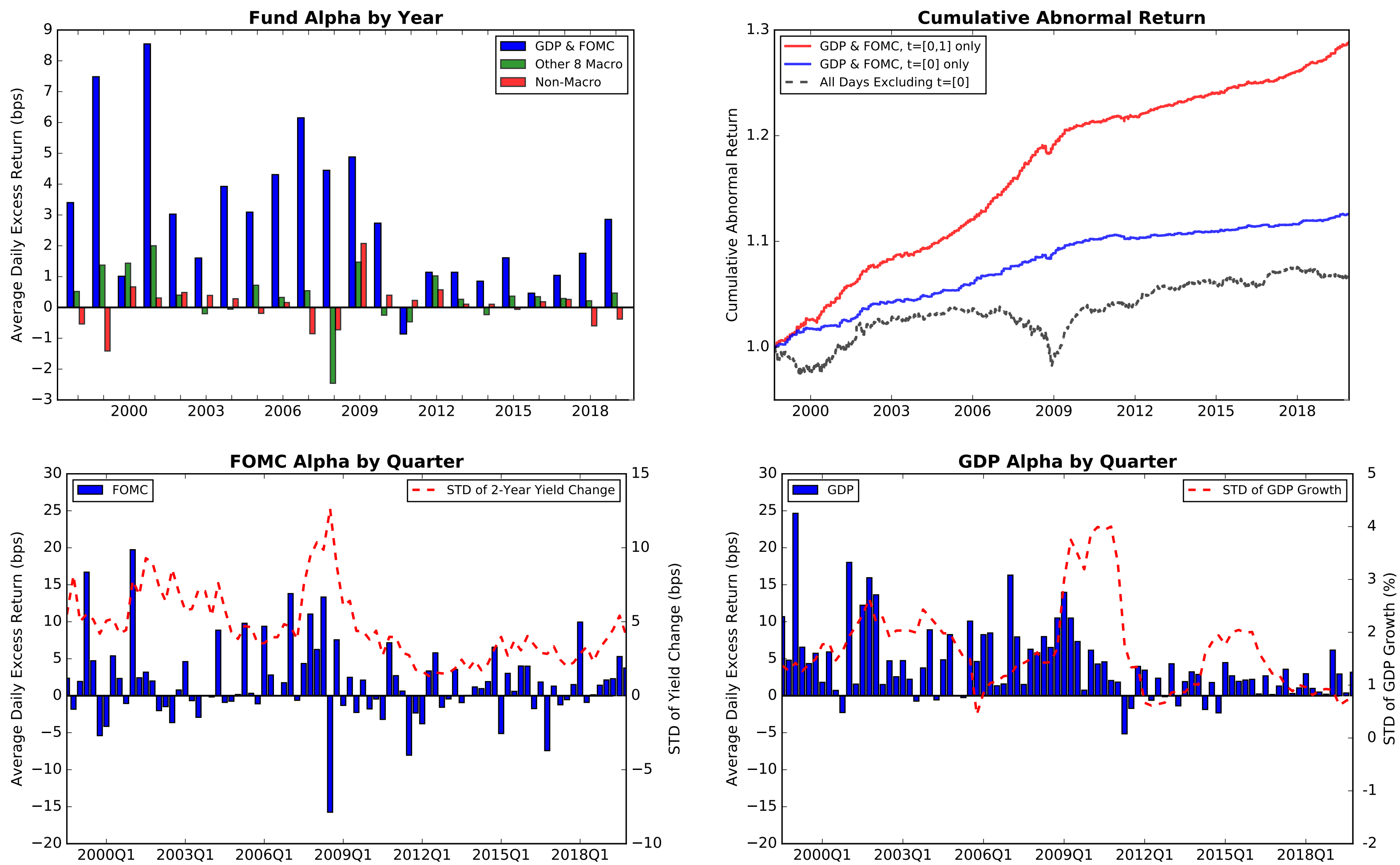


Figure 2. Bond Fund Return around Macro Announcements

The graphs show the daily returns of government bond funds around the [-6, 6] trading day window of GDP, FOMC, and other 8 macro announcements. In the left graphs, fund excess return is calculated as fund raw return minus the risk free rate. In the right graphs, alphas of government bond funds are estimated for each event day ($t = i$) under the four-factor model, by regressing the government bond fund daily excess returns of event day i on the Level, Slope30, Slope10, and Stock factors. The shaded areas denote the 95% confidence interval.

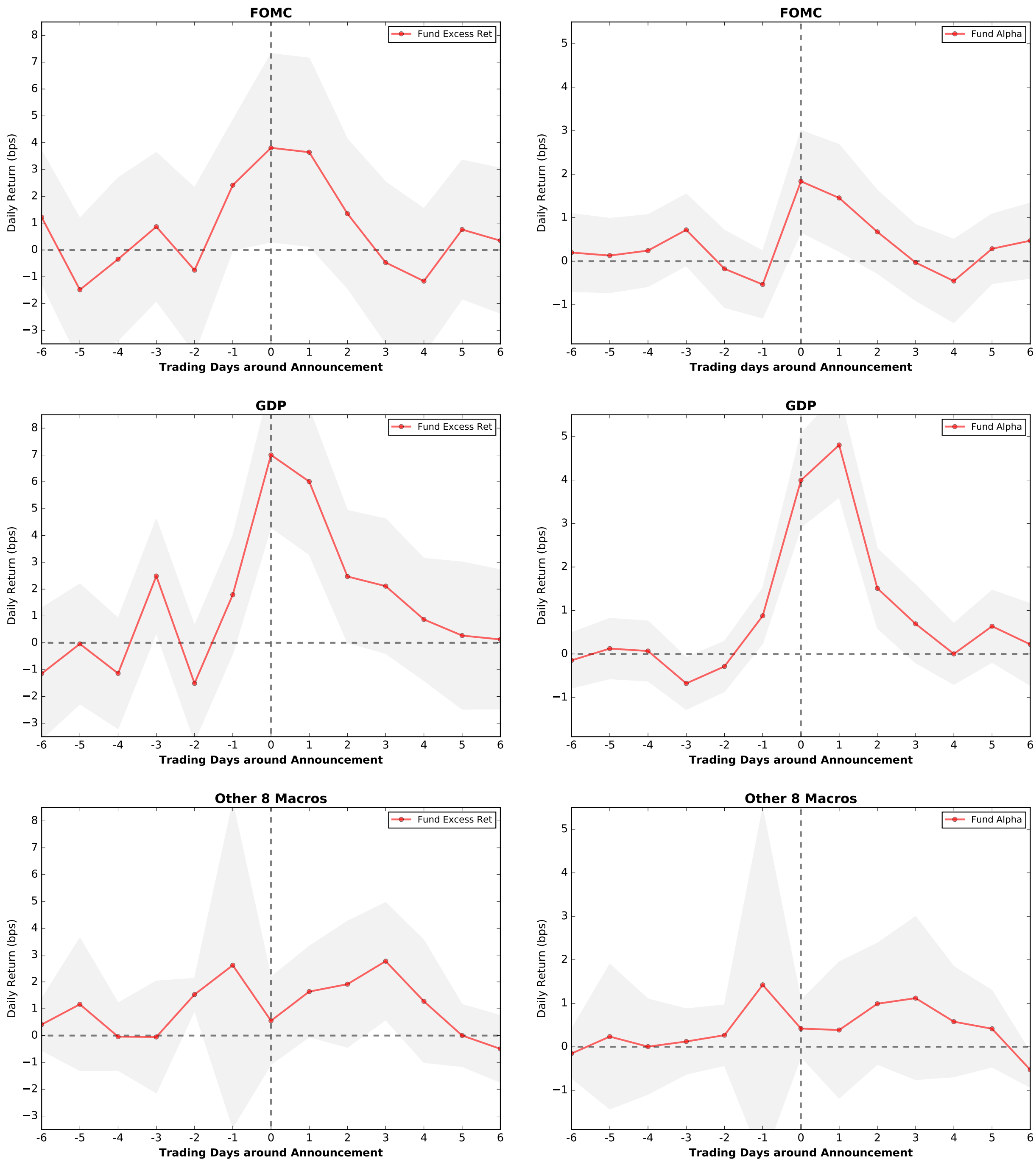
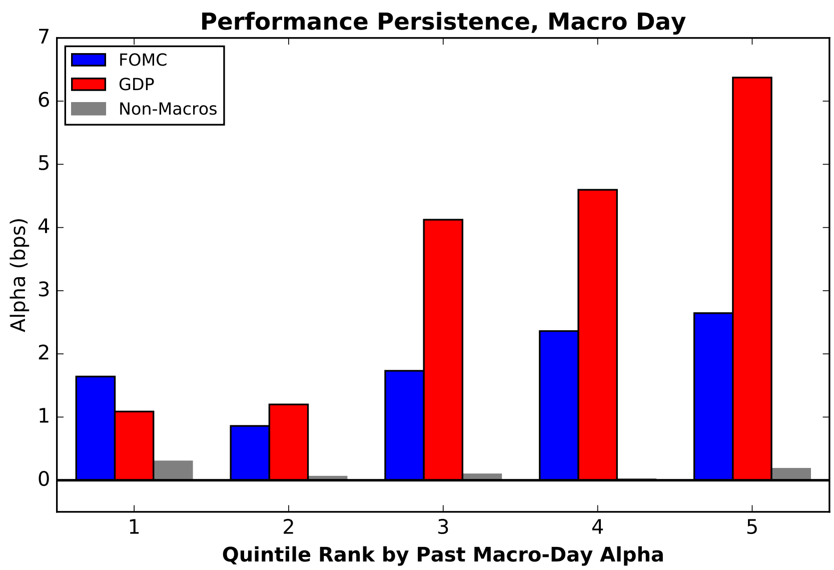


Figure 3. Macro-Day Alpha Conditional on Past Performance

The graphs plot the FOMC, GDP, and non-macro day alpha for portfolios constructed based on funds' past macro-day and non-macro day alphas respectively. Alphas are estimated under the four-factor model using a rolling window of 24-months. At the beginning of each quarter, we sort funds into quintile groups based on their past performance, we then form value-weighted fund portfolios and examine their performance during the next quarter. The figure plots the portfolio alpha estimated for FOMC, GDP, and non-macro days separately under the four-factor model. Quintile 1 denotes the past loser funds and quintile 5 denotes the past winner funds on macro announcement days.



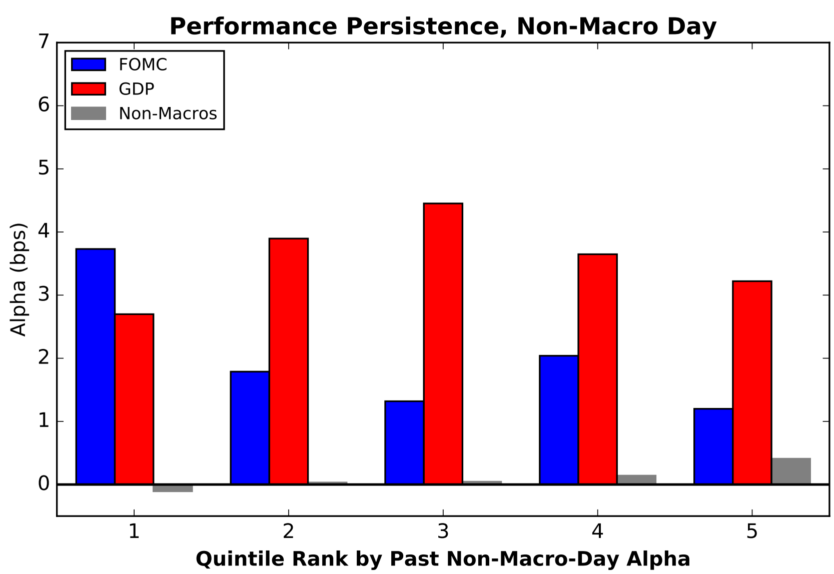


Figure 4. Macro-Day Alpha Conditional on Fund Activeness

The upper left graph plots the average fund macro and non-macro day alpha conditional on their last-quarter idiosyncratic volatility. At the beginning of each quarter, we sort funds into quintile groups based on their last quarter idiosyncratic volatility, we then form value-weighted fund portfolios and examine their performance during the next quarter. The figure plots the portfolio daily alpha estimated for FOMC, GDP, and non-macro days separately under the four-factor model. The lower two graphs plot the cumulative four-factor adjusted abnormal return of government bond funds on FOMC and GDP announcement days (t=0 only) respectively. Quintile 1 denotes the least active funds and quintile 5 denotes the most active funds. The upper right graph plots the four-factor adjusted excess return for each quintile group of funds, sorted based on last-quarter idiosyncratic volatility, on September 16, 2008.

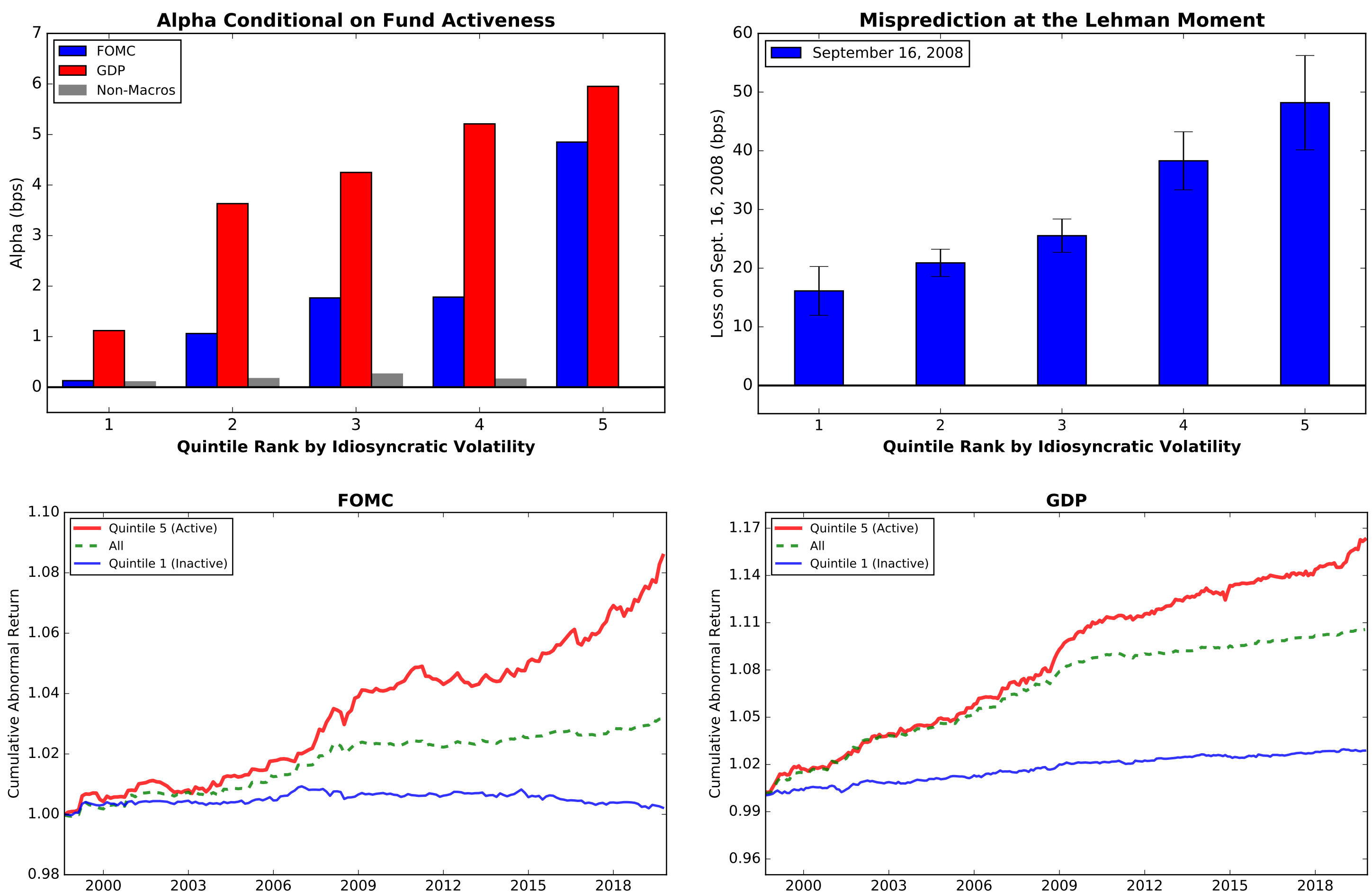
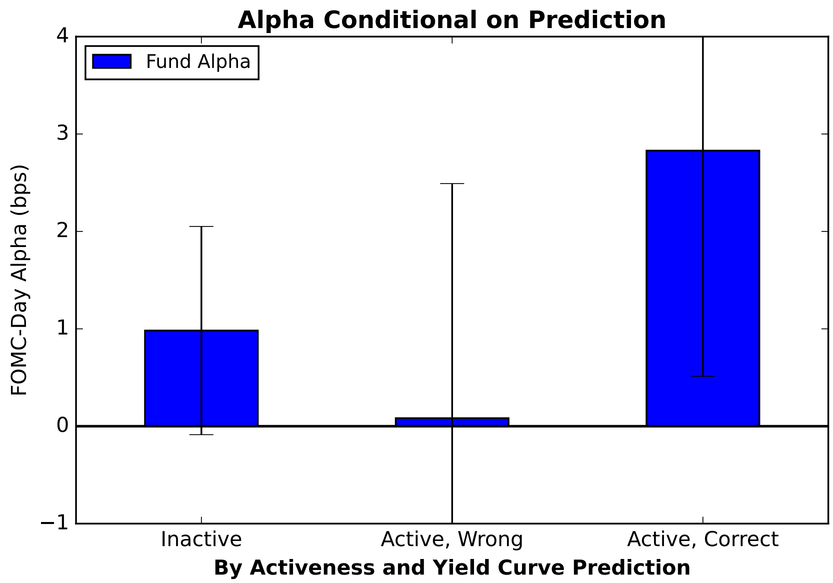


Figure 5. Macro-Active Funds' Prediction and Yield Curve Change

The upper graph reports funds' FOMC-day alpha conditional on their activeness and yield curve prediction. Change in fund duration exposure ($\Delta\beta$) is calculated as the change in the sensitivity to Treasury return, from window [-30, -16] before the announcement to window [-15, -1] before the announcement. Correct prediction refers to funds whose $\Delta\beta$ is in the same direction as the announcement day Treasury return. For example, "Active, Correct" denotes funds that are in the top quintile group based on last-quarter idiosyncratic volatility and, meantime, have bet correctly on the direction of Treasury market return. The lower graph shows how the abnormal change in duration exposure by actively managed government bond funds predicts the change in 2-year Treasury yield on the announcement day. Abnormal change in duration exposure is calculated as the duration exposure change of active funds minus that of the inactive funds.



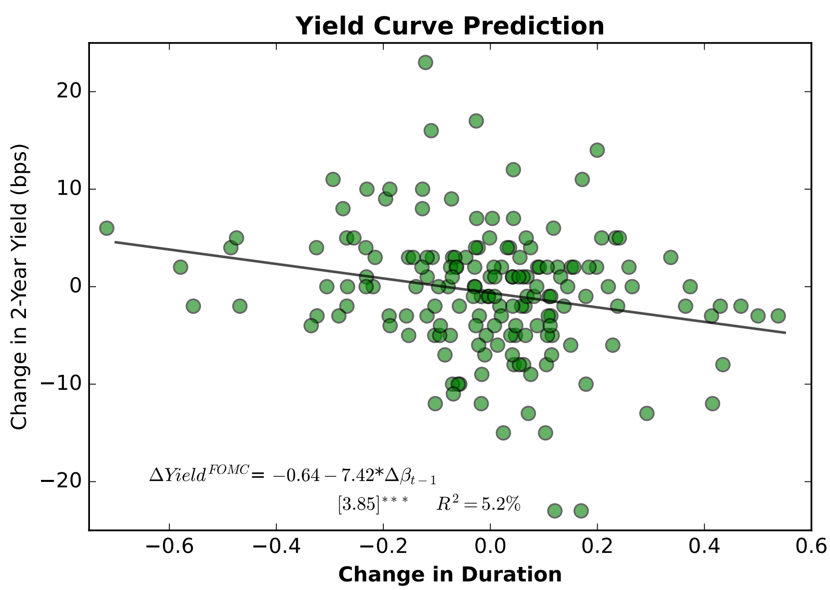


Table 1. Summary Statistics of Government Bond Funds

Panel A reports the summary statistics for actively managed government bond funds. We require a fund to have at least \$1 million total assets under management and with age longer than 12 months to be included. $\#Funds$ is the number of unique funds in each year. TNA is fund total net asset in millions of dollars. Age is number of months since a fund's inception. $Flow$ is fund monthly flow in percent, estimated as $\frac{TNA_t - TNA_{t-1}(1+Ret_t)}{TNA_{t-1}}$. $Expense$ refers to funds' annual expense ratio in percent. $Turnover$ is calculated as the minimum of aggregated sales or purchases, divided by the average 12-month TNA. Ret is fund daily raw returns in bps, calculated by averaging across all funds each day, and then averaged across all days in a year. STD is the standard deviation of fund daily raw returns in bps, calculated for each fund and then averaged across all funds in a year. Panel B reports the summary statistics for market returns. $Level$, $Slope30$, $Slope10$ are the three bond market portfolio returns constructed from principal component analysis on the daily returns of the 2-, 5-, 10-, and 30-year Barclay US Treasury indices. $Stock$ is CRSP value weighted market daily return in bps. $Treasury$ is Barclays US Treasury index daily return in bps. The sample period is from September 1998 to December 2019.

Panel A. Distribution of Fund Characteristics

	Fund Characteristics						Fund Return	
Year	#Fund	TNA ($Million)	Age (Months)	Flow (%)	Expense (%)	Turnover	Ret (bps)	STD (bps)
1998	495	178	188	2.42	1.08	1.71	2.75	30.48
1999	480	179	192	-0.04	1.08	1.68	-0.12	25.29
2000	466	160	201	-0.84	1.08	1.98	4.29	23.19
2001	433	183	215	2.88	1.08	2.04	3.01	29.71
2002	409	238	223	3.43	1.05	1.87	3.68	24.39
2003	392	288	230	-0.08	1.05	1.92	1.07	24.77
2004	389	248	233	-1.39	1.06	1.56	1.52	21.06
2005	377	228	235	-0.91	1.05	1.48	1.07	18.60
2006	362	210	238	-1.02	1.04	1.67	1.74	17.58
2007	348	206	239	0.02	1.02	2.22	2.82	22.09
2008	351	247	235	1.86	1.00	2.81	2.39	37.81
2009	382	288	225	0.33	1.00	2.20	1.37	28.24
2010	388	334	221	0.15	0.99	2.04	2.18	22.94
2011	390	347	216	0.09	0.98	2.12	2.57	22.58
2012	382	395	214	-0.32	0.96	2.39	1.16	15.47
2013	367	374	214	-2.25	0.95	2.52	-0.70	19.03
2014	351	318	212	-0.87	0.96	2.50	1.77	14.60
2015	348	334	208	-0.48	0.94	2.90	0.38	19.63
2016	338	368	204	-0.08	0.89	2.41	0.67	17.13
2017	336	327	198	-1.01	0.85	1.59	0.90	15.10
2018	321	338	193	-0.38	0.82	1.60	0.33	15.88
2019	317	390	191	-0.31	0.81	2.21	2.24	18.30
All	846	284	216	-0.02	0.99	2.08	1.65	22.42

Panel B. Distribution of Market Returns

Summary Statistics				Correlation					
Variable	N	Mean	STD		Level	Slope30	Slope10	Stock	Treasury
Level	5,326	2.23	63.30	Level	1.00				
Slope30	5,326	1.09	21.18	Slope30	-0.01	1.00			
Slope10	5,326	1.20	11.37	Slope10	0.00	-0.01	1.00		
Stock	5,326	3.62	118.12	Stock	-0.33	-0.08	-0.10	1.00	
Treasury	5,326	1.71	28.43	Treasury	0.95	0.26	0.04	-0.33	1.00

Table 2. Macro-Day Alpha

The table reports the performance of different types of mutual funds and passive indexes, estimated under the four-factor model. Macro is a dummy that equals one if the day falls into any of the ten macro announcements, including GDP, FOMC, Manufacturing index (ISM), Consumer Confidence Index (CCI), nonfarm payroll (NFP), Consumer Price Index (CPI), Michigan Consumer Sentiment Index (CSI), Durable Goods Orders (DGO), Retail Sales (RS), and New Home Sales (NHS). GDP, FOMC, CCI, NFP, CPI, CSI, DGO, RS, NHS are dummies that equal to one for the corresponding announcements. The controls include turn of month dummy, turn of year dummy, VIX, and TED rate. Other Factors include investment-grade bond factor, high-yield bond factor, and municipal bond factor. The standard errors are adjusted for heteroskedasticity. *, **, and *** denote significance at 10%, 5% and 1% levels, respectively.

	Government Bond Fund			Equity Fund			Other Bond Funds and Passive Indices				
							IG	HY	Muni	Barclay UST	Barclay AGG
Macro	0.690***	0.726***		0.381	0.361						
	[3.65]	[3.77]		[1.26]	[1.19]						
FOMC			1.099**			0.855	0.599	0.439	0.940	0.321	0.344
			[2.06]			[1.06]	[0.82]	[0.45]	[1.52]	[1.24]	[0.80]
GDP			2.463***			2.303***	2.772***	5.289***	1.942***	-0.164	-0.154
			[4.65]			[3.26]	[4.06]	[4.50]	[3.05]	[-0.71]	[-0.50]
CCI			0.814*			0.477	1.191**	2.931***	2.100***	-0.147	-0.487
			[1.81]			[0.71]	[2.18]	[3.20]	[3.62]	[-0.66]	[-1.47]
NFP			-0.140			0.171	-0.038	-1.195**	-0.733*	-0.364	0.281
			[-0.34]			[0.26]	[-0.07]	[-2.04]	[-1.73]	[-1.28]	[0.79]
CPI			-0.317			-0.065	-0.745	-0.885	-0.441	-0.451*	-0.566
			[-0.88]			[-0.10]	[-1.47]	[-1.54]	[-0.97]	[-1.85]	[-1.47]
CSI			0.737			0.657	0.308	0.539	-0.194	-0.380	-0.351
			[1.46]			[1.10]	[0.77]	[0.83]	[-0.49]	[-1.50]	[-1.17]
DGO			0.216			-0.395	0.512	-1.256	-0.380	0.030	0.167
			[0.56]			[-0.50]	[1.10]	[-1.41]	[-0.97]	[0.14]	[0.56]
RS			0.173			-0.610	0.048	0.470	-0.128	-0.226	-0.102
			[0.34]			[-0.86]	[0.11]	[0.74]	[-0.34]	[-1.06]	[-0.37]
NHS			0.790			0.038	0.655	0.911	0.565	0.305	0.135
			[1.56]			[0.05]	[1.39]	[1.29]	[1.37]	[1.20]	[0.41]
Level	0.275***	0.274***	0.274***	0.024***	0.024***	0.023***	0.408***	0.351***	0.648***	0.431***	0.428***
	[116.72]	[118.31]	[119.72]	[7.92]	[7.92]	[7.78]	[30.42]	[25.38]	[51.42]	[342.76]	[51.44]
Slope30	0.298***	0.297***	0.297***	0.042***	0.043***	0.043***	0.363***	0.373***	0.291***	0.360***	0.334***
	[46.85]	[47.92]	[48.46]	[4.68]	[4.80]	[4.81]	[29.16]	[16.14]	[29.16]	[108.80]	[39.63]
Slope10	0.081***	0.074***	0.074***	-0.019	-0.020	-0.020	0.024	-0.019	-0.133***	0.114***	0.014
	[5.79]	[5.40]	[5.42]	[-1.04]	[-1.12]	[-1.13]	[0.97]	[-0.53]	[-5.66]	[14.41]	[0.72]
Stock	0.008***	0.007***	0.007***	0.785***	0.783***	0.783***	0.016***	0.045***	0.001	0.003***	0.010***
	[5.14]	[4.89]	[4.89]	[332.71]	[334.92]	[335.56]	[7.84]	[16.35]	[0.29]	[4.48]	[6.42]
Intercept	0.085	-0.146	-0.098	0.204	1.975***	2.009***	0.134	1.095*	0.992**	0.499***	0.527
	[0.79]	[-0.45]	[-0.30]	[1.06]	[3.70]	[3.79]	[0.29]	[1.96]	[2.19]	[3.62]	[1.49]
Controls	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
Other Factors	N	N	N	N	N	N	Y	Y	Y	N	Y
Observations	5,326	5,326	5,326	5,326	5,326	5,326	4,752	4,752	4,752	5,326	4,752
R-squared	0.889	0.896	0.897	0.986	0.987	0.987	0.855	0.809	0.822	0.984	0.953

Table 3. Robustness of Macro-Day Alpha

Panel A shows the distribution of market returns on macro and non-macro days. Panel B reports fund alpha on placebo macro days. We match each announcement day with a non-macro day that has the closest bond factors (Level, Slope30, Slope10) in row (a), or closest bond factors and stock factor in row (b), or closest Treasury excess return in row (c). Panel C reports macro-day performance under alternative specifications. We regress government bond fund value-weighted returns on the ten macro announcement dummies under the four-factor model, and the coefficients on FOMC, GDP and Intercept (Non-Macros) are reported. In row (a), we allow for announcement specific risk exposures, by estimating funds' risk exposures under the four-factor model using FOMC or GDP or non-macro days only. In row (b), we replace the three bond factors with 2-year, 10-year and 30-year bond factors, calculated as the Barclays Treasury 2-year, 10-year and 30-year index returns minus risk free rate. In row (c) and (d), we add "Mortgage" factor and "TIPS" factor respectively into our baseline specification and report the coefficient estimates. In row (e), we add "Mortgage", "TIPS", and "Agency" factors to estimate fund alpha under a seven-factor model. In row (f), fund performance is measured in excess to their prospectus benchmark index return. In row (g), we estimate fund alpha using the net-fee returns. In row (h), we use the equal-weighted fund returns to estimate FOMC, GDP, and non-macro day alpha under the four-factor model. *, **, and *** denote significance at 10%, 5% and 1% levels, respectively.

Panel A. Market Returns on Macro vs. Non-Macro days

	Mean of Daily Return						STD of Daily Return		
	FOMC		GDP		Non-Macros		FOMC	GDP	Non-Macros
Level	6.01	[1.08]	10.16**	[2.35]	2.36**	[2.26]	72.64	68.95	59.90
Slope30	2.34	[0.93]	0.77	[0.54]	1.07***	[3.08]	32.78	23.04	19.90
Slope10	0.46	[0.38]	2.02**	[2.54]	1.09***	[5.56]	15.74	12.68	11.28
Stock	29.50***	[3.28]	14.06**	[2.12]	-0.36	[-0.17]	117.57	105.93	117.66
Treasury	4.41*	[1.86]	4.73***	[2.68]	1.77***	[4.13]	30.93	28.17	24.65
Number of Days	171	171	255	255	3301	3301	171	255	3301

Panel B. Fund Alpha on Placebo Macro Days

	FOMC		GDP	
	Alpha	*t*-stat	Alpha	*t*-stat
(a) Match by Level, Slope30, Slope10	-0.32	[-0.58]	-0.41	[-1.03]
(b) Match by Level, Slope30, Slope10, Stock	0.60	[1.15]	-0.19	[-0.44]
(c) Match by Treasury	-0.44	[-1.09]	-0.48	[-1.36]

Panel C. Macro-Day Alpha Using Alternative Specifications

	FOMC		GDP		Non-Macros	
	Alpha	*t*-stat	Alpha	*t*-stat	Alpha	*t*-stat
(a) Event-Specific Beta	1.84***	[3.39]	3.99***	[7.35]	0.09	[0.82]
(b) 2Yr+10Yr+30Yr+Stock	1.36**	[2.54]	3.97***	[7.42]	0.06	[0.58]
(c) Level+Slope30+Slope10+Stock+Mortgage	1.26**	[2.55]	3.85***	[7.87]	-0.01	[-0.14]
(d) Level+Slope30+Slope10+Stock+TIPS	1.16**	[2.09]	3.85***	[7.20]	0.07	[0.65]
(e) Level+Slope30+Slope10+Stock+Mortgage+TIPS+Agency	0.92**	[2.05]	3.79***	[7.87]	-0.07	[-0.88]
(f) Benchmark Adj. Ret	0.91**	[2.22]	3.64***	[8.13]	-0.19**	[-2.44]
(g) Net Fee Return	1.24**	[2.23]	3.95***	[7.38]	-0.16	[-1.52]
(h) Equal-Weighted Return	1.70***	[3.54]	3.75***	[7.45]	0.10	[1.04]

Table 4. Dynamic Event Window

We regress value-weighted government bond fund daily excess returns on macro announcement event-day dummies for FOMC, GDP and other 8 macros. D($t = i$) is a dummy variable that equals one for the ith trading day around the macro announcement, and t=0 is for the announcement date. For announcements that fall into holidays, we use the next trading day as t=0. We include t=-6 to t=6 window around the macro announcements. To control for market risks, we include the stock market returns and the three government bond market returns, i.e., Level, Slope30, and Slope10, in the regressions. The returns are all in excess of risk-free rate, as measured by one-month Treasury bills. In columns (2), (4) and (6), we further include TOM, TOY, VIX and TED. The standard errors are clustered at the macro event level. *, **, and *** denote significance at 10%, 5% and 1% levels, respectively.

	FOMC		**GDP**		**Other 8 Macros**	
	(1)	(2)	(3)	(4)	(5)	(6)
D($t = -3$)	0.601	0.659	-1.118***	-0.586*	-0.119	0.121
	[1.25]	[1.42]	[-3.68]	[-1.93]	[-0.33]	[0.37]
D($t = -2$)	-0.438	-0.488	-0.747**	-0.199	0.049	-0.059
	[-0.87]	[-1.02]	[-2.31]	[-0.62]	[0.17]	[-0.13]
D($t = -1$)	-0.783*	-0.988**	0.555	0.410	1.236	1.158
	[-1.90]	[-2.55]	[1.51]	[1.10]	[0.63]	[0.82]
D($t = 0$)	1.558**	1.220**	3.828***	2.623***	0.153	-0.046
	[2.53]	[2.15]	[6.81]	[4.82]	[0.71]	[-0.10]
D($t = 1$)	1.438**	0.904	4.818***	3.141***	0.176	-0.244
	[2.20]	[1.41]	[7.35]	[4.68]	[0.31]	[-0.34]
D($t = 2$)	0.562	0.026	1.217**	-0.715	0.772	0.475
	[1.03]	[0.05]	[2.52]	[-1.24]	[1.64]	[1.82]
Level	0.276***	0.274***	0.277***	0.276***	0.274***	0.273***
	[52.55]	[52.44]	[64.18]	[64.71]	[110.52]	[116.83]
Slope30	0.282***	0.281***	0.298***	0.296***	0.299***	0.297***
	[21.45]	[22.32]	[27.78]	[27.68]	[77.58]	[83.29]
Slope10	0.078**	0.072**	0.091***	0.086***	0.086***	0.078***
	[2.44]	[2.37]	[3.72]	[3.67]	[16.35]	[17.31]
Stock	0.008***	0.008***	0.010***	0.010***	0.008***	0.007***
	[5.18]	[4.93]	[5.30]	[5.17]	[11.31]	[11.09]
TOM		3.550***		2.889***		3.880***
		[11.05]		[8.81]		[49.99]
TOY		0.655**		0.651**		0.305***
		[2.05]		[2.38]		[3.83]
VIX		0.013		-0.021		-0.014**
		[0.47]		[-0.87]		[-3.44]
TED		-0.006		-0.001		-0.006**
		[-1.13]		[-0.23]		[-2.94]
Intercept	0.110	-0.511	0.292*	0.103	0.242	0.024
	[0.69]	[-0.94]	[1.84]	[0.22]	[1.07]	[0.30]
Observations	2,223	2,223	3,315	3,315	25,974	25,974
R-squared	0.898	0.903	0.888	0.891	0.887	0.894

Table 5. Identifying the Macro-Active Funds

The table reports the Fama-MacBeth regression estimates of government bond funds' macro-day alpha conditional on their past performance and past risk taking. Fund FOMC- and GDP-day alphas are estimated under the four-factor model using a rolling window of 24 months. Past macro-day alpha is the average daily alpha on FOMC and GDP announcement days in the past 24-month window. Similarly, past non-macro day alpha is the average daily alpha on non-macro days in the past 24-month window. To capture fund risk-taking, we include their last quarter daily return volatility (Total Vol), systematic volatility (Systematic Vol), and idiosyncratic volatility (Idiosyncratic Vol), estimated under the four-factor model using daily returns in the last quarter. Systematic Vol is the standard deviation of the fitted values; Idiosyncratic Vol is the standard deviation of the residual terms. For easiness of interpretation, all the variables are standardized with mean zero and standard deviation of one, event by event for each announcements. We require at least 6 months window in the estimation of funds' historical macro-day performance and risk exposure, hence the sample starts from the Q2 of 1999. The standard errors are Newey-West adjusted with three lags. *, **, and *** denote significance at 10%, 5% and 1% levels, respectively.

	FOMC Alpha				GDP Alpha			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Past Macro-Day Alpha	0.782***			0.537**	1.820***			1.689***
	[3.09]			[2.19]	[7.59]			[7.08]
Past Non-Macro Alpha	-0.070			-0.016	0.083			0.233*
	[-0.31]			[-0.08]	[0.48]			[1.65]
Total Vol		0.202				0.460		
		[0.75]				[1.60]		
Systematic Vol			-0.316	-0.186			-0.368	-0.230
			[-1.15]	[-0.74]			[-1.03]	[-0.68]
Idiosyncratic Vol			0.794***	0.702***			1.330***	0.916***
			[2.88]	[2.69]			[5.37]	[3.86]
Intercept	1.137**	1.139**	1.146**	1.144**	3.617***	3.621***	3.619***	3.621***
	[2.04]	[2.04]	[2.05]	[2.05]	[7.77]	[7.76]	[7.76]	[7.77]
Observations	60,722	60,722	60,722	60,722	90,845	90,845	90,845	90,845
R-squared	0.083	0.097	0.133	0.191	0.108	0.083	0.122	0.203
Number of groups	166	166	166	166	248	248	248	248

Table 6. Macro-Day Alpha Conditional on Fund Activeness

We sort government bond mutual funds into quintile groups based on their last quarter idiosyncratic volatility. The table reports the regression results for each quintile group of funds, following the specification in column (3) of Table 2. *, **, and *** denote significance at 10%, 5% and 1% levels, respectively.

	Inactive	**2**	**3**	**4**	**Active**
FOMC	-0.345	0.465	0.925*	1.207**	3.893***
	[-0.77]	[1.05]	[1.79]	[2.01]	[3.97]
GDP	0.694*	2.160***	2.332***	3.136***	3.604***
	[1.83]	[5.72]	[5.31]	[6.17]	[4.33]
CCI	-0.517	0.503	1.234***	1.492***	1.743**
	[-1.39]	[1.37]	[2.88]	[3.01]	[2.15]
NFP	0.818**	-0.482	-0.502	-0.29	-0.534
	[2.21]	[-1.31]	[-1.17]	[-0.59]	[-0.66]
CPI	0.330	-0.064	-0.543	-0.441	-1.039
	[0.88]	[-0.17]	[-1.26]	[-0.88]	[-1.27]
CSI	0.922**	0.627	0.825*	1.031**	0.134
	[2.40]	[1.64]	[1.85]	[2.00]	[0.16]
DGO	0.338	-0.266	0.167	0.354	0.435
	[0.86]	[-0.68]	[0.37]	[0.67]	[0.50]
RS	0.173	0.289	0.163	0.278	0.439
	[0.43]	[0.72]	[0.35]	[0.52]	[0.50]
NHS	0.151	0.659*	0.438	0.609	0.529
	[0.38]	[1.68]	[0.96]	[1.15]	[0.61]
Level	0.165***	0.223***	0.263***	0.301***	0.493***
	[125.19]	[170.56]	[172.80]	[170.85]	[170.90]
Slope30	0.278***	0.310***	0.301***	0.314***	0.189***
	[74.50]	[83.47]	[69.55]	[62.83]	[23.03]
Slope10	0.118***	0.098***	0.062***	0.019**	-0.002
	[16.92]	[14.12]	[7.68]	[2.02]	[-0.14]
Stock	0.006***	0.005***	0.006***	0.008***	0.010***
	[8.94]	[6.98]	[7.18]	[8.07]	[6.30]
Controls	Y	Y	Y	Y	Y
Observations	5,305	5,305	5,305	5,305	5,305
R-squared	0.81	0.882	0.878	0.873	0.862

Table 7. Time-Series Variation of Macro-day Alpha

We examine government bond funds' macro-day alpha conditional on announcement content. The dependent variable is fund four-factor adjusted excess return on FOMC, GDP and non-macro days respectively. "All funds" is estimated using the value weighted daily return of all the government bond mutual funds in our sample. "Active funds" is estimated using the value-weighted daily return of the most active quintile group of funds, constructed based on last-quarter idiosyncratic volatility. Disagreement is constructed as the difference between the 75th percentile and 25th percentile Bloomberg economist forecasts. The surprise for FOMC is computed from the 1-day change in the spot-month future rate following Kuttner (2001). The surprises for GDP is constructed as the realized announcement value minus the median Bloomberg economist forecasts. We also use the Barclay Treasury index return (Treasury), Level factor, Slope30 factor, Slope10 factor on the announcement day as market-based measures of surprise. VIX refers to CBOE volatility index. For easiness of interpretation, all dependent variables are standardized with mean zero and standard deviation of one. Panel A, B, and C report the coefficient estimates on the dependent variables, using FOMC, GDP, and non-macro days respectively. *, **, and *** denote significance at 10%, 5% and 1% levels, respectively.

Panel A. FOMC-Alpha

		Disagreement	Surprise	|Surprise|	Treasury	|Treasury|	|Level|	|Slope30|	|Slope10|	VIX
All funds	Coeff.	0.656**	-0.535	0.973**	0.220	1.081*	0.994**	0.075	0.973*	-0.146
	t-stat	[2.29]	[-0.92]	[2.16]	[0.35]	[1.70]	[2.08]	[0.13]	[1.86]	[-0.27]
Active funds	Coeff.	2.737***	-1.123	2.266**	0.130	2.326*	2.817**	0.350	2.403*	0.088
	t-stat	[3.17]	[-0.90]	[2.27]	[0.11]	[1.75]	[2.24]	[0.29]	[1.92]	[0.06]

Panel B. GDP-Alpha

		Disagreement	Surprise	|Surprise|	Treasury	|Treasury|	|Level|	|Slope30|	|Slope10|	VIX
All funds	Coeff.	1.520***	1.060*	0.960*	0.179	2.189***	2.080***	1.439**	2.187***	1.363*
	t-stat	[3.13]	[1.85]	[1.72]	[0.25]	[3.84]	[4.28]	[2.20]	[3.12]	[1.70]
Active funds	Coeff.	2.511***	0.825	1.494*	-0.075	1.198	0.873	-0.051	1.823*	1.798*
	t-stat	[3.18]	[0.89]	[1.70]	[-0.08]	[1.30]	[0.85]	[-0.05]	[1.71]	[1.70]

Panel C. Non-Macro Alpha

		Treasury	|Treasury|	|Level|	|Slope30|	|Slope10|	VIX
All funds	Coeff.	0.294	-0.114	-0.207	-0.094	-0.205	-0.034
	t-stat	[1.60]	[-0.56]	[-1.07]	[-0.51]	[-0.86]	[-1.54]
Active funds	Coeff.	0.249	-0.628	-0.753	-0.356	-0.335	-0.075
	t-stat	[0.64]	[-1.41]	[-1.50]	[-0.82]	[-0.80]	[-1.23]

Table 8. Fund Duration Change in Predicting Announcement Outcome

The table reports the predictability of fund duration change on FOMC-day interest rate movements. Government bond funds are sorted into quintile groups based on their last quarter idiosyncratic volatility. For each quintile group of funds, we estimate its duration change as the difference in the sensitivity to US Treasury return, from window [-30, -16] before the announcement to window [-15, -1] before the announcement. In column "Active-Inactive", duration change is calculated as the difference in duration change between the most active quintile and the least active quintile. The dependent variables are changes in Treasury yield on the FOMC announcement day, with a maturity ranging from 2 years to 30 years. *, **, and *** denote significance at 10%, 5% and 1% levels, respectively.

Predicting FOMC-Day Yield Curve Change							
		Inactive	2	3	4	Active	Active-Inactive
2 Year	Coeff.	4.640	1.918	-3.933	-6.137*	-5.913***	-7.419***
	t-stat	[0.67]	[0.58]	[-1.19]	[-1.72]	[-3.14]	[-3.85]
	R-squared	0.3%	0.1%	0.6%	1.4%	3.9%	5.2%
3 Year	Coeff.	6.880	-0.553	-5.001	-7.943**	-7.765***	-8.929***
	t-stat	[0.96]	[-0.14]	[-1.45]	[-2.14]	[-3.63]	[-3.96]
	R-squared	0.5%	0.0%	0.8%	2.0%	5.5%	6.2%
5 Year	Coeff.	6.939	0.115	-5.421	-7.492**	-7.602***	-8.915***
	t-stat	[0.97]	[0.03]	[-1.63]	[-1.98]	[-3.12]	[-3.34]
	R-squared	0.4%	0.0%	0.8%	1.4%	4.2%	5.0%
10 Year	Coeff.	8.189	2.980	-1.824	-2.318	-5.907**	-7.694***
	t-stat	[1.28]	[0.74]	[-0.64]	[-0.72]	[-2.54]	[-3.00]
	R-squared	0.7%	0.2%	0.1%	0.2%	3.0%	4.4%
30 Year	Coeff.	9.380*	5.765	3.178	3.993	-2.267	-4.179*
	t-stat	[1.73]	[1.61]	[1.23]	[1.21]	[-1.15]	[-1.94]
	R-squared	1.5%	1.1%	0.5%	0.8%	0.7%	2.1%

Table 9. Horse-race against Alternative Yield Curve Predictors

The table reports the horse-race tests on the predictability of FOMC-day change in 2-year yield. $\Delta\beta_{t-1}$ is the abnormal duration change, calculated as the difference in duration change between the most active quintile funds and the least active quintile funds. $\text{Forward}_{t-1}^{\text{2Year}}$ is the 2-year forward-spot spread constructed following Fama and Bliss (1987) for the month before the FOMC announcement. γ_{t-1} is a tent-shaped linear function of forward rates constructed following Cochrane and Piazzesi (2005) for the month before the FOMC announcement. Survey Forecast_{t-1} is the forecasted change in Fed Funds Rate from Bloomberg economist survey. Fed Funds Futures_{t-1} is the forecasted change in Fed Funds Rate, inferred from Fed Funds futures price one day before the announcement. Announcement Surprise_t is computed from the announcement-day change in the spot-month future rate following Kuttner (2001). *, **, and *** denote significance at 10%, 5% and 1% levels, respectively.

Alternative Yield Curve Predictors						
	X		$\Delta\beta_{t-1}$			
	Coeff.	*t*-stat	Coeff.	*t*-stat	R-squared	Nobs
X=$\text{Forward}_{t-1}^{\text{2Year}}$ (Fama and Bliss, 1987)	-0.914	[-0.90]			0.6%	170
	-1.219	[-1.22]	-7.765***	[-3.90]	6.2%	170
X=γ_{t-1} (Cochrane and Piazzesi, 2005)	-0.140	[-0.39]			0.1%	170
	-0.311	[-0.86]	-7.671***	[-3.90]	5.5%	170
X=Survey Forecast_{t-1}	0.021	[0.89]			0.7%	170
	0.020	[0.90]	-7.378***	[-3.82]	5.8%	170
X=Fed Funds Futures_{t-1}	0.012	[0.86]			0.5%	170
	0.010	[0.77]	-7.331***	[-3.77]	5.6%	170
X=Announcement Surprise_t (Kuttner, 2001)	0.503**	[2.44]			7.9%	170
	0.480**	[2.41]	-6.883***	[-3.62]	12.4%	170

Online Appendix to

"Macro-Active Bond Mutual Funds"

A Bond Factor Constructions

A.1 Level, Slope30, and Slope10 Factors

We construct the three government bond factor portfolios based on the principal component analysis of 2-, 5-, 10-, and 30-year Barclay US Treasury return indices. Litterman and Scheinkman (1991) show that the shape and day-to-day variation of the yield curve can be well captured by three factors, mimicking the level, slope, and curvature of the yield curve. Unlike principal component analysis (PCA) conducted in the yield space, we conduct the analysis in the return space, with the benefit that the resulting factors can be directly used as actual portfolio returns.

To construct the three bond factor portfolios, we first apply the principal component analysis (PCA) on the daily returns of the 2-, 5-, 10-, and 30-year Barclay US Treasury indices for the period from September 1999 to December 2019. Panel A shows the eigenvectors for each principal component. Essentially, each PC is a linear combination of 2-, 5-, 10-, and 30-year bond indices, with the coefficients given by the eigenvectors.

$$\begin{cases} \mathrm{PC1}_t = \mathrm{D}_1 \cdot \mathrm{R}_t^{2Y} + \mathrm{D}_2 \cdot \mathrm{R}_t^{5Y} + \mathrm{D}_3 \cdot \mathrm{R}_t^{10Y} + \mathrm{D}_4 \cdot \mathrm{R}_t^{30Y} \\ \mathrm{PC2}_t = \mathrm{G}_1 \cdot \mathrm{R}_t^{2Y} + \mathrm{G}_2 \cdot \mathrm{R}_t^{5Y} + \mathrm{G}_3 \cdot \mathrm{R}_t^{10Y} + \mathrm{G}_4 \cdot \mathrm{R}_t^{30Y} \\ \mathrm{PC3}_t = \mathrm{F}_1 \cdot \mathrm{R}_t^{2Y} + \mathrm{F}_2 \cdot \mathrm{R}_t^{5Y} + \mathrm{F}_3 \cdot \mathrm{R}_t^{10Y} + \mathrm{F}_4 \cdot \mathrm{R}_t^{30Y}, \end{cases} \tag{4}$$

where $D^T = (D_1, D_2, D_3, D_4)^T$, $G^T = (G_1, G_2, G_3, G_4)^T$ and $F^T = (F_1, F_2, F_3, F_4)^T$ are the eigenvectors for the three PCs, reported in Panel A. For example, the first principal component puts a respective weight of 0.063, 0.228, 0.442, and 0.866 on the 2-, 5-, 10-, and 30-year bond indices. Consistent with Litterman and Scheinkman (1991), the variations in bond returns is well captured by the three PCs: The first principal component explains 95.32% of the variations in bond returns, followed by PC2 and PC3 accounting for another 4.25% and 0.35% respectively. By construction, all three bond factors are orthogonalized. Adding all the three PCs together, they can explain 99.92% of the variations in 2-, 5-, 10-, and 30-year Barclay US Treasury index returns.

The PCs, however, can not be directly taken as portfolio returns in the bond market, as the eigenvectors do not sum up to one. We then conduct the following transformation to normalize each principal component, so that the transformed portfolio can be interpreted as a net long position of a dollar investment.

$$\begin{cases} \mathrm{R}_t^{\mathrm{Level}} = \mathrm{PC1}_t / \sum_{i=1}^4 D_i \\ \mathrm{R}_t^{\mathrm{Slope30}} = \mathrm{PC2}_t / \sum_{i=1}^4 G_i \\ \mathrm{R}_t^{\mathrm{Slope10}} = \mathrm{PC3}_t / \sum_{i=1}^4 F_i. \end{cases} \tag{5}$$

Panel B reports the portfolio weights after normalization. We label the normalized PC1 portfolio as "Level" (R_t^{Level}), as its respective portfolio weights for 2-, 5-, 10-, and 30-year index returns are 3.95%, 14.26%, 27.63% and 54.16%. By applying PCA in the return space, the longer duration bonds would carry higher weights, as the same unit change in yields would result in a larger price movements for long-duration bonds. Relating to PCA in the yield space, R_t^{Level} corresponds to a parallel shift in the yield curve, which is confirmed in Panel C. Regressing the changes in daily yields, with maturities ranging from 2 years to 30 years, on the level portfolio return, we find that a ten bps increase in R_t^{Level} corresponds to 0.53, 0.79, 0.85, and 0.78 bps decrease in the 2-, 5-, 10-, and 30-year yields, mimicking a parallel shift of the yield curve.

For normalized PC2 and PC3, instead of interpreting them as slope and curvature factors, we label them as "Slope30" (R_t^{Slope30}) and "Slope30" (R_t^{Slope10}), as they both capture relative trades (or slope trades) on the yield curve. More specifically, the respective portfolio weights for R_t^{Slope30} are 28.54%, 62.68%, 55.84%, and -47.07%, and the weights for R_t^{Slope10} are 104.19%, 86.25%, -122.80%, and 32.35% on the 2-, 5-, 10-, and 30-year bond indices return, i.e., "Slope30" loads positively on bonds with short maturities and negatively on bonds with 30-year maturity, while the short position in "Slope10" is concentrated more on bonds with 10-year maturity. Mapping the return space to the yield space, consistently, we find both the "Slope30" and "Slope10" are significantly related with the change in yield curve slope, proxy by 10- minus 2-year yield. Zooming into each specific yield tenor, a ten basis points increase in R_t^{Slope30} corresponds to a 0.17 bps increase in 30-year yield and an unanimously decrease in 2-, 5-, and 10-year yields. The same ten basis points increase in R_t^{Slope10} corresponds to a 0.35 bps increase in 10-year yield and a decrease in 2-, and 5-year yields. Hence, despite that the literature and practitioners often interpret the third principal component as the curvature factor, we interpret the second and third PCs as both capturing the slope variations, with “Slope30” capturing more of the 30-year slope and “Slope10” capturing more of the 10-year slope.

Finally, when applying the three bond factors to evaluate funds’ risk taking, we find that the Level, Slope30, and Slope10 factors can capture 88.70% of variations in government bond fund returns. Consistent with the Level factor explaining majority of the variations in the underlying bonds, Level factor alone explains 78.14% of the variations in fund returns, followed by Slope30 and Slope10, each accounts for 10.04% and 0.13%.

Panel A. Eigenvector for the Three PCs

	PC1	PC2	PC3
2 Year	0.063	0.284	-0.562
5 Year	0.228	0.625	-0.465
10 Year	0.442	0.556	0.662
30 Year	0.866	-0.469	-0.174
Eigenvalue/Total	95.32%	4.25%	0.35%

Panel B. Bond Factors’ Portfolio Weights

	Level	Slope30	Slope10
2 Year	3.95%	28.54%	104.19%
5 Year	14.26%	62.69%	86.25%
10 Year	27.63%	55.84%	-122.80%
30 Year	54.16%	-47.07%	32.36%

Panel C. Bond Factors and Yield Curve Change

	2 Year	5 Year	10 Year	30 Year	10 Year−2 Year
	(1)	(2)	(3)	(4)	(5)
Level	-0.053***	-0.079***	-0.085***	-0.078***	-0.032***
	[-96.54]	[-179.60]	[-211.64]	[-187.18]	[-66.42]
Slope30	-0.147***	-0.138***	-0.073***	0.017***	0.074***
	[-81.54]	[-98.51]	[-60.08]	[13.14]	[44.89]
Slope10	-0.142***	-0.051***	0.035***	0.001	0.178***
	[-31.83]	[-14.95]	[11.18]	[0.44]	[36.22]
Intercept	0.396***	0.338***	0.175***	0.103***	-0.222***
	[14.76]	[17.12]	[9.37]	[4.91]	[-8.49]
Observations	5,326	5,326	5,326	5,326	5,326
R-squared	0.868	0.948	0.949	0.914	0.757

A.2 Other Bond Factors

We further construct other bond factors to control for the risks in mortgage backed securities, TIPS, agency bonds, investment grade bonds, and high yield bonds. We use Barclays US mortgage backed securities(MBS) index, Barclays US Treasury Inflation-Linked index, Barclays US Agency index, Barclay US corporate bond index, and Barclays US high yield index returns to capture the performance of the underlying assets. Since those fixed income assets carry not only credit risk but also interest rate risks, to tease out the interest rate risks components, we subtract the corresponding maturity matched Treasury index returns from the underlying assets. Based on Bloomberg description, the average maturities for Barclays MBS index, TIPS index, agency index, corporate index, and high yield index are 6.04, 8.18, 4.99, 12.27, and 6.59 years, respectively. Therefore, we map the Mortgage index return with the Barclay Treasury 5-7 year index return to control for the underlying interest rate risks. Our Mortgage Factor is then calculated as Barclays MBS index return minus Barclay Treasury 5-7 year index return. Similarly, TIPS Factor is calculated as Barclays TIPS index return minus Barclay Treasury 7-10 year index return; Agency Factor is calculated as Barclays agency index return minus Barclay Treasury 5 year index return; IG Factor is calculated as Barclay corporate index return minus Barclay Treasury 10-20 year index return; and HY Factor is calculated as Barclays high-yield index return minus Barclay Treasury 5-7 year index return.

B Other Discussions

B.1 Profitability of Trading on Macro-day Alpha

To what extend does the phenomenon of fund macro-day outperformance constitute a valid trading strategy for retail investors? Is the macro-day alpha big enough to survive the transaction costs? To evaluate the profitability of trading on macro-day alpha, especially when taking into account various potential transaction costs, we use the net-fee returns of funds to replicate our main findings. Meanwhile, we restrict the sample to a group of funds that do not charge any front-end loads or back-end loads, which accounts for around 50% of our sample. Section 3.3 and Section 3.4 show that the outperformance of government bond funds is not only concentrated on the day of announcement, but also extends to one day afterwards. From investors' perspective, the trading strategy to precisely target the mutual fund returns, earned around the macro announcements, involves buying government bond funds one day before macro announcements (t=-1) and selling them one day after the announcements (t=1). Essentially, investors hold these bond mutual funds on the [0,1] announcement window, and for the rest of the days, they just earn the risk free rate.

Appendix Figure A1 replicates the lower left graph in Figure 1 using the net fee returns of funds that do not charge any loads. It mimics the cumulative abnormal return earned by an investor who adopts the above trading strategy. The four-factor adjusted abnormal return for the above trading strategy accumulates to 30.1% from 1998 to 2019, which generates an annualized Sharpe ratio of 2.34. The improvement in Sharpe ratio is huge, as the portfolio without dynamically targeting the macro announcements, generates a Sharpe ratio of only 0.86. However, the cumulative abnormal return of 30.1% could be further improved. As discussed in Section 4.1.2, macro-active funds, captured by their idiosyncratic risk taking, are able to generate higher macro-day alpha on FOMC and GDP announcements. The green line in Figure A1 hence replicates the above trading strategy, restricting the sample to funds in the top quintile group based on last-quarter idiosyncratic volatility. The portfolio abnormal return accumulates to 43.3% from 1998 to 2019, with a Sharpe ratio of 1.52.

B.2 Characteristics of Macro-Active Funds

Who are those macro-active funds and what fund characteristics predict their activeness? To examine the characteristics of macro-active funds, we start by exploring the explanatory power of fund-specific characteristics on macro-day alpha, we then move on to investigate the importance of family and managerial characteristics. Appendix Table A3 reports the results.

Overall, we find that fund-specific characteristics fail to explain their FOMC-day outperformance. Though funds with larger size exhibit higher GDP-day alpha, the economic magnitude is small. One standard deviation increase in the natural logarithm of fund size is associated with 0.32 bps (t-stat=4.86) increase in GDP-day alpha. Funds' past performance positively predicts their activeness and GDP-day alpha, which is consistent with the evidence on performance persistence documented in Section 4.1.

Adding family characteristics, including family size and family bank-affiliation into the regression, we find that one standard deviation increase in family size leads to 0.18 bps (t-stat=1.53) increase in FOMC-day alpha, 0.41 bps (t-stat=5.02) increase in GDP alpha, and 0.28 bps (t-stat=2.43) increase in fund's activeness. Interestingly, bank affiliation has a negative impact on GDP alpha and fund activeness. If fund family is affiliated with an investment bank, fund GDP-day alpha decreases by -0.51 bps (t-stat=-2.81) and fund activeness decreases by -1.33 bps (t-stat=-11.66). One potential explanation is that bank-affiliated funds create alpha not through the trading of macro-related news, but through liquidity provision and order-flow trades, by utilizing their broker-dealer connections (Kondor and Pinter (2021)).

Finally, we further add manager-related characteristics including manager tenure and team management dummy into the regression. Managers with shorter experience exhibit higher activeness and are able to outperform more on macro announcement days. One standard deviation decrease in manager tenure is associated with 0.31 bps (t-stat=2.42) increase in FOMC-day alpha, 0.16 bps (t-stat=1.50) increase in GDP-day alpha, and 0.15 bps (t-stat=2.01) increase in activeness. For less experienced managers, with strong incentives to prove themselves, they are more willing to actively take risk and build a good tracking record. While for established fund managers, with no strong incentives to excel, they tend to shirk (Evans (2010)). To conclude, we find some supporting evidence that macro-active funds are managed by managers with shorter tenure in a big and non-bank affiliated family.

B.3 Stale Pricing and Macro-Day Alpha

Choi, Kronlund, and Oh (2020) show that zero returns are widely prevalent among fixed-income funds, driven by the stale pricing of funds with illiquid security holdings. Though we focus on government bond mutual funds that invest in the most liquid asset class of US Treasury, Panel A of Appendix Table A4 shows that the average zero-day fraction for the entire sample could be as high as around 25%. If funds do not properly update prices of bonds in its portfolio in a timely manner, its NAVs would change less often, and it would prohibit us from detecting any performance difference between macro and non-macro days. However, if funds update NAV more timely on macro days compared with non-macro days, this differential pattern of stale pricing might affect the magnitude of macro-day alpha, though the direction is unclear. To alleviate this concern, we re-examine our baseline results for subsamples of funds with a smaller zero-return-day ratio. In particular, by restricting the sample to funds with a rolling-one-year ZRD ratio of less than 25% (or 15%), the median ZRD ratio in our sample reduces to 12% (or 6%). Evaluating funds' macro-day performance using this subsample of funds, we find a much stronger FOMC- and GDP-day alpha. As reported in Panel B of Table A4, for funds with a ZRD ratio less than 15%, they are able to outperform on FOMC-day by 3.87 bps (t-stat=2.53) and on GDP-day by 3.19 bps (t-stat=3.03).

B.4 Do Investors Learn about Fund Macro Skills?

Finally, we investigate whether investors can rationally learn about fund macro skills and divert more capital into macro-active bond funds before the macro announcements. In Appendix Table A5, we regress value weighted government bond fund daily flows on the event-day dummies in the announcement [-3, +2] window for FOMC, GDP and other 8 macros announcements respectively. The regression specification is similar to that of Table 4. For FOMC announcement, we find no abnormal flows around the announcement day. For GDP announcements, it's interesting to see that inflows to government bond funds steps in only on t=2 after the announcement, with a magnitude of 5.88 bps (t-stat=2.89). For other 8 macro announcements, there is a significant outflow on t=2, with a magnitude of -2.2 bps (t-stat=2.57). In sum, the regression estimates seem to suggest that investors fail to learn about funds' macro skills before the actual release of the announcements. If anything, flow exhibits a pattern of performance chasing. Investors divert more capital into macro active funds after they observe a positive GDP-day fund outperformance.

Figure A1. Net-Fee Return on Macro and non-Macro Days

This figure replicates the lower left graph in Figure 1 using funds that do not charge front-end loads or back-end loads. To track the portfolio returns of investors who hold mutual funds on macro-active days, we use the next expense returns of mutual funds when calculating fund alpha. The graph plots the cumulative abnormal returns of government bond funds, earned on FOMC and GDP announcement day (t=[0]) and on announcement day and one day after the announcement (t=[0,1]) respectively. We further include the cumulative abnormal returns of macro-active government bond funds, earned during FOMC and GDP announcement window (t=[0, 1]). Macro-active funds refer to funds in the top quintile based on last quarter idiosyncratic volatility. The dotted line plots the cumulative abnormal return for all trading days. Fund alpha is estimated using a four factor model, by regressing value weighted fund net returns on the Level, Slope30, Slope10, and stock market factors.

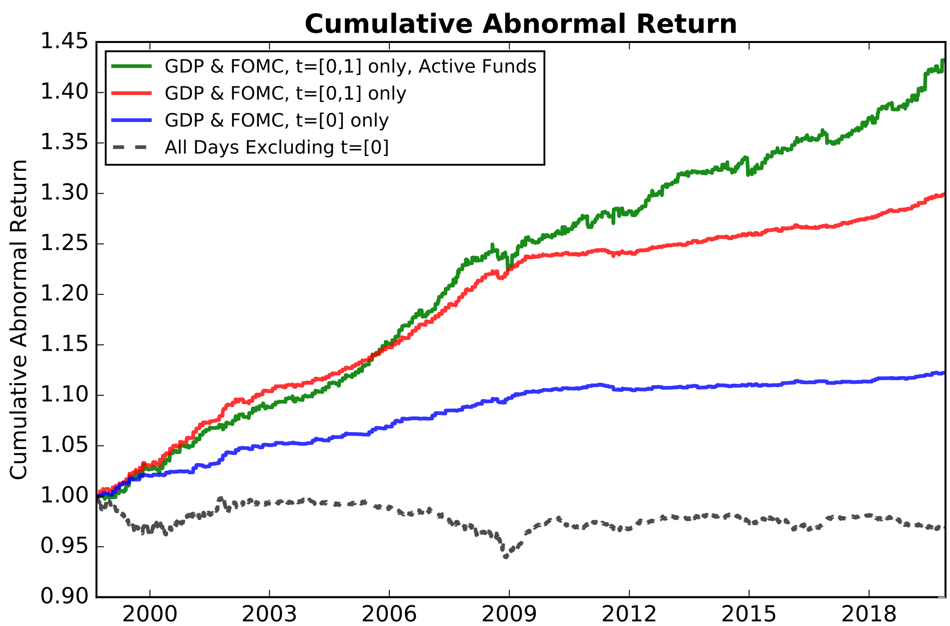


Table A1. Turnover for Different Types of Mutual Funds

This table reports fund turnover ratio for different types of mutual funds by year. *Turnover* is calculated as the minimum of aggregated sales or purchases, divided by the average 12-month TNA. Government bond mutual funds are sorted into 5 groups based on fund last quarter idiosyncratic volatility.

Year	Government					Equity	HY	IG	Muni
	Inactive	2	3	4	Active				
1998	1.77	1.21	1.39	2.01	2.20	1.12	1.00	1.41	0.42
1999	1.31	1.27	1.45	1.63	2.74	1.12	0.92	1.43	0.48
2000	1.39	1.62	1.66	1.53	3.51	1.16	0.91	1.66	0.43
2001	1.33	1.65	1.84	2.31	3.01	1.16	1.07	2.04	0.35
2002	1.52	1.71	1.77	1.80	2.52	1.16	1.02	1.95	0.33
2003	1.33	1.71	1.91	1.95	2.71	1.05	1.03	2.00	0.32
2004	1.16	1.50	1.65	1.76	1.72	0.93	0.84	1.80	0.26
2005	1.31	1.63	1.61	1.46	1.36	0.88	0.73	1.66	0.27
2006	1.32	1.56	1.63	1.83	1.77	0.87	0.75	1.55	0.29
2007	1.24	1.28	1.68	2.46	4.48	0.88	0.75	1.62	0.30
2008	1.76	1.55	1.55	3.22	5.81	1.04	0.68	1.85	0.33
2009	1.97	1.62	2.11	2.56	2.77	0.99	0.80	1.92	0.26
2010	1.81	1.77	1.89	1.87	2.83	0.88	0.81	1.88	0.22
2011	1.95	2.01	2.11	2.22	2.24	0.87	0.78	1.97	0.24
2012	1.96	2.59	2.77	2.78	1.66	0.85	0.78	1.83	0.24
2013	1.40	2.49	2.76	3.13	2.55	0.78	0.80	1.69	0.25
2014	1.55	2.15	2.22	3.66	2.62	0.75	0.72	1.62	0.23
2015	1.38	2.04	2.84	2.73	4.99	0.77	0.68	1.60	0.22
2016	1.41	2.17	2.23	2.87	3.02	0.77	0.71	1.55	0.27
2017	1.08	1.75	1.88	1.26	1.86	0.71	0.72	1.41	0.29
2018	1.14	1.85	1.94	1.73	1.10	0.70	0.65	1.39	0.31
2019	1.00	2.14	2.99	3.04	1.30	0.70	0.71	1.49	0.29
All	1.45	1.81	2.02	2.27	2.69	0.91	0.81	1.70	0.30

Table A2. Impact of Macro Surprise on Equity and Bond Market

This table shows the effect of macro surprise on stock and bond market. For each type of macro announcement, we regress the announcement day factor return or yield change on the macro announcement surprise, controlling for all the other macro announcement surprises. For factor returns, we include stock market return, government bond market return, and the three government bond factors (Level, Slope30, Slope10), constructed using the principal component analysis on the daily returns of the 2-, 5-, 10-, and 30-year Barclay US Treasury indices. The returns are all in excess of risk-free rate, as measured by one-month Treasury bills. Columns (6) to (9) report the results for announcement day yield change, ranging from two years to 30 years. The standard errors are adjusted for heteroskedasticity. The t-stats are in the bracket. *, **, and *** denote significance at 10%, 5% and 1% levels, respectively.

	Factor Returns					**Yield Change**			
	Stock	Government Bond	Level	Slope30	Slope10	2 year	5 year	10 year	30 year
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
GDP	-4.006	-4.020*	-5.925	-3.872**	-0.696	1.010**	0.964**	0.746*	0.256
	[-0.53]	[-1.95]	[-1.22]	[-2.53]	[-0.75]	[2.47]	[2.18]	[1.77]	[0.63]
FOMC	-11.229	-5.630**	-6.781	-8.607***	-1.654	1.905**	1.674**	0.949	0.171
	[-0.72]	[-2.44]	[-1.32]	[-2.91]	[-1.14]	[2.32]	[2.22]	[1.60]	[0.38]
ISM	18.485**	-12.246***	-26.268***	-3.811**	-0.989	2.491***	2.735***	2.535***	2.025***
	[2.12]	[-6.50]	[-6.25]	[-2.51]	[-1.30]	[5.95]	[6.24]	[6.22]	[6.08]
CCI	-2.069	-4.090**	-10.069**	0.427	-1.289*	0.869**	1.025**	0.927**	0.842**
	[-0.15]	[-2.16]	[-2.36]	[0.32]	[-1.95]	[2.48]	[2.49]	[2.23]	[2.38]
NFP	3.209	-18.185***	-33.887***	-10.008***	-3.091***	3.821***	4.118***	3.308***	2.285***
	[0.38]	[-7.63]	[-7.06]	[-4.56]	[-3.17]	[7.23]	[7.09]	[6.77]	[6.48]
CPI	-8.607	-2.838	-4.978	-1.231	-0.904	0.418	0.528	0.404	0.218
	[-0.78]	[-1.37]	[-1.01]	[-0.79]	[-0.93]	[1.06]	[1.12]	[0.83]	[0.52]
CSI	-2.941	-3.352*	-7.407	-2.745*	2.423**	0.442	0.906**	0.927**	0.606
	[-0.34]	[-1.86]	[-1.62]	[-1.88]	[2.53]	[1.30]	[2.21]	[2.26]	[1.62]
DGO	8.751	-2.115	-4.29	-1.03	-0.508	0.415	0.576	0.528	0.359
	[1.36]	[-0.99]	[-0.97]	[-0.66]	[-0.95]	[0.76]	[1.02]	[1.08]	[0.96]
RS	20.719**	-8.251***	-19.286***	-2.776*	-1.099	1.754***	2.106***	2.032***	1.544***
	[2.18]	[-5.17]	[-4.76]	[-1.68]	[-1.26]	[5.62]	[5.37]	[5.30]	[4.83]
NHS	-1.229	-3.495**	-7.852**	-0.692	0.451	0.323	0.638*	0.742**	0.700**
	[-0.20]	[-2.10]	[-2.25]	[-0.62]	[0.89]	[1.00]	[1.67]	[2.11]	[2.48]

Table A3. Fund and Manager Characteristics

This reports the Fama-MacBeth regression estimates of government bond funds' macro-day alpha and activeness conditional on their characteristics. Fund FOMC alpha and GDP alpha are estimated using a rolling window of 24 months under the four-factor model. Fund activeness is measured by idiosyncratic volatility in bps, estimated under the four-factor model using daily returns in the quarter. For independent variables, we include fund's last month size (log(FundSize)), age since inception (Log(Age)), flow (Flow), past 12 months return (Momentum), and fee. We also control for family and manager characteristics, including family size (Log(FamilySize)), Bank-Affiliated (=1 if fund is affiliated with an investment bank), manager Tenure (Log(Manager Tenure)), and Teammanage (=1 if fund has more than one manager). For easiness of interpretation, all the continuous independent variables are standardized with a mean of zero and standard deviation of one. *, **, and *** denote significance at 10%, 5% and 1% levels, respectively.

	FOMC Alpha			GDP Alpha			Idiosyncratic Vol		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log(Size)	0.144	0.073	0.047	0.323***	0.159***	0.136**	0.127	-0.001	-0.017
	[1.42]	[0.71]	[0.47]	[4.86]	[2.63]	[2.30]	[1.47]	[-0.01]	[-0.22]
Log(Age)	-0.154	-0.087	-0.021	-0.003	0.125	0.162	0.800	0.752	0.577
	[-1.04]	[-0.56]	[-0.15]	[-0.03]	[1.16]	[1.57]	[1.16]	[1.00]	[0.76]
Momentum	0.489	0.459	0.475	0.506**	0.453**	0.494**	0.769***	0.724***	0.713***
	[1.18]	[1.13]	[1.14]	[2.52]	[2.29]	[2.44]	[3.02]	[2.86]	[2.81]
Fee	-0.023	-0.044	-0.063	-0.126	-0.186**	-0.183**	0.090	-0.014	0.029
	[-0.13]	[-0.24]	[-0.35]	[-1.49]	[-2.26]	[-2.29]	[0.86]	[-0.14]	[0.33]
Flow	0.004	-0.017	-0.022	0.096	0.112*	0.117*	-0.135**	-0.155***	-0.147***
	[0.05]	[-0.22]	[-0.31]	[1.60]	[1.68]	[1.76]	[-2.29]	[-2.67]	[-2.73]
Log(Family Size)		0.183	0.172		0.413***	0.428***		0.275**	0.362***
		[1.53]	[1.38]		[5.02]	[4.76]		[2.43]	[4.03]
Bank-Affiliated		0.030	0.076		-0.508***	-0.253		-1.326***	-1.110***
		[0.15]	[0.40]		[-2.81]	[-1.34]		[-11.66]	[-11.30]
Log(Manager Tenure)			-0.309**			-0.155			-0.152**
			[-2.42]			[-1.50]			[-2.01]
Teammanage			-0.056			-0.075			-0.945***
			[-0.25]			[-0.36]			[-5.00]
Intercept	1.245**	1.230**	1.244**	3.799***	3.343***	3.240***	8.513***	8.984***	9.676***
	[2.21]	[2.21]	[2.01]	[6.52]	[6.23]	[5.82]	[20.67]	[22.38]	[22.57]
Observations	54,091	53,945	52,351	80,994	80,788	78,402	28,593	28,498	27,606
R-squared	0.101	0.126	0.148	0.081	0.104	0.129	0.166	0.192	0.222
Number of groups	166	166	166	248	248	248	85	85	85

Table A4. Stale Pricing and Macro-Day Alpha

Panel A shows the distribution of zero-return-day (ZRD) ratio for different sample of government bond funds. For each fund, we calculate the fraction of zero trading days for all days, FOMC days, and GDP days respectively. We then report the cross-sectional mean, median, and standard deviation of ZRD ratio for the entire sample of funds, for funds with a ZRD ≤ 25%, and for funds with a ZRD ≤ 15%. To avoid look-ahead bias, funds with a ZRD ≤ 25% or ≤ 15% are defined based on the daily returns in a rolling window of past one year. Panel B reports the performance of government bond funds in ≤ 25% group and ≤ 15% group, estimated under the four-factor model. *, **, and *** denote significance at 10%, 5% and 1% levels, respectively.

Panel A. Fraction of Zero-Return Days (ZRD)

	All Funds			ZRD≤ 25%			ZRD≤ 15%		
	Mean	Median	STD	Mean	Median	STD	Mean	Median	STD
All Days	28%	21%	18%	13%	14%	4%	8%	8%	3%
FOMC	25%	19%	20%	13%	12%	12%	9%	6%	11%
GDP	23%	18%	16%	11%	10%	9%	7%	4%	11%

Panel B. Macro-Day Alpha

	ZRD≤ 25%			ZRD≤ 15%		
Macro	0.869***	1.013***		0.925*	1.140**	
	[3.28]	[3.72]		[1.86]	[2.23]	
FOMC			1.823**			3.868**
			[2.23]			[2.53]
GDP			2.661***			3.193***
			[4.37]			[3.03]
CCI			0.829			-0.169
			[1.29]			[-0.14]
NFP			0.327			-1.229
			[0.51]			[-0.90]
CPI			-0.361			-0.228
			[-0.60]			[-0.20]
CSI			0.695			0.402
			[0.99]			[0.32]
DGO			0.408			0.721
			[0.75]			[0.70]
RS			0.250			0.700
			[0.33]			[0.50]
NHS			0.847			0.624
			[1.37]			[0.57]
Level	0.417***	0.416***	0.416***	0.598***	0.597***	0.596***
	[114.75]	[115.24]	[115.74]	[84.37]	[84.48]	[84.55]
Slope30	0.281***	0.279***	0.279***	0.199***	0.198***	0.198***
	[28.09]	[28.23]	[28.29]	[11.17]	[11.13]	[11.10]
Slope10	0.064***	0.058***	0.058***	0.039	0.033	0.033
	[2.96]	[2.70]	[2.70]	[1.09]	[0.90]	[0.91]
Stock	0.012***	0.011***	0.011***	0.016***	0.015***	0.015***
	[5.60]	[5.49]	[5.49]	[4.75]	[4.65]	[4.61]
Intercept	0.086	0.078	0.167	0.013	-0.020	0.139
	[0.56]	[0.16]	[0.33]	[0.05]	[-0.02]	[0.16]
Controls	N	Y	Y	N	Y	Y
Other Factors	N	N	N	N	N	N
Observations	5,326	5,326	5,326	5,326	5,326	5,326
R-squared	0.895	0.898	0.899	0.826	0.828	0.828

Table A5. Do Investors Learn about Fund Macro Skills?

We regress value weighted government bond fund daily flows on macro announcement event day dummies for FOMC, GDP and other 8 macros announcements respectively. D($t = i$) is a dummy variable that equals one for the i^{th} trading day around the macro announcement, and t=0 is for the announcement date. For announcements that fall into holidays, we use the next trading day as t=0. The sample include t=-6 to t=6 window around each macro announcements. In columns (2), (4) and (6), we control for the stock market factor and government bond Level, Slope30, and Slope10 factors and also include TOM, TOY, VIX and TED. The standard errors are clustered at the macro event level. *, **, and *** denote significance at 10%, 5% and 1% levels, respectively.

	FOMC		**GDP**		**Other 8 Macros**	
	(1)	(2)	(3)	(4)	(5)	(6)
D(t = -3)	0.673	1.137	0.997	1.267	-1.905**	-1.829**
	[0.31]	[0.52]	[0.56]	[0.69]	[-2.65]	[-2.75]
D(t = -2)	2.853	3.178	0.182	0.526	-0.698	-0.701
	[1.19]	[1.33]	[0.11]	[0.29]	[-1.02]	[-1.03]
D(t = -1)	1.110	1.052	-1.656	-1.694	-2.364	-2.323
	[0.50]	[0.47]	[-0.95]	[-0.97]	[-1.56]	[-1.42]
D(t = 0)	2.331	2.388	-2.724	-3.132	0.360	0.316
	[1.04]	[1.09]	[-1.40]	[-1.51]	[0.21]	[0.21]
D(t =1)	0.264	0.440	1.278	0.454	1.052	0.964
	[0.12]	[0.19]	[0.64]	[0.20]	[1.04]	[1.08]
D(t =2)	-0.517	-0.410	5.883***	4.793**	-2.206**	-2.225**
	[-0.22]	[-0.17]	[2.89]	[2.08]	[-2.57]	[-2.42]
Level		0.006		-0.005		-0.011***
		[0.68]		[-0.75]		[-7.26]
Slope30		-0.032		-0.025		-0.022***
		[-1.51]		[-1.26]		[-6.32]
Slope10		0.004		-0.032		-0.006
		[0.11]		[-1.01]		[-0.49]
Stock		0.010**		0.002		-0.001
		[2.32]		[0.45]		[-0.65]
TOM		0.717		1.666		1.484***
		[0.40]		[1.12]		[6.14]
TOY		-3.690**		-1.432		-1.241***
		[-2.08]		[-0.98]		[-5.92]
VIX		0.425***		0.337***		0.333***
		[3.97]		[4.21]		[23.56]
TED		-0.059		-0.040		-0.037***
		[-1.62]		[-1.46]		[-21.33]
Intercept	-1.968**	-7.300***	-1.209	-6.277***	0.094	-4.937***
	[-2.06]	[-4.22]	[-1.60]	[-4.71]	[0.57]	[-18.76]
Observations	1,196	1,196	1,781	1,781	14,246	14,246
R-squared	0.002	0.029	0.008	0.025	0.003	0.019