# Characteristics of Mutual Fund Portfolios: Where are the Value Funds? ☆


## Abstract

This paper provides a comprehensive analysis of portfolios of active mutual funds and ETFs through the lens of risk (anomaly) factors. We show that these funds do not systematically tilt their portfolios towards profitable factors, such as high book-to-market (BM) ratios, high momentum, small size, high profitability, and low investment growth. Strikingly, there are almost no high-BM funds in our sample while there are many low-BM "growth" funds. Portfolios of "growth" funds are concentrated in low BM-stocks but "value" funds hold stocks across the entire BM spectrum. In fact, most "value" funds hold a higher proportion of their portfolios in low-BM ("growth") stocks than in high-BM ("value") stocks. The bias towards "growth" is present in other characteristics, is stable across the sample, and is not explained by liquidity differences in "value" vs. "growth" stocks. The distributions of mutual fund momentum, profitability, and investment growth are concentrated around the market averages with little variation across funds. The characteristics distributions of ETFs and hedge funds do not differ significantly from those of mutual funds. We show that most "value"/"growth" indices that are tracked by index mutual funds and ETFs are based on combinations of price multiples and fundamental growth rates. As a result, "value"/"growth" index funds and ETFs do not resemble "value"/"growth" growth portfolios that are typically studied in academic research. Since portfolio sorts based on fundamental growth rates have negligible return premia, there is no "value" premium for index funds and ETFs. We conclude that the characteristics of mutual fund portfolios raise a number of questions about why funds do not exploit well-known return premia and how their portfolio choices affect asset prices in equilibrium.



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## 1. Introduction

Since the seminal study by Jensen (1968) most of the research on active mutual funds has been about their performance and the related issue of whether fund managers have skill or not. Some recent examples include Fama and French (2010), Berk and van Binsbergen (2015), Cremers and Petajisto (2009), Kacperczyk, Nieuwerburgh, and Veldkamp (2014), Pástor, Stambaugh, and Taylor (2015), and many more. The composition and characteristics of mutual fund portfolios have received far less attention.[1] The goal of this paper is to fill this gap in the literature and provide a comprehensive analysis of the cross-sectional distribution of portfolio holdings of active domestic equity mutual funds and ETFs through the lens of characteristics that are associated with return premia, such as the three "classic" size, value, and momentum anomalies.[2]

Studying the composition and characteristics of mutual fund and ETF portfolios is interesting for several reasons. First, we ask to what extent characteristics associated with return premia are reflected in portfolios of mutual funds and ETF. To what extent do active fund managers exploit these factor premia? If there are limits to arbitrage, do active funds contribute to the existence of these anomalies, or do they overweight underpriced stocks?

Second, notions, such as "growth" and "value", are to some degree vague and have no precise, universally accepted definitions. For example, the evidence of the value premium in the academic literature is based on portfolio sorts on price-multiples, particularly the book-to-market ratio. Do "value" and "growth" funds hold predominantly stocks with high and low book-to-market ratios, respectively? If not, what are the key characteristics of portfolios of "value" and "growth" funds, and how are they related to returns?

Finally, what set of strategies is available to retail investors via active funds? The literature on mutual funds typically takes the universe of funds as given. However, the set of funds in existence is an endogenous object subject to demand supply. What are the market forces that determine the set of funds that are available to investors?[3] This paper takes a first step in answering these questions by establishing a comprehensive set of stylized facts about the characteristics of portfolios of mutual funds, ETFs, and, to a limited degree, hedge funds.

We find that (most) mutual funds do not systematically exploit return premia of well-known risk/anomaly factors. For some factors, mutual funds target the low-return leg of long/short factor portfolios rather than the high-return leg. Consider, for example, the "value" premium defined as the return spread of stocks with high and low book-to-market (BM) ratios, which is one of the most well-known and robust stylized facts in the asset pricing literature. Yet, we find that portfolios of mutual funds, ETFs, and hedge funds are strongly tilted towards low book-to-market values rather than high BM ratios. This bias is not only present in the BM ratio but other price multiples as well.

[1] One recent exception is Pástor, Stambaugh, and Taylor (2020) who study the relationship between liquidity and fund characteristics, in particular, the optimal choice of stocks of different size.

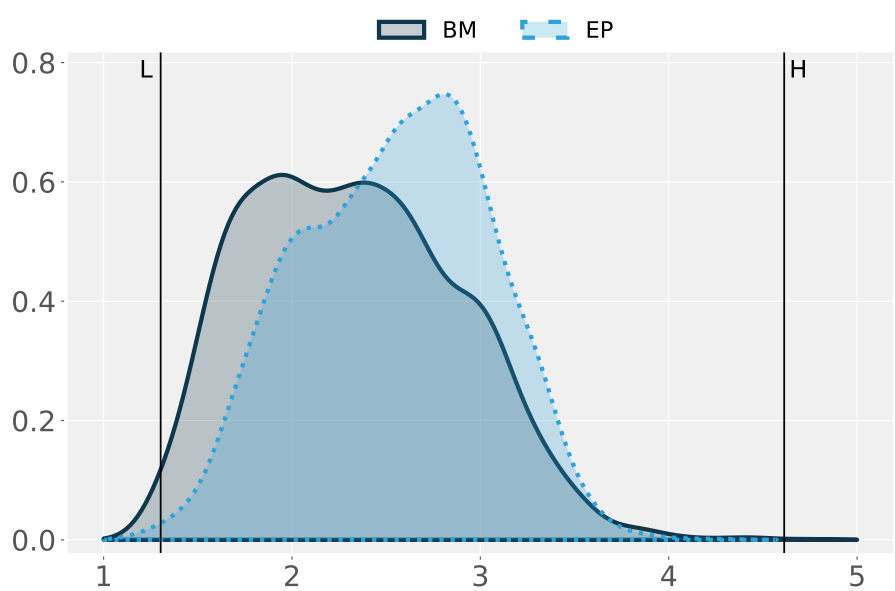
[2] There is an ongoing debate whether factor premia are due to risk or behavioral biases. We remain agnostic about the underlying source of factor premia.

[3] Berk and Green (2004) study how demand supply affect flows performance across funds, but they take the set of funds that are available to investors as given.

This result is illustrated in Figure 1, which shows the distributions of book-to-market (BM) and earnings-to-price (EP) ratios of 2,993 active equity mutual funds. The plot is based on the following methodology, described in more detail below. In each quarter, we assign stocks BM and EP scores based on quintile sorts so that stocks in the lowest/highest quintile have scores of 1 and 5, respectively. Then we compute BM and EP scores of mutual funds as the portfolio-weighted average of the BM and EP scores of stocks that are held by the funds. Hence, funds that only invests in stocks in the lowest/highest BM quintiles have BM scores of 1 and 5, respectively. A BM score of 3 corresponds to a fund holding stocks that are on average in the middle BM quintile. The vertical lines represent the BM scores of the two components of HML, i.e., the high BM portfolio H and the low BM portfolio L as benchmarks.

The figure shows that the distribution of mutual funds is heavily tilted towards low BM and EP scores. The means of the BM and EP distributions are 2.33 and 2.55, respectively, and thus well below the midpoint of 3. The vast majority of active equity mutual funds have book-to-market and earnings-to-price scores below 3. While 33% of funds have BM scores below 2 and 54% between 2 and 3, only 13% have scores between 2 and 3. Moreover, only 7 of almost 3,000 funds in our sample have BM scores above 4. A comparison to the H and L portfolios is also instructive. There are numerous mutual funds with BM scores that are similar to that of the L portfolio; however there are virtually no funds that have book-to-market ratios that are close to that of the H portfolio. Mutual funds have on average slightly higher earnings-to-price scores than book-to-market scores, but the overall shape is similar. In particular, there are also very few funds with EP scores above 4. In this sense, high BM/EP "value" funds are missing from the US equity market.

**Figure 1: Book-to-Market and Earning-to-Price Ratios of Mutual Funds**




Notes: See Figure 3.

Next, we study portfolio compositions in more detail and compute the portfolio shares by quin-

tiles for each mutual fund. The average domestic active equity fund holds 39% of its equity holdings in stocks with BM scores between 1 and 2 and only 10% in stocks in the highest BM quintile. Not surprisingly, the portfolios of "growth" funds are even more tilted towards low BM stocks. For example, 95% of all "growth" funds hold over a quarter of their portfolios in low-BM stocks. IN contrast, we find that "value" funds hold a larger portion of their portfolio in stocks in the lowest BM quintile (20%) than in stocks in the highest BM quintile (16%). More than half of all "value" funds hold a larger share of low-BM stocks than high-BM stocks, and only 7% hold more than 25% of their portfolio in high-BM stocks. Evidently, "value" funds do not hold "value" stocks if "value" is defined by a high book-to-market ratio.

We consider several possible explanations of these findings. For example, mutual funds might have a preference for holding liquid stocks. If "value" stocks are less liquid than "growth" stocks, then it would not be surprising that the distribution of mutual funds would be biased towards "growth". We consider a number of liquidity measure but find no link between "value"/"growth" and liquidity. Conditional on size, high book-to-market stocks are as liquid as low BM stocks and the liquidity of stocks in mutual fund portfolios does not depend on BM ratios of funds. Hence, liquidity is unlikely to explain the bias towards "growth" in mutual funds. Another possibility is that the notion of "value" vs. "growth" used by mutual funds is different from that used in the academic literature. We analyze 15 different characteristics related to "value"/"growth", including the Morningstar index used in their "style box" classification of mutual funds, and find a similar bias toward "growth' in all characteristics. There are virtually no "value" funds no matter what definition of "value" vs. "growth" is used. Finally, we ask whether the negative value premium since 2007 has impacted the distribution of mutual funds. However, the "value"/"growth" distribution of mutual funds is not related to the value premium and is similar in periods with positive and negative value premia. More generally, the "value"/"growth" distribution of funds has been stable over the sample period starting in 1980, and the lack of "value" funds is present throughout the sample.

Portfolios of ETFs exhibit the same tilt towards "growth" as very few of the over 1,500 ETFs in our sample have consistently high price multiples. Since index providers publish the methodology of indices that are tracked by ETFs, we are able to trace the reasons why ETFs portfolios are tilted towards "growth" characteristics. We find that "value" and "growth" indices are based not only on price-multiples but also on growth rates of fundamentals, such as earnings, cash flow, and sales growth. Since price multiples and fundamental growth rates have low cross-sectional correlations, ETF portfolios hold few stocks with either very low or very high price multiples. Moreover, we find that portfolio sorts based on fundamental growth rates do not create a significant return spread, so that the "value" ETFs that are based on such indices earn a much smaller return premium relative the "growth" ETFs than the value premium based on the book-to-market ratio and other price-multiples. The distribution of price-multiples of our limited sample of hedge funds is close to those of mutual funds and ETFs.

We also find that the majority of mutual funds hold predominantly very large stocks. The fund-level distributions of other factor characteristics that are associated with return premia, such as mo-

mentum, profitability, and investment growth are centered around the CRSP-VW index and exhibit little variation across funds. This suggests that funds do not systematically target these characteristics.

Our analysis focuses primarily on holdings of mutual funds instead of factor exposures estimated from regressions of fund returns on factor portfolios. While estimating factor loadings is appropriate for analyzing funds returns, there are several reasons why holdings give a more accurate description of mutual fund strategies than factor loadings. First, factor loadings are estimated and thus subject to estimation error while holdings are directly observable. Second, loadings might vary over time and estimates with historical data might not reflect changes in fund portfolios. Third, regression loadings are more difficult to interpret than characteristics computed from portfolio holdings, as we will show below. We estimate loadings of characteristic Factors and find that the average HML beta of mutual funds is close to zero and more than half of all mutual funds have a positive HML beta. At first glance, the distribution of HML loadings of mutual funds might be inconsistent with their distribution of book-to-market ratios, but we show that magnitudes of regression loadings cannot be interpreted in isolation. [4] When using the appropriate benchmarks, we find that the distribution of HML loadings confirm the bias towards low book-to-market ratios derived from fund holdings.

Finally, we study how mutual fund characteristics relate to returns. When we compute the average return of stocks by characteristic quintiles, the familiar pattern emerges: Small stocks and stocks with high BM ratios and momentum have higher returns than large stocks and stocks with low BM ratios and momentum. Sorts on other price multiples, such as the earnings, cash flow, and sales-to-price ratios, yield similar return premia as BM sorts, confirming the notion of a "value" premium when "value" vs. "growth" is defined as high vs. low valuation ratios. In contrast, portfolios sorted according to fundamental growth rates, such as earnings, cash flows, and sales growth, exhibit no consistent return patterns across characteristic values. We also consider Fama-MacBeth regressions and find similar patterns between returns and characteristics.

This paper is related to several strands to the large literature about institutional investment but, to the best of our knowledge, our paper is the first that provides a comprehensive analysis of portfolio holdings of individual funds and that documents the bias growth characteristics across funds. Several papers that focus on the performance of mutual funds include some results about fund characteristics without exploring this issue further. Daniel, Grinblatt, Titman, and Wermers (1997) use mutual fund holdings to construct benchmark portfolios. Their study focuses on performance but they report average size, book-to-market, and momentum quintile scores (their Table I). Becker, Ferson, Myers, and Schill (1999) study market timing of mutual funds but report some information about the number of mutual funds by style and objective. Chan, Chen, and Lakonishok (2002) study the relationship of investment styles of mutual funds and performance but note that fund portfolios are on average biased towards low BM values (their Table 4). Papers that use mutual fund holdings data include Grinblatt, Titman, and Wermers (1995) and Cremers and Petajisto (2009). Grinblatt, Titman, and Wermers (1995) use mutual fund holdings to construct a momentum measure of mutual funds, while

[4] For example, over 60% of mutual funds have positive SMB betas even though most funds hold large stocks.

Cremers and Petajisto (2009) use holdings data to construct the "active share" of mutual funds by comparing portfolio weights of mutual funds to those of benchmarks. Finally, there is a literature that uses holdings data from 13F filings to study institutional investors. A key difference of this literature relative to our paper is that 13F filings are on the institution-level, while we focus on individual funds. Gompers and Metrick (2001), Sias (2004), and Lewellen (2011) study the portfolios and demand of institutional investors. Finally, there is a literature that explores 13F filings of hedge funds, including Agarwal, Jiang, Tang, and Yang (2013), Agarwal, Fos, and Jiang (2013), Brunnermeier and Nagel (2004), and Grinblatt, Jostova, Petrasek, and Philipov (2020).

The rest of the paper proceeds as follows. Section 2 describes the sample and data construction. Results about the characteristics distributions of mutual funds, ETFs and hedge funds are presented in sections 3 and 5. Section 6 compares the characteristics distributions derived regression factor loading to those of portfolio holdings. Results about the link between mutual fund characteristics and returns are reported in section 7. Section 8 concludes.

## 2. Data Construction

The mutual fund and ETF holdings data are from Thompson-Reuters and CRSP. The quarterly sample starts in 1980Q1 and ends in 2018Q4. Portfolio holdings data from CRSP are available after 2010Q3 and are merged with the Thomson-Reuters holdings data. Our benchmark sample includes active mutual funds that hold mostly domestic equities and are not index or sector funds. We use standard screens to exclude funds that hold on average fewer than 10 stocks, have an AUM of less than $10M, and funds with less than 16 quarterly observation in the sample.[5] ETFs are analyzed separately. We merge the portfolio holdings data with stock-level data from CRSP and Compustat to compute characteristics on the fund level.

Unlike mutual funds, hedge funds are not required to report holdings of individual funds to the SEC. However, every institutional investment manager, including hedge funds, with at least $100 million in equity assets under management has to disclose their aggregate equity holdings to the SEC using form 13F. Since only aggregate holdings are reported, it is not possible to obtain holdings data for individual funds for the majority of hedge funds. Instead, we manually identify 13F filings of 79 hedge funds with only a single fund under management.[6] For this subset of hedge funds, the 13F filings of portfolio holdings correspond to individual funds and are thus comparable to the holdings data of individual mutual funds. Given that we can only identify portfolio holdings of hedge funds with only a single individual fund, our sample of hedge funds is very limited and not representative.

The CRSP/Thompson-Reuters database includes multiple objective codes that classify mutual funds into different "styles". However, these classifications are often unreliable, inconsistent across providers, and can change over the life of a fund. For example, 173 mutual funds that include the term "value" in their names are classified as "growth" funds (CRSP Objective Code EDYG). Manual checks of

[5] See Appendix A for details.

[6] To identify hedge funds in the 13F filings we follow Agarwal, Jiang, Tang, and Yang (2013) and Agarwal, Fos, and Jiang (2013). We thank Vikas Agarwal for sharing his data.

these cases confirm that the provided classification codes are less reliable than a classification based on fund names. Therefore, our primary style classification identifies "value" and "growth" funds as those funds that include these terms in their fund names. We use CRSP, Lipper, Wiesenberger, and Strategic Insight objective codes only for funds that cannot be identified by their names. Details of the classification scheme are in Appendix B. The main difference is that our classification identifies a larger number of funds as "value" funds compared to an identification scheme based on the provided objective codes. Only 177 of the 2,993 mutual funds in our sample are identified by at least one of the provided objective codes as "value" funds, whereas 624 funds include the term "value" in their fund names. The effect on the classification of "growth" funds is smaller since more funds have "growth" objective codes. However, our results do not depend on which classification is scheme is used to identify mutual fund objectives.

In addition to "value" and "growth", we use three additional categories: "balanced", "cap-based", and "sector". The benchmark sample excludes sector funds but our results hold if sector funds are included. For ease of presentation, we group all funds that are not designated as "value" of "growth" in a catch-all group "other". The benchmark mutual fund sample does not include ETFs, which we study separately. It is well known that the MFLINKS module that connects Thompson-Reuters holdings data and CRSP does not capture all ETFs, so that the ETF sample does not have the same coverage as the mutual funds sample.[7]

Table 1 reports descriptive statistics of the sample. The overall sample before applying any screens includes 8,892 mutual funds and 1,640 ETFs. After applying screens, our benchmark sample includes 2,993 active domestic equity mutual funds, 575 ETFs, and 79 hedge funds. The number of active mutual funds has grown from 200 in 1980Q1 to 1,552 in 2018Q4 with a peak of 1,988 in 2011Q1. The number of "growth" ("value") funds has risen from 91 (14) in 1980Q1 to 596 (385) in 2018Q4, respectively. The ETF sample starts in 2010Q3 with 149 ETFs and includes 461 active ETFs in 2018Q4. Our limited sample of hedge funds includes 2 funds in 2018Q1, 28 funds in 2018Q4, with a peak of 44 in 2007Q2. The median number of quarterly observations for mutual funds is 46, 13 for ETFs, and 36 for ETFs. The median mutual fund holds 74 stocks in its portfolio, however, there is a significant amount of variation across funds. 44 mutual funds hold over 1,000 stocks while 73 hold less than 25. The distribution of the number of stocks is similar across mutual fund categories but ETFs hold on average more stocks than mutual funds while the hedge funds in our sample hold fewer stocks.

The total "total net asset value" (TNA) of active mutual funds has risen from $25B in 1980Q1 to a maximum of $4.5T in 2018Q3 (before declining to $3.8 in 2018Q4[8]). "Growth" funds account for the largest share of the total TNA, followed by "other" and "value" funds. The total TNA of the ETFs in our sample is $1.3T in 2018Q4 and the total equity values of our limited sample of hedge funds is $91M. The median fund TNA over the entire sample period is $222M, while the medians for "values" is slightly higher than that of "growth" funds. The TNA distribution across funds is right skewed

[7]Recent updates of MFLINKS have improved the ETF coverage significantly.
[8]The CRSP-VW return was -14.5% in the fourth quarter of 2018.

as indicated by the fact that the TNA mean is about four times higher than the median. The size distribution of ETFs is not directly comparable to that of mutual funds since the ETF sample starts in 2010 instead of 1980, however it is more right-skewed than the mutual funds distribution as indicated by the larger difference in the median and the mean. Finally, even though our sample of hedge funds includes only 79 funds, its size distribution is very similar to the distribution of mutual funds.

The bottom three rows of Table 1 summarize the performance of funds. The median betas for all fund categories are all close to one but "growth" funds have a slightly larger beta on average (1.04) than "value" funds (0.95). Note that the reported numbers are medians of fund averages and betas, so that the returns by fund are computed over different time spans and thus not directly comparable. We therefore report median fund returns in excess of the returns of the S&P 500 index, as well as the median 4-factor alphas. Consistent with the extensive literature on mutual fund performance, we find that funds returns are on average lower than S&P 500 returns, even though the average fund beta is close to one. While this is true for all fund categories we study, the median for "growth" funds is less negative than the median for other categories. In addition, median 4-factor alphas are negative as well, however, median alphas of ETFs and "value" funds are larger than medians for growth and "other" funds. The average excess returns (net of S&P 500 returns) of 63% of mutual funds and of 72% of ETFs are negative, as are two-thirds of mutual and ETF alphas.

*Mutual fund characteristics*

Next, we construct characteristics of mutual funds, ETFs and hedge funds. We begin our analysis with the three "classic" characteristics that are associated with return premia: Size (ME), book-to-market (BM), and momentum (MOM). Results for the earnings-to-price ratio (EP) are reported as robustness checks. We consider two different methods for computing fund-level characteristics. The benchmark case follows Daniel, Grinblatt, Titman, and Wermers (1997): In each quarter $t$, we sort all stocks into five quintiles based on characteristic $C$ using NYSE breakpoints. Stock $i$ in quintile $j$ is assigned a characteristic score of $C_{i,t} = j, j \in \{1, 2, \ldots, 5\}$. The characteristic score of fund $m$ in quarter $t$, $C_{m,t}$, is computed as the portfolio-weighted average of the characteristic scores of the stocks in the fund's portfolio:

$$C_{m,t} = \sum_{i \in I_t} w_{m,i,t} \, C_{i,t}, \tag{1}$$

where $I_t$ is the set of stocks listed in quarter $t$ and $w_{m,i,t}$ is the fraction of stock $i$ in the total value of all stocks held by fund $m$ in quarter $t$.

This procedure has several advantages. First, it is robust to stocks with extreme values of characteristics. Second, all characteristic scores range from 1 to 5 and are comparable across characteristics. Third, characteristic scores are based on the same portfolio sorts that are used in most of the asset pricing literature. On the other hand, quintile scores depend on the choice of breakpoints and the entire distribution of characteristics across all stocks. For example, it is possible that a stock switched quintiles even if its own characteristic has not changed but its ranking in the overall distribution changed. Moreover, the total market capitalizations vary across quintiles and, therefore, the value-weighted market portfolio does not necessarily have a characteristic score equal to the midpoint of

three, but will be biased towards the quintiles with higher total market capitalization. For example, the top size quintile accounts for about 73% of the total market cap while the bottom quintile accounts for only 3%. Hence, the size quintile score of the value-weighted CRSP index will be strongly tilted towards the fifth quintile. In contrast, the low BM quintiles account for a larger share of the total market cap that the high BM quintiles. Thus the BM score of the CRSP-VW index is below the midpoint of 3.[9]

As an alternative measure, we compute "market-adjusted" characteristics. For example, in each quarter we compute the "market-adjusted" BM ratio for each stock $i$ as

$$\mathrm{BM}_{i,t}^{\mathrm{adj}} = \mathrm{BM}_{i,t} - \mathrm{BM}_{\mathrm{MKT},t}. \tag{2}$$

Subtracting the market BM ratio serves two purposes. First, it removes changes in the market-wide BM ratio, so that the distribution of the adjusted book-to-market ratio is comparable across time. Second, since the adjusted book-to-market ratio $\mathrm{BM}_t^{\mathrm{adj}}$ for the market portfolio itself is equal to zero by construction, the scale of adjusted BM of mutual funds have a natural benchmark and are easy to interpret.[10]

Market-adjusted characteristics have two further advantages compared to quintile scores. First, unlike characteristic scores based on quintiles, market-adjusted characteristics do not rely on the selection of breakpoints. Second, adjusted characteristics do not depend on the characteristic of other stocks. On the other hand, adjusted characteristics of mutual funds can be sensitive to outliers since distributions of price-based ratios are typically severely right-skewed. Another drawback is that the units differ across characteristics making a comparison difficult. Most of the results reported in the paper are based on characteristics scores but the online appendix includes results for adjusted characteristics and quintile score based on different breakpoints. Our main results are not affected by the methodology of how mutual funds characteristics are constructed.

*Benchmarks*

It will be useful to compare the distributions of mutual fund characteristics to benchmarks. We consider a variety of alternatives. First, we compute the characteristics of the CRSP-VW portfolio as a proxy for the market portfolio. We also consider the S&P 500 and the CRSP-EW portfolio as a benchmarks for large and smaller stocks, respectively. Second, given the widespread use of the Fama-French factors, the portfolios that underlie these factors are natural choices as characteristic benchmarks. We compute the characteristics of the component portfolios of SMB, HML, and MOM and treat them as if they were mutual funds. For example, SMB and HML are based on the four corner portfolios of the intersection of two size and three BM-sorted portfolios (value-weighted with NYSE breakpoints). Let SL denote the small/low-BM portfolio, BL the big/low-BM portfolio, etc. The long-short portfolios SMB and HML are in turn defined as SMB = S−B, where S = (SH+SL)/2, B = (BL+BL)/2

[9] We also consider the case where breakpoints are chosen so that the market cap in each quintile is identical. Results are reported in the online appendix.

[10] An alternative adjustment is to take ratios, e.g. $\mathrm{BM}_{i,t}/\mathrm{BM}_{\mathrm{MKT},t}$. We choose the adjustment using differences as default but use the ratio if its distribution is more stable and closer to normal than the distribution of the ratios.

and HML $= H - L$, where $H = (SH + BH)/2, L = (SL + BL)/2$. We compute characteristics of each of the four corner portfolios, SH, BH, SL, and BL, as well as S, B, H, and L, following the same methodology described above for mutual funds. These portfolios span the ME/BM spectrum and are therefore useful benchmarks for mutual fund portfolios. The construction of the momentum factor follows the same methodology using a size/momentum double-sort and we compute characteristics of the four size/momentum portfolios SD, BD, SU, and BU, as well as $D = (SD + BD)/2, U = (SU + BU)/2$. Finally, we compare the distributions of mutual fund characteristics to those of individual stocks.

Table 2 reports the quintile characteristics scores of the benchmark portfolios. Consider first the characteristic scores of the CRSP-VW index computed as time-series averages of quarterly scores over the sample period. The average size (ME) score of the CRSP-VW portfolio is 4.51. The BM score is 2.31, which is slightly lower than the average EP score of 2.2.65. The average momentum (MOM) score is 3.30. The reason why these value-weighted averages are not equal to the midpoint of 3 is that the total market capitalizations in the quintiles are different. For example, the 5th size quintile contains on average 71% of the total market cap, while the 1st size quintile contains only 3%. Therefore, the average ME score of the value-weighted CRSP index is closer to the maximum of 5 than to the midpoint of 3. For the same reason, the BM and EP scores are below the midpoint of 3 while the MOM score is above 3. Since the S&P 500 portfolio is composed of only large stocks, its ME score of 4.90 is close to the maximum of five, while the ME score of the CRSP-EW portfolio is 1.90. The BM, EP and MOM scores of the S&P 500 are close to that of the CRSP-VW portfolio. On the other hand, CRSP-EW scores can differ significantly from CRSP-VW scores as the equally-weighted index is dominated by small stocks that have on average higher BM scores but lower EP and MOM scores.

The remaining columns of the top panel report characteristics of the six portfolios that are used to construct SMB, HML, and MOM: S, B, H, L, U, and D. Recall that S and B are value-weighted portfolios based on bivariate sorts rather than on quintile sorts, hence S(B) contains stocks from lower (higher) ME quintiles. The corresponding ME scores of S and B are 2.31 and 4.80. Since the return of the long-short SMB portfolio is a benchmark for the size return premium, the S and B size scores are in turn benchmarks for mutual funds with an objective to exploit the size premium. The H and L BM scores of 4.61 and 1.30, respectively, are in turn benchmarks for mutual funds that exploit the value premium, and the U and D momentum scores of 4.65 and 1.40 are momentum benchmarks.

Characteristic scores of the double-sorted SL, BL, ... portfolios are reported in the bottom panel of Table 2. The four "small" portfolios have ME scores between 2.10 and 2.44, while the "big" portfolios range between 4.70 and 4.85. This pattern is similar for the other characteristics. Note that the BM score of the high-BM portfolio of large stocks, BH, is 4.70 is similar to that of the high-BM portfolio of small stock SH, 4.85. The same is also true for the low BM portfolios BL and SL. This implies that the book-to-market distribution of bigger and smaller stocks are similar and that portfolios with high BM scores can be constructed not just from small and potentially illiquid stocks but also from large liquid stocks.

*An Example*

As an illustration, Figure 2 plots the characteristics of the largest mutual funds in our sample, the "Growth Fund of America" (ticker AGTHX, 2018Q4 AUM $166B). The fund is classified as a "growth" fund, holds an average of 225 stocks, and invests on average 77% of its assets in domestic common stocks. Note that, for this fund, there are 16 quarters with missing observation over the sample. Panel A plots the quintile scores for size (ME), the book-to-market ratio (BM), the earnings-to-price (EP), and momentum (MOM). At the beginning of the sample, ME scores are around 3.5 but increase close to the maximum of five over the rest of the sample. This pattern implies that the fund started out holding medium to large stocks but then started to hold only very large stocks: In 1980Q1, the about 70% of the portfolio was invested in ME decile 3 and 4 stocks, while about 90% of the portfolio consists of stocks in the top size quintile while.

The BM and EP scores are close to each other and appear to be stable over the course of the sample. They range from 1.4 to 2.9 with overall means of 2.03 and 2.23. respectively. The fund invested about half of its portfolio in stocks that are in the lowest BM and EP quintiles over the course of the sample. In contrast to the other characteristics scores, the time series of the MOM score varies at a higher frequency and is less persistent, which is a typical pattern across the sample. On the one hand, this is not surprising since momentum is also less persistent than other characteristics on the stock-level, but the fact that this pattern is carried over to mutual funds suggests that mutual funds do not maintain a portfolio that minimizes variation in momentum.

Panel B show the market-adjusted characteristics. Recall that the adjusted characteristics are constructed so that a value of zero indicates a characteristic that is equal to that of the CRSP-VW index. However, the scales are not comparable since different characteristics have different "units", hence we normalize the sample standard deviation to one. The behavior of the adjusted characteristics is similar to those of characteristic scores. Adjusted ME is increasing over the sample and positive. The adjusted BM and EP ratios are negative at the beginning of the sample implying that the portfolio of this fund has price-ratios that are lower than those of the CRSP-VW index. The adjusted ratios are around zero between 1992 and 2013 before declining towards the end of the sample.

## 3. Characteristics Mutual Fund Portfolios

In this section we study the univariate distributions of mutual fund characteristics. The histograms of mutual funds scores of size (ME), book-to-market (BM), earnings-to-price (EP) and momentum (MOM) are shown in Figure 3. (Figures 4 to 6 show further results and have similar layouts.) Each panel shows the histogram of a characteristics score for all funds in our benchmark mutual fund sample (solid red) in the sample, as well as the histograms of "growth" (dashed green) and "value" (dotted blue) funds. The vertical lines show the scores of the CRSP-VW index and passive benchmark portfolios. The numbers at the bottom of each histogram represent the percentage of all funds in the sample with characteristic scores between 1 and 2, 2 and 3, etc., respectively. The means, medians, and 10th, 25th, 75th, and 90th percentiles of the distributions are reported in Table 3.

Panel A shows the histograms of ME scores. The distributions of all funds and "value" and "growth" are heavily skewed towards large quintile scores. The size score of 66% of all funds is above 4 implying that most mutual funds invest in large stocks. The histogram shows that 18% of funds have an ME score between 2 and 3, and only 3% of funds hold on average stocks with a ME quintile between 1 and 2. The size scores of the majority of mutual funds are similar to those of the CRSP-VW and "Big" portfolios. The size score of 47% and 28% of mutual funds is larger than those of the CRSP-VW and "Big", respectively. In contrast, only 6% of funds have an ME score that is lower than that of "Small". Thus, the stocks that make up the composition of the S component of SMB are smaller than the stocks held by all but 6% of mutual funds. The figure also shows the size distribution of "growth" and "value" funds. The ME distribution is similar for "growth" and "value" funds, although "growth" funds have somewhat larger ME scores than "value" funds. One possible explanation why mutual funds tilt towards large stocks because small-stocks a more expensive to trade as argued in Pástor, Stambaugh, and Taylor (2020). In equilibrium, funds optimally choose the tradeoff of trading costs versus potentially higher returns of small stock. Large funds have higher trading costs and therefore hold large stocks.

The distribution of BM scores is shown in Panel B. As already described in the introduction, the BM distribution is heavily skewed towards low BM scores as 89% of all funds have a BM score below 3, and virtually no funds have a BM score that exceeds 4. The histogram also shows that many funds have a BM score that is close to that of the "Low" portfolio but no funds with a BM score that is similar to that of the "High" portfolio. Only 7 of the 2,657 funds in the sample are in fact high-BM funds with a score above 4, while 983 funds have a BM score below 2. While it is not surprising that the distribution of "growth" funds is more skewed towards low BM scores, it is noteworthy that the BM score of the majority of "value" funds is also below 3. The means of BM scores, shown in Panel A in Table 3, are 2.33 for all funds, 1.99 for "growth" funds and 2.90 for "value" funds. Furthermore, the BM score of 90% of mutual funds is below 3.08. The distribution of earnings-to-price ratios of mutual funds in Panel C is similar to that of book-to-market ratios and confirms the skew towards "growth" and virtual absence of "value" mutual funds. We will analyze this finding in more detail below and explore possible explanations.[11]

Table 4 shows the 10 funds with the highest BM score and the 10 funds with the lowest score. The scores of the H and L components of HML are included for comparison. In our sample of 2,993 funds, only seven funds have a BM score above 4, and only one fund exceeds the BM score of H. Most of these high BM funds are small and only four of the 10 funds have an AUM above $1B. Interestingly, the two largest fund on this list are Dimensional Fund Advisor (DFA) funds that, according to their prospectuses, specifically target stock with high price multiples but, in contrast to the Morningstar

[11] The mean BM quintile score in reported in Daniel, Grinblatt, Titman, and Wermers (1997) is somewhat higher than that in our sample, which is due to the fact that their sample includes index funds while we focus on active funds. They also do not study the cross-sectional distribution of characteristics scores. Chan, Chen, and Lakonishok (2002) find that few funds take extreme low or high BM positions. Their results are mainly driven by sorting stocks into BM deciles without controlling for size. Since size and BM are negatively correlated on the stock level, their low BM deciles are comprised mostly of small stocks that few mutual funds hold. Moreover, their sample appears to include index funds.

definition of "value", do not take fundamental growth into account.[12] Note, however, that the BM scores of the DFA funds are significantly below that of the H portfolio. The bottom panel shows the 10 funds with the lowest BM scores. Note that their BM scores are all below that of the low BM benchmark portfolio.

Panel D shows the distributions of momentum, profitability, and investment. While all three characteristics are associated with large return premia, there few mutual funds with high characteristic scores. The mean momentum score is 3.35 and 90% of funds have scores between 3.00 and 3.76 (Table 2, Panel A). The moments of the profitability and investments scores are similar. The means are 3.20 and 3.38 and the (10%, 90%) quantiles are (2.61, 3.64) and (2.96, 3.83), respectively, and less than 3% of funds have scores above 4. Hence, there is little evidence that mutual funds form portfolios to exploit the return premia in momentum, profitability, and investment.

*Characteristics of Stocks*

Since mutual funds hold mostly large stocks, it is instructive to compare the characteristics distribution of mutual fund portfolios to characteristics distributions of individual large and liquid stocks. We include stocks that were constituents of the S&P 500 index for at least eight quarters during the sample period but none of our results depend on this choice of benchmark sample.[13]

Figure 4 plots characteristic histograms of these individual S&P 500 stocks (dashed black) along with the histograms for mutual funds for comparison. Panel B of Table 3 reports means and percentiles of the stock characteristic distributions. The histogram of size distribution in Panel A shows that ME scores of mutual funds is skewed to the right relative to the size distribution of S&P 500 stocks confirming the result that mutual funds hold mostly very large stocks. Panel B shows that the BM score distribution of S&P stocks differs substantially from that of mutual funds. While most of the mass of the mutual fund distribution is to the left of the midpoint of 3, the stock distribution is more spread out and has significantly more mass on the right side of the score range. 38% of stocks have BM scores that exceed 3 compared to 13% of mutual funds, and the BM score of 14% of S&P stocks is larger than 4 compared to 0.2% of 7 mutual funds (7 out of 2,993). The average BM score of stocks is 2.62, which is significantly higher than the mean for mutual funds of 2.23, as are the 25th, 75th, and 90th percentiles (Table 3). Even the 75th and 90th percentiles of the BM distribution of "value" funds are significantly smaller than those for the stock distribution: 3.45 and 4.22, compared to 3.15 and 3.38. In contrast, the 10th and 25th percentiles of "growth" funds are similar to those of the stock distribution. The shift towards "growth" characteristics of mutual funds relative to S&P 500 stocks is present not just in book-to-market scores but also in earnings-to-price scores (Panel C).

The momentum distributions of stocks, shown in Panel D, exhibits significantly less variation than the BM and EP distributions as the momentum score of 96% of S&P 500 stocks is between 2 and

[12]The prospectuses of the DFA funds state: "Securities are considered value stocks primarily because a company's shares have a low price in relation to their book value." (https://us.dimensional.com/funds)

[13]The characteristic distributions of stocks do not vary much across stocks with size scores above 2. For example, the means BM scores across stocks with ME scores between 2 and 3 is 2.71, between 3 and 4 is 2.67, and between 4 and 5 is 2.61, while the BM mean of the smallest stocks with size scores between 1 and 2 is 2.97.

4 (compared to 97% of all mutual funds, see Panel D of Figure 3). The distribution of stocks is slightly shifted towards lower scores compared to the distribution of mutual funds and the respective means are 3.16 for stocks and 3.35 for mutual funds.

*ETFs, Hedge Funds, and 13F Institutions*

How do portfolios of Exchange Traded Funds (ETFs) and hedge funds compare to those of mutual funds? We focus on the book-to-market ratio but results for the earnings-to-price ratio are similar. Figure 5 shows the BM distributions of 575 ETFs and our limited samples of 79 hedge funds, and Panels E and F of Table 3 reports descriptive statistics. The BM distribution of ETFs shown in Panel A is shifted towards low BM scores but slightly less so than the distribution of mutual funds. 19% of ETFs have a BM score above 3, compared with 13% of mutual funds, but only 4 out of 575 ETFs in our sample have a BM score above 4, and no ETF approaches the BM score of the H portfolio. The sample includes 134 ETFs that track "value" indices and 264 "growth" ETFs. Portfolios of "value" ETFs show the same bias towards low BM book-to-market scores as "value" mutual funds. The mean BM score of "value" ETFs is 2.93 and 69, over half, of "value" ETFs have a BM score below 3. Since ETFs track stock market indices, their portfolio compositions depend on the constructions of indices. We will analyze the methodologies and properties of some of the major stock market indices in more detail in Section 5.

Panel C shows the BM distribution of hedge funds and Panel F of Table 3 reports the corresponding means and percentiles. Recall that our sample of hedge funds consists of only 79 individual funds and is not representative. Yet, the BM histogram of hedge funds is very similar to that of mutual funds and the means and percentiles of both BM distributions are similar. Hedge funds also exhibit the same bias as mutual funds and ETFs towards low book-to-market values. 82% of hedge funds have a BM score of less than 3 compared to 87% of mutual funds and only one hedge fund in our sample has a BM score above 4, while the BM score of 17 funds is below 2. Hedge funds have on average lower Morningstar scores than mutual funds.

We consider two further samples. Panel C of Figure 5 and Panel G of Table 3 shows the BM distribution of all 8,892 mutual funds in the Thompson-Reuters/CRSP database without applying any screens. This sample includes not only domestic active equity funds but also index funds, funds holding foreign assets, sector funds, etc. Comparing the quantiles to those of our benchmark sample in Panel A Table 3 shows that this broader sample has similar properties as our benchmark sample for all characteristic that we construct. In addition to the 7 funds in our main sample, 361 mutual funds in this broader sample have BM scores above 4. 205 of these are foreign equity funds (CRSP objective code EF) and 125 are non-equity funds. Of the remaining 31 domestic equity funds with BM score above 4, 13 are sector funds, 5 are index funds, and 13 funds that did not pass our other screens. We conclude that the results found for the benchmark sample are also valid in the broader sample without applying screens.

Finally, we construct characteristics of portfolios of financial institutions that file a 13F form, see Panel D of Figure 5 and Panel H of Table 3. Our sample includes 9,006 such institutions. The total

market value of assets of the 4,571 institutions in 2018Q4 is $21T, or about 90% of GDP. Even though the 13F portfolios represent aggregate holdings of each institution instead of portfolio holdings of individual mutual funds, the characteristic distributions are similar. The means and quantiles of 13f institutions (Panel H) are almost identical to those for mutual funds (Panel A). 88% of all financial institutions have a BM score less than 3, so the aggregate 13F portfolios shows the same bias towards low BM scores that is present in the BM distribution of mutual funds, ETFs, and hedge funds. 236 out of 9,006 institutions, or 2.6%, have a BM score above 4 while 3,533 institutions, or 39%, have a BM less than 2.

*Robustness*

Next, we perform a number of robustness checks that are reported in Figure 6. Results for additional robustness checks are reported in the online appendix. The results reported so far are based on averages by fund, in other words, we compute the time series mean characteristic score for each of the 2,993 fund in our sample over the quarters in which the fund is in our sample. Panel A shows instead the BM distributions of fund/quarter observations of all funds in our sample (154,418 fund/quarter observations), "value" funds (30,412 observations), and "growth" funds (63,591 observations). The BM distributions of all funds in our sample, "value" funds, and "growth" funds based on fund/quarter-level data are almost identical to those for fund-level data shown in Panel B of Figure 3.

Panel B shows the distribution of market-adjusted book-to-market ratios, i.e. the difference between the BM-ratio of the mutual fund and the BM-ratio of the CRSP-VW index, see Section 2. Market-adjusted characteristics do not rely on quintile sorts but are more sensitive to outliers and are not directly comparable across different characteristics. The distribution of all mutual funds in our benchmark sample is centered around 0, and therefore close to the BM-ratio of the CRSP-VW index. To interpret the fund distribution, consider the adjusted BM-ratios of the portfolio sort that underlies HML: -0.20 for L, 0.17 for the medium portfolio M, and 0.71 for H. 81% of mutual funds have an adjusted BM-ratio that is between the that of the L and M portfolios, while only 18% of funds have a adjusted ratio that is between M and H. The adjusted BM-ratio of 32 funds, less than 1%, is below that of L, and only 2 funds have a adjust BM-ratio above that of H. The overall results are consistent with those found for BM quintile scores.

Since the sizes of mutual funds varies significantly in our sample, it is useful to compute characteristic Distributions that are weighted by the AUM of funds instead of equally-weighting each fund regardless of size. However, the AUM-weighted distributions of BM scores plotted in Panel D is essentially identical to the equally-weighted histogram in Panel A in Figure 3. Weighted histograms for other characteristic are included in the online appendix and confirm that the results are similar to those based on equally-weighted distributions.

The book-to-market distributions of 296 index and 124 sector funds that pass our other screens, shown in Panel E, show the same pattern found in the benchmark sample. The means of the BM distributions of sector and index funds are 2.35 and 2.47, respectively, and close to the mean of the sample of active equity funds of 2.33. Only 4 sector funds and 3 index funds have a BM score above

4, while 47% and 23% of index and sector funds, respectively, have a BM score below 2.

*Portfolio Composition by Quintiles*

So far, we have focused on average portfolio characteristics of mutual funds. Next, we analyze portfolio compositions in more detail. For each fund in each quarter, we compute the share of its portfolio that is invested in stocks in the five quintiles of a given characteristic. The results reported in this section are based on the time-series means of shares over the lifetime of each fund.

Panel A of Table 5 shows the average portfolio composition across BM quintiles for mutual funds in our benchmark sample, "value" and "growth" funds, as well as ETFs and hedge funds. The portfolio share of mutual funds in our benchmark sample is declining across BM quintiles. Mutual funds invest on average 38.53% of their portfolio in stocks that are in the lowest BM quintile and 9.75% in stocks in the highest BM quintile. The portfolios of "growth" funds are more heavily concentrated in extreme low BM stocks. The average portfolio share of stocks in quintile one is 50.1% and 22.82% in quintile two. "Growth" funds hold on average 15% of their portfolios in high BM stocks that are in the top 2 quintiles. In contrast, the portfolios of "value" funds are more evenly distributed across BM quintiles. In fact, "value" funds hold on average a higher share of their portfolios in stocks in the lowest BM quintile (20.32%) than in stocks in the highest quintile (16.13%). In other words, on average "value" funds hold a higher fraction of their portfolios in low BM "growth" stocks than in high BM "value" stocks. This pattern explain why the average BM score of "value" funds is 2.89 and below the midpoint of 3. The two bottom rows of Panel A report the average portfolio shares of ETFs and hedge funds and show a similar pattern as mutual fund portfolios. ETFs and hedge funds hold mostly low book-to-market stocks but the portfolio share of high BM stocks is relatively small.

The BM shares of the five largest "value" funds as of 2018Q4, shown in Panel B, illustrate the typical pattern of "value" fund portfolios. The portfolios of four of the five largest "value" funds are invested mostly in low BM "growth" stocks instead of high BM "value" stocks and the shares are declining from quintile 1 to 5. One of these "value" funds holds almost 60% BM1 and BM2 stocks and only less than 8% and 14% in BM5 and BM4 stocks, respectively. The notable exception is the "DFA US Large Cap Value" fund. This fund holds very small fractions of stocks in the lowest two BM quintiles and holds on average 70% in stocks in the two highest BM quintiles. In contrast, portfolios of "growth" funds are more concentrated in low BM stocks. Panel C shows the average portfolio weights for the five largest "growth" funds in our sample. These funds hold at least 62% of their portfolios in BM1 and BM2 stocks and the portfolio shares are declining in BM.

Figure 7 shows the distribution of portfolio shares in the five BM quintiles across all mutual funds (in black), "value" funds (in red), and "growth" fund (in blue). The percentages of mutual funds with portfolio weights between 0% and 25%, 25% to 50%, 50% and 75%, and 75% to 100% are at the bottom of each histogram. Panel A shows that most mutual funds hold a large share of their portfolio in stocks that are in the lowest BM quintile. 28% of funds hold more than half of their portfolios in stocks in the lowest BM quantile and 73% of funds hold at least a quarter in BM1 stocks. Panels B to E show that portfolio shares of BM quintile-2 to 5 stocks are much lower than the BM1 shares and more shifted

towards low portfolio shares the higher the BM quintile. For example, the share of mutual funds that hold more than 25% of their portfolio in BM3, BM4, BM5 stocks is 6%, 5%, and 3%, respectively, and the portfolios of 75% of all funds hold at least 96% of BM1 to BM4 stocks.

Portfolios of "growth" funds are more concentrated in low book-to-market stocks and few "growth" funds invest a significant portion of their portfolios in BM4, and BM5 stocks. On the other hand, Figure 7 confirms the finding that portfolios of "value" funds are also biased towards low BM "growth" stocks. 29% and 24% invest at least a quarter of their portfolio in stocks in BM1 and BM2 stocks, respectively, and 90% of "value" funds hold at least half of their portfolios in BM1, BM2, and BM3 stocks. There are 11 "value" funds with portfolios that consist of over 50% in BM1 stocks but only 2 "value" funds with over 50% in BM5 stocks.

*Stock Ownership by Characteristics*

The results presented so far focused on properties of mutual funds. Next, we explore how characteristics are related to the ownership structure of shares of individual stocks. For each stock we compute the fraction of the total market cap that is held by various types of mutual funds. Table 6 shows results for the ownership share of funds in our benchmark sample of active equity funds, all funds in our sample (without applying any screens, including index and sector funds), as well as "value" and "growth" funds for the 1,275 S&P 500 stocks in our sample. As before, we report results for time-series means using the quarters for which a stock is in the sample. Unless otherwise stated, results refer to those in the benchmark sample. Panel A reports summary statistics. Active equity funds hold on average 8.61% of the total market cap of S&P 500 stocks and an average of 13.22% is held by all mutual funds in our sample. Ownership by mutual funds has risen over the sample. In 1980Q1, all (active equity) mutual funds owned on average 3.45% (3.05%) compared to 32.46% (13.21%) in 2018Q4. Ownership of "growth" funds is about three times as high as that of "value" funds. The 10% and 90% quantiles suggest that there is considerable variation across stocks, e.g. the ownership share of all funds ranges from 0.15% to 47.64%.

Panel B shows the average ownership by book-to-market scores of stocks. Results for the earnings-to-price ratio are similar and not reported to conserve space. Ownership shares by all funds as well as active equity fund of low BM stocks are significantly higher than those of high BM stocks. For example, mutual funds ownership of stocks with BM scores between 1 and 2 is 9.45%, which is almost twice that of stocks with BM scores above 4. While ownership of "growth" funds also declines with BM scores, but this is not the case for ownership by "value" funds. Stocks with BM scores in the middle intervals 1-2 and 2-3 have the highest fraction of market cap held by "value" funds, while holdings of stocks in the lowest and highest BM intervals are less than 1%.

Next, we run stock-level cross-sectional regressions of the ownership shares of mutual funds on ME, BM, and MOM scores. As before, the results for mutual funds in the benchmark sample are in the first column of Panel C. Since all characteristic scores are between 1 and 5, the coefficients are comparable across characteristic. To assess the economic significance of each coefficient, we compute the predicted ownership shares of stocks with characteristic scores of 1 and 5 while holding the other

variables constant at their sample means. The book-to-market coefficient is -1.04 and statistically significant, therefore ownership of funds is lower for high BM stocks than for low BM stocks. The predicted ownership share of a BM1 stock is 10.24% but only 6.08% for a stock with a BM score of 5. The momentum coefficient is the largest in absolute "value" suggesting a strong link between ownership of mutual funds and momentum. This interpretation is only partially correct, however. Recall that the regression is based on time series averages of individual stocks, so that the estimation results imply that stocks with high *average* momentum have a higher mutual fund ownership share. But momentum is more volatile and less persistent than other characteristics. The point estimate of the momentum coefficient is close to zero when the regression is run with stock/quarter observations instead of stock-averages while the ME and BM coefficients are much less affected. The size coefficient is negative and statistically insignificant because the sample includes only large S&P 500 stocks. The three characteristics explain 9& of the variation in stock ownership shares. The regression using ownership of all funds or "growth" funds instead of active equity funds yields similar result. However, the $R^2$ of the regression for "growth" funds is 21% and thus more than twice as high as the $R^2$s of the first two regressions suggesting that holdings of "growth" funds are strongly related to stock characteristics.

The results for the regression for "value" funds are different from the other three specifications. The BM coefficient is positive and statistically significant but its economic magnitude is relatively small. The size and momentum are small and insignificant. In addition, the $R^2$ is only 2% and thus smaller than in the other regression specifications. It appears that ownership shares by "value" funds is not strongly related to stock characteristics.

Thus, we find that the book-to-market ratio has economically and statistically significant negative effect on ownership share by mutual fund: Mutual fund ownership of stocks with low BM ratios is higher than that of stocks with high BM ratios. However, this pattern is not true for ownership by "value" funds and the book-to-market ratio has only a minor effect on ownership. Replacing the BM ratio with EP yields similar results. We conclude that these results are consistent with those presented above about the distributions of "value" and "growth"-related characteristics of mutual funds portfolios.

*Summary*

We have documented that portfolios of mutual funds, ETFs, and hedge funds are strongly tilted towards low book-to-market and earnings-to-price ratios. While there is a large number of funds with BM ratios that are close to the L reference portfolio, there are virtually no mutual funds or ETFs with high BM ratios similar to the H portfolio. Furthermore, portfolios of "growth" funds are concentrated in stocks with low BM ratios, but "value" funds hold on average larger shares of low BM stocks than stocks with high BM values. Next, we consider a variety of possible explanations for these empirical facts.

## 4. Possible Explanations

*Liquidity*

One possible reason why mutual funds hold relatively few high-BM stocks is that such stocks might be small, illiquid, and costly to trade. To investigate whether this is indeed the case, we first study the relationship between stock sizes and book-to-market ratios. Panel A of Figure 8 shows a scatter plot of BM scores on the $x$-axis and ME scores on the $y$-axis for all 23,801 stock in our sample. The size of each circle is proportional to the market cap of the stock. The scatter plot shows that there is no strong relationship between the book-to-market ratios and market caps across stocks. The correlation is -0.10 and slightly negative. Of the 1,100 stocks are in the largest size quintile, 185 have BM scores above 4 and 246 have a BM score between 3 and 4. An additional 276 and 326, stocks in the second largest size quintile have BM scores above 4 and between 2 and 4, respectively. In total, there are 1,033 large stock with high book-to-market ratios that are in the top two quintiles.

The scatter plot also displays the BM and ME scores of Fama-French portfolios. Since the SL, BL, SH, and BH portfolios are based on ME/BM sorts, they are located towards the four corners of the plot. The size and book-to-market scores of the big/low-BM BL portfolio are 4.85 and 1.27, respectively, so it is positioned very close to the top left corner of the figure. The big/high-BM portfolio BH is slighter further from the top right corner and its ME and BM scores are 4.70 and 4.55, respectively. The ME scores of small-stock portfolios are above 2 because they are value-weighted, so that the smallest stocks with a ME score below 2 are dominated by the slightly larger stocks in the small-stock portfolios. The S, B, H, and L portfolios are averages of the double-sorted portfolios and are therefore between the two portfolios from which they are constructed.

The BM scores of the three high-BM portfolios, BH, SH, and H are 4.55, 4.65, and 4.61, respectively, are almost identical. Since the big/high-BM portfolio consists only of large stocks, it is therefore possible to form high-BM portfolios using only liquid stocks without having to rely on smaller and potentially illiquid stocks.

The scatter plot for mutual funds is in Panel B. “Growth” funds are in black, “value” funds in blue, and “other” funds are in orange. The size of the circles are proportional to the TNA of funds. The joint distribution of size and BM scores of mutual funds is different from the joint distribution of stocks as 61% of funds invest in very large and low book-to-market stocks (727 funds, or 24%, are in ME5-BM1 and 1,099, 37%, in ME5-BM2 quintiles). Even though there are many stocks in the top ME/BM quintile, there is only a single mutual fund with ME and BM scores above 4. In fact, there is a significant mass in the joint distribution of stocks with BM scores above 4 in each size quintile but virtually no mutual funds.

Next, we construct characteristics that are designed to measure liquidity on the stock level directly; the Pástor, Stambaugh, and Taylor (2015) measure (PSLIQ) and the bid-ask spread (SPREAD). Additional results for trading volume and turnover in the internet appendix. We group stocks and mutual funds with ME and BM scores between 1 and 2, 2 and 3, 3 and 4, and 4 and 5 and compute average liquidity characteristics for each of the 16 combinations. The four panels of Table 7 show

results for PSLIQ in the sample of stocks (Panel A) and mutual funds (Panel B), and bid-ask-spreads in Panels C and D. Recall that there are only seven mutual funds with book-to-market scores above 4. Of these seven funds, two are in each of the first, second and third ME groups, and only one fund has a size score above 4. Therefore, the results in the BM[4,5] column are based on no more than 2 observations and are indicated with a $^{\dagger}$ superscript.

There is little variation in the average Pástor-Stambaugh liquidity measure PSLIQ across size and book-to-market scores of stocks (Panel A) and mutual funds (Panel B). The PSLIQ means for stock quintiles range from 2.96 to 3.11 and 2.91 to 3.15 for mutual funds and thus close to the midpoint of 3. Even though the means are similar, the variation of PSLIQ is much larger for small stocks than for large stocks. The cross-sectional standard deviation of stocks in the bottom size quintile is 0.61 compared to 0.25 for stock in the top quintile. In contrast, the PSLIQ means and variation across BM quintiles are similar, implying that the Pástor-Stambaugh liquidity measure is not closely related to book-to-market ratios.

The PSLIQ score shows little variation across mutual funds and is also not related to ME and BM scores of funds. The PSLIQ score of 90% of all mutual is between 2.8 and 3.2 and the minimum and maximum scores in the sample are 2.68 and 3.31. Average scores of bid-ask spreads of stocks and mutual funds, shown in Panels C and D, are, not surprisingly, negatively correlated with size scores but are only weakly related to BM scores. Conditional on the ME score, high BM stocks and mutual funds have slightly higher bid-ask spreads than low BM stocks and funds but the spread is much smaller than that across size.

Based on the evidence presented above, it seems unlikely that the lack of high-BM funds can be explained by liquidity. First, the number of large stocks with high book-to-market ratio is sufficient to create well-diversified portfolios consisting of liquid stocks. Second, controlling for size, liquidity of individual stocks is only weakly correlated with the book-to-market ratio. Third, the liquidity of stocks in mutual fund portfolios varies little across funds and is not related to book-market-ratios.

*Alternative Definitions of "Value" vs. "Growth"*

The academic literature on the value premium has focused on the book-to-market ratio, and to a lesser extent on the earnings-to-price ratio, as measures of "value" vs "growth". In this section, we consider the possibility that the mutual funds industry uses other measures to define what constitutes a "value" stock vs. a "growth" stock and analyze an exhaustive list of alternative characteristics. In additions to studying individual characteristics, we also consider the composite index that is used in the well-known Morningstar "style box" that classifies mutual funds in a two-dimensional matrix of size and "value"/"growth".[14] The Morningstar "value"/"growth" index is based on 10 individual characteristics: Five price-multiples and five growth rates of stock fundamentals and is defined below.

First, we construct characteristic scores of four additional price-ratios: Expected-earnings ($\hat{E}P$), cash flows (CFP), sales (SP), and dividends (DP). Next, we consider five quarterly growth rates of firm

[14] http://news.morningstar.com/pdfs/FactSheet_StyleBox_Final.pdf

fundamentals that are used in the Morningstar index: Expected long-term earnings growth (GRLTE)[15], current earnings (GRE), cash flows (GRCF), sales (GRS), and the book value (GRB). Finally, we replicate the Morningstar "value"/"growth" index, which is defined as the difference of a multiples index (MULT) and a growth index (GR). The MULT index is defined as an average of price multiples while the GR index is an average of growth rates of fundamentals:

$$\text{MULT} = \frac{1}{2}\,\widehat{\text{E}}\text{P} + \frac{1}{2}\,\text{avg}\,(\text{BM, SP, CFP, DP}), \tag{3}$$

$$\text{GR} = \frac{1}{2}\,\text{GRLTE} + \frac{1}{2}\,\text{avg}\,(\text{GRE, GRCF, GRS, GRB}). \tag{4}$$

Note that the forward-looking measures $\widehat{\text{E}}\text{P}$ and GRLTE have larger weights than the other multiples and growth rates. Each individual characteristic is measured as percentile rank and range from 0 to 100. While the respective components of MULT and GR are positively correlated, there is a considerable amount of orthogonal information in the variables. For example, the pairwise correlations of the five price multiples across individual stocks in our sample is on average 0.41 and ranges from 0.18 to 0.76. The average correlation across the five growth rates is 0.33. On the other hand, price multiples and growth rates are only weakly correlated. The pairwise correlation of multiples and growth rates ranges from -0.44 to 0.26 and is -0.03 on average, so that the correlation of the MULT and GR indices is only -0.17.

The Morningstar value/growth index, MS, is defined as the difference between the index of multiples and the index of growth rates

$$\text{MS} = \text{MULT} - \text{GR} \tag{5}$$

and ranges from -100 to 100.[16] We compute MS, MULT, and GR indices for each stock in each quarter, form quintiles and compute scores for mutual funds as the portfolio-weighted average of MS scores of the stocks in the fund's portfolio. The scores are constructed so that low values correspond to "growth" and high values correspond to "value", so that stocks with high multiples have high MULT scores but stocks with high growth rates have low GR scores. Adjusted MS is computed as the difference between the MS of a stock and that of the market.

Figure 9 shows the densities of characteristic scores in three panels. First, we consider alternative price-ratios. Panel A plots the histograms of the scores of the earnings-to-price, cash-flow-to-price, sales-to-price, and dividends-to-price ratios. The sales-to-price distribution is more strongly biased towards low scores than the BM distribution and has a lower mean of 2.24 compared to the mean of the BM distribution of 2.33. The earnings-to-price and cash-flow-to-price distributions are shifted further to the right compared to the BM histogram but most of their mass is below 3 (81% and 75% of mutual funds have EP and CFP scores below 3, respectively). However, there are virtually no mutual funds with EP, CFP, or SP scores above 4 confirming the results for BM. Our sample includes two mutual funds with an EP score above 4, four with a CFP score above 4, and a single fund with a SP

[15] Mornigstar uses analyst's estimates of three- to five-year EPS growth.

[16] The Morningstar index used in the style box is defined as scaled GR$[0, 100]$ − scaled MULT$[0, 100]$. We adjust the definition so that low/high MS values have the same value/growth interpretation as low/high BM scores.

score above 4.

The distribution of dividing-price ratios differs significantly from those of the other four price-multiples and is more spread out and only very slightly biased to the left. Its mean of 2.87 is close to the midpoint of 3, 46% of mutual funds have a DP score above 3, and 190 mutual funds (or, 6%) with a DP ratio above 4. Hence, the dividend-price ratio is the only "value" measure that is associated with a significant number of mutual funds in our sample. The main reason for this finding is that a number of the mutual funds in our sample are "Dividend" funds that specifically invest in stocks that pay high and stable dividends. For example, 79 mutual funds and 57 ETFs include the term "Dividend" in their name. We will discuss these funds further in Section 7.

The densities of fundamental growth rates are in Panel B. The distributions of scores of earnings, cash flow, sales, and book value growth rates are very similar. Almost all funds have growth rate scores between 2 and 3 and thus hold on average stocks that have slightly above average growth rates (recall that low growth rate scores correspond to higher growth rates). The distribution of scores of long-term growth rates is more spread out than those of the other four growth rates, however, all five means are between 2.64 and 2.73. None of the growth rate densities have mass above 4, hence there are no mutual funds that hold on average stocks with very low growth rates.

Finally, consider the densities of the three Morningstar indices: MULT, GR, and MS. All three distributions exhibit the same bias towards low scores related to "growth" that we have documented above. Recall that the forward-looking expected-earnings-to-price ratio and growth of expected long-term earnings account for 50% of the MULT and GR indices, so their respective densities are similar. The only variable among the 10 components that has significant mass over 4 is the DP ratio, which has only a 12.5% weight in MULT and a 6.25% weight in the overall MS index.

We conclude that the bias in mutual fund portfolios towards "growth" is present in all characteristics that we have studied. No matter how "value" is defined, there are virtually no mutual funds with high "value" scores, whereas there are many funds with characteristic scores related to "growth".

*Declining Value Premium*

It is well known that the last decade of the sample has been unusual in the sense that the value premium has been negative for an extended period. Panel A of Figure 10 plots the cumulative return of HML over the sample. We split the sample into subsamples with extended periods of positive and negative HML returns. The periods with low HML returns are shaded in blue: 1980Q1-1980Q4, 1989Q1-1991Q4, 1998Q2-2000Q1, and 2006Q4-2018Q4. There have been shorter periods of negative HML returns in the early 1990s and around 2000, but the negative HML returns over more than the decade since 2007 is unprecedented. Next, we investigate whether this unusual period has contributed to the lack of mutual funds and ETFs with high book-to-market and earnings-to-price ratio, and, more generally, whether "value" vs. "growth" returns are related to the distribution of mutual funds and ETFs.

For the results in this section we merge the mutual funds and ETFs samples to account for all available funds. Panel B shows the number of "value" and "growth" mutual funds and ETFs over the

sample. [17] Recall that portfolio holdings data from CRSP are available after 2010Q3 improving the coverage of the set of mutual funds and, in particular, of ETFs. The number of funds increases by about 50%, which explains the spike in the plot in 2010Q3. The number of "growth" funds increases from 81 in 1980Q1 to 718 in 2018Q with a peak of 817 in 2011Q3. There are fewer "value" funds than "growth" funds throughout the sample and their number has increased from 11 to 450.

Recall that subsamples with low HML returns are shaded in blue and HML returns are high during the unshaded periods. There is no apparent link between "value" vs. "growth" returns and the number of "value" and "growth" funds. For example, the number of new "growth" funds outstrips the number of new "value" funds in every subsample with the exception of the last one. Even though "growth" returns were higher than those of "value", the number of "value" funds increased by 130 whereas the number of "growth" funds went up by only 81.

Panel C shows the densities of BM scores of mutual funds in the two subsamples with positive (in orange) and negative (in black) HML returns. The densities are similar suggesting that the book-to-market distribution of mutual funds and ETFs does not depend on whether "value" returns are higher than those of "growth", *vice versa*. In fact, the mean BM score in the subsample with high HML returns is 2.25 and *lower* than the mean in periods with low HML returns of 2.41.

Finally, we compute cross-sectional means of BM scores over time. Panel D plots quarterly means of all mutual funds and ETFs in our benchmark sample, as well as means of the H and L portfolios as references. The shaded areas of the figure represent the 25% to 75% percentile range (darker) and 5% to 95% percentile range (lighter). The figure shows that the overall distribution of BM scores is stable over time. The mean BM score in the benchmarks is between 2 and 3 for most of the sample but drops to 1.74 in 2000Q2. The maximum is 2.62 in 2014Q2 and thus well below the midpoint of 3. The interquartile range shows that most funds have BM scores between throughout the sample, again with the exception of a period around 2000. The 95% percentiles are between 3.5 and 4 until 1988Q2, but are based on fewer than 300 funds and thus potentially unreliable. After 1988, 95% percentiles of the BM distributions by quarter range from 3 to 3.6 and confirm that the absence of high BM funds has been present throughout the sample. The vast majority of mutual funds and ETFs have book-to-market ratios that are between that of the L portfolio and the midpoint of 3. In contrast, there are virtually no funds with BM ratios that are close to that of H over the course of the sample throughout the sample. Furthermore, the BM distribution does not appear to be related to the value premium. Results for other price-ratios are similar; hence we conclude that the disappearing value premium since 2007 is not responsible for the lack of mutual funds with high valuation ratios.

## 5. ETFs and Stock Market Indices

So far, we have focused mostly on the sample of active equity funds. Since ETFs and passive mutual funds track stock market indices, we can gain further insights by studying the properties of the major "value" and "growth" indices since index providers publish detailed information of their

[17] We remove the smallest 10% of funds in every period to avoid counting very small funds.

methodologies. In particular, we are able to analyze the specific definition of "value" or "growth" that is underlying the portfolios of each "value" or "growth" ETF and index fund. Our sample, before applying screens, contains 234 index mutual funds and 1,148 ETFs that focus on domestic equities, including 164 passive "value" and 317 passive "growth" funds. We first match each ETF and index mutual fund to the index that is tracked by the funds. Then, we aggregate funds by index, and analyze the portfolio compositions of the funds that are tracking the index. Results for the five value and five growth indices with the largest net asset values are in Table 8. Panels A shows the sum of asset values of all funds that track the index, the book-to-market, Morningstar, earnings-to-price, and sales-to-price scores. Panel B reports the portfolio shares across BM quintile scores.

While all indices in Panel A are "value" indices, their portfolio properties are heterogeneous. The BM scores range from 2.89, which is below the midpoint of 3, to 3.75, while all MS scores are somewhat higher and between 3 and 4. EP scores are between 2.64 and 3.30 but all SP scores are well below 3. All valuation scores in the panel are below 4 indicating that none of the indices is a "true" value index in the sense of high price-based ratios. In contrast, the "growth" indices in Panel B are indeed true "growth" indices with low valuation ratios. The BM score of all "growth" indices are all well-below 2 and scores of other price-ratios are only slightly higher and between 1 and 2 (with some exceptions).

The portfolio weights across the five BM quintiles reported in Panels C and D show the differences between "value" and "growth" indices in more detail. With the exception of the small-cap Russell 2000 Value index, about 70% of the portfolios of "value" indices is concentrated in the middle BM2, BM3, and BM4 quintiles, and share of high-BM5 stocks of all indices is less than 25%. Instead, the portfolios of all "growth" indices are without exception strongly tilted towards stocks with low book-to-market ratios.

Next, we download the index methodology documentation of the major index providers (S&P, Russell, CRSP, and Morningstar) and compile a list of characteristics that are used in the construction of "value" and "growth" indices, see Panel C. While the details of the methodology vary, all indices are based on the same principle, which is similar to that used in the Morningstar index. All "value" and "growth" indices are a combination of two separate components: The first component is based on an average of several price-multiples. In addition, all indices also include a second component that is computed using (mostly) growth rates of fundamentals. The two components are then combined to form a single "value"/"growth" index for each stock that is then applied to a subset of stocks based on size. For example, the Russell 1000 Value/Growth indices include only the 1,000 largest stocks while the Russell 2000 Value/Growth indices include only small-cap stocks.

Each index provider uses a different set of characteristics. CRSP and Morningstar combine five price-multiples to form their valuation index while Russell uses only the book-to-market ratio. The construction of the indices of growth characteristics varies even more. While Russell and Morningstar indices use only growth rates of fundamentals (e.g. current and expected long-term earnings, sales, cash flow, book value), the other providers incorporate characteristics that are not directly linked to growth rates. For example, the S&P "growth" index uses 12-month momentum, and CRSP includes the investment-to-assets ratio and the ROA.

The academic literature on the value premium has focused almost exclusively on price-multiples, in particular on the book-to-market ratio, as measures of "value" vs. "growth". In contrast, indices that are tracked by "value" and "growth" index funds and ETFs also incorporate information in other firm fundamentals, some of which are not directly linked to multiples of fundamental growth rates. Therefore, the properties of mutual fund and ETF portfolios that are created based on these indices are different from those of characteristic sorts and portfolios that underlie the extensive body of research about the value premium. One consequence is that very few, if any, index funds and ETFs are true "value" investments if "value" is defined in the academic sense as stocks with high price-multiples. Nor do any "value" and "growth" ETFs or index funds resemble "value" and "growth" portfolios typically studied in academic research. It is an open question if and how these different notions of "value" vs. "growth" are related to returns and performance of mutual funds and ETFs. We will return to this issue in Section 7.

## 6. Loadings vs. Holdings

In the literature on mutual fund performance, the magnitudes of regression factor loadings (i.e., betas) are less relevant since the factors serve only as controls for diversifiable risk. For our purposes, the question is whether loadings estimated from time series regressions of fund returns on factors such as SMB, HML, and MOM are informative indicators of fund strategies. Next, we argue that while factor loadings are appropriate as a measure of exposure to diversifiable risk, they are not necessarily reliable indicators of the underlying investment strategy of an active mutual fund.

First, risk exposures are estimated using historical data and are thus subject to estimation error. Historical data might also not reflect the current portfolio of an active fund. This is especially true for firm characteristics that change over time, such as momentum. Unless a fund deliberately hedges momentum, the momentum of a fund's portfolio changes as momentum of the stocks in its portfolio change over time. In contrast, measuring fund characteristics directly from portfolio holdings yields an accurate assessment of the fund's portfolio at each point in time.

Second, the interpretation of the magnitudes of estimated loadings in factor regressions are not straightforward and can easily be misinterpreted. Consider the following simple example. Let P and Q be two portfolios that are based on sorts on some characteristic and let $\mathrm{P}_t - \mathrm{Q}_t$ be the corresponding long/short portfolio. It is easy to see that the coefficients of regressions of P and Q on P-Q satisfy $\beta_{\text{P,P-Q}} - \beta_{\text{Q,P-Q}} = 1$. Moreover, their magnitudes depend on the relative volatilities of P and Q: $|\beta_{\text{P,P-Q}}| > |\beta_{\text{Q,P-Q}}| \iff \sigma_{\text{P}} > \sigma_{\text{Q}}$. Hence, betas are not necessarily symmetric around 0 and the more volatile portfolio has a larger (in absolute value) beta with respect to the long/short portfolio. For example, the beta of the "neutral" portfolio $(\mathrm{P}_t + \mathrm{Q}_t)/2$ is positive if $\sigma_{\text{P}} > \sigma_{\text{Q}}$ and negative otherwise. In other words, the magnitudes of betas are more informative about the volatility of the portfolios that make up the long/short portfolios than as a measure of how tilted a portfolio is towards the underlying characteristic.[18]

[18] The beta of the excess market return is an extreme example. The volatility of the risk-free rate is negligible relative to that of the market return, so that $\beta_{\text{M,M-RF}} \approx 1$ and $\beta_{\text{RF,M-RF}} \approx 0$.

The dependence of regression loadings on the volatility of the long/short portfolios is borne out in the data. In our sample, univariate HML betas are not centered around zero since $\sigma_L > \sigma_H$ and thus $|\beta_{L,HML}| > |\beta_{H,HML}|$. The estimated univariate betas are $\beta_{L,HML} = -0.75, \beta_{H,HML} = 0.25$. The HML beta of the "BM-neutral portfolio" (H+L)/2 is -0.25. In contrast, the HML beta of a "growth-tilted" portfolio of 0.75H+0.25L is 0. Hence, a comparison of HML loadings of two portfolios based only on the magnitudes of their HML betas is misleading. Say, the HML betas of two portfolios are -0.2 and 0.2, respectively. The portfolio with an HML beta of 0.2 is much closer to H than the portfolio with an HML beta of $-0.2$ is to L.

This pattern is even more pronounced for the SMB $\beta$'s of S and B: $\beta_{S,SMB} = 1.60, \beta_{B,SMB} = 0.60$. The *positive* sign of $\beta_{B,SMB}$ is counterintuitive since SMB=S$-$B but is due to the fact that S is much more volatile than B and Cov(B,S) > Var(B). Hence, the SMB beta of any linear combination of S and B with non-negative weights is strictly positive. Thus univariate SMB betas of large stocks, or mutual funds that hold large stocks, are positive. By themselves, beta coefficients in regressions on long/short factors are generally not informative. Instead, betas need to be interpreted relative to the range spanned by the betas of the components of the long/short factors.

In multivariate regression, betas depend on the joint variance-covariance structure of the left- and right-hand side variables and the relative magnitudes and signs of betas can take any value. The betas of the six component portfolios of SMB, HML and MOM in 4-factor regressions are in shown Table D.4. The SMB loading of S is 0.90, while the loading for B is $-0.10$ and thus much smaller in absolute value. The same pattern is true for the HML loadings of H and L: $\beta_{H,HML} = 0.72$ and $\beta_{L,HML} = -0.28$, while $\beta_{U,MOM} = 0.34$ and $\beta_{D,MOM} = -0.66$. While the signs of the betas are intuitive in the sense that betas of "long" portfolios S, H and U are positive and betas of "short" portfolios B, L and D are negative, the betas are not symmetric around zero.

The asymmetry of loadings is present in the estimation of multifactor models in standard data sets. Panels B and C of Table 9 shows SMB and HML loadings of 25 ME-BM sorted portfolios in a factor model with the market, SMB, HML, and MOM. SMB betas of all portfolios constructed from size quintiles 1 to 4 are positive and only the five portfolios with the smallest stocks have a negative SMB beta. The magnitudes of the SMB betas are only interpretable in comparison to the S and B betas of 0.9 and -0.10 (Panel A). The SMB loadings of ME1 and ME2 portfolios are between 0.70 and 1.33 and thus comparable to the loading of S, while SMB loadings of ME5 portfolios are similar to the H loading. [19] The pattern of HML betas is similar. Only the portfolios with the lowest BM quintile have negative HML betas. As in the case of SMB betas, HML betas need to be interpreted in conjunction with H and L betas, which are 0.72 and -0.28, respectively. HML loadings of BM1 portfolios are similar to the loading of H and BM5 betas are similar to that of L. The SMB and HML loadings of the "neutral" ME/BM portfolio formed from stocks in the third ME and BM quintiles are 0.35 and 0.55 and positive, suggesting, incorrectly, that this portfolio is tilted towards large, high BM stocks.

Clearly, estimated loadings of models with long/short factors cannot be interpreted without a

[19] The betas of the 25 ME-BM portfolios can be larger in absolute value than the S, B, H and L betas since they are based on quintiles while S, B, H and L are constructed from two ME quantiles and BM terciles.

proper scale. We suggest to use the estimated loadings of the long and short components of the factors as natural benchmarks for high and low exposure of any test asset to a factor. The exposure of a factor-"neutral" midpoint is given by the average of the betas of the long and short components of the factor. For example, the low, neutral, and high SMB benchmarks are -0.10, 0.40, and 0.90, and those of HML are -0.28, 0.22, and 0.72 (see Table 9, Panel A).

Proper framing is important when interpreting factor loadings of mutual funds. Consider two mutual funds with $\beta_{1,\text{HML}} = 0.25$ and $\beta_{2,\text{HML}} = -0.25$, respectively. Since the HML betas are equal in absolute value, it might seem that both funds are comparable in terms of their respective value and growth strategies. However, the HML beta of fund 2 is close to the HML beta of L of $-0.28$ while the HML beta of fund 1 is much smaller than the HML beta of H of 0.72. Hence, fund 1 is a "moderate" "value" fund, while fund 2 is an "extreme" "growth" fund.

We estimate the 4-factor model with the market, SMB, HML, and MOM for each mutual fund and ETF in our sample and study the distributions of the loadings. [20] The histograms are plotted in Figure 11 along with the loadings of the component portfolio of the factors as vertical lines. The distributions of ETF betas in all cases is almost identical to those of mutual funds, hence we will focus on the mutual funds sample. This histogram of market betas in Panel A shows that the betas of almost all mutual funds is between 0.5 and 1.2. The mean market beta across funds is 0.96 with an inter-quartile range of (0.89, 1.05). SMB betas, shown in Panel B, vary significantly more across mutual funds and range from about -0.3 to 1 with an overall mean is 0.2. We have seen in section 3 that mutual funds hold predominantly large stocks but only 39% of all funds have a negative SMB beta. The reason for relatively small number of funds with negative SMB betas is of course that the SMB of the B portfolio of large stocks is -0.1 and thus only slightly less than zero, thus the SMB beta of the majority of mutual funds is similar to that of B. The beta of the small stock S portfolio is 0.9, so that the size-neutral midpoint is 0.4. The overall distribution of SMB loadings is consistent with the size distribution based on portfolio holdings when it is compared to the betas of the S and B portfolios.

The distribution of mutual fund HML betas in Panel C is centered around 0, with a mean and median of 0.04, and close to symmetric. Most HML betas are small in magnitude as 93% are between -0.5 and 0.5. Of course, this does not imply that most funds hold book-to-market neutral portfolios since the betas of the high and low-BM portfolios H and L are not symmetric around 0. The HML beta of H is 0.72 and that of L is -0.28 with a midpoint of 0.22. The fact that 75% of all mutual funds have HML betas that are smaller than 0.22 confirms the finding that funds are biased towards low book-to-market stocks. Moreover, only 18 funds have a HML beta that is larger than that of H but 383 funds with smaller betas than L.

## 7. Characteristics and Returns

The results presented above suggest that the notion of "value" vs. "growth" in the mutual fund industry is vague and involves a diverse set of characteristics. This is particularly transparent in the

[20] We focus on the point estimates of betas but acknowledge that the standard errors are substantial and range from about 0.25 to 0.6.

construction methodologies of indices that are tracked by "value" and "growth" ETFs. While the precise definition differs across providers, all indices incorporate information in price multiples, fundamental growth rates, and sometimes other variables. The popular Morningstar index is constructed in a similar fashion. The extensive academic literature has documented of return premia in sorts based on price-multiples but there is less evidence about the return patterns in growth characteristics.

We first compute average returns of stocks and mutual funds by characteristic decile. For stocks, we sort stocks according to their characteristic score in each quarter and measure the return over the following quarter. We then compute the value-weighted average return by quarter and then take the mean across quarters. Panel A of Table 10 shows the results for size, book-to-market, Morningstar, momentum, as well as the "growth" and multiples components of the MS index. Results for all individual characteristics components of the MS index are in Table 11. Consistent with the literature, the mean returns of the quintile 5 minus quintile 1 long/short portfolios of book-to-market and momentum are positive while the size premium is negative. In contrast, there is no evidence of a return premium associated with the Morningstar index as mean returns show no clear pattern across quintiles. The last two columns show results for MULT and GR, the two components of the MS index. Stocks in the lowest MULT quintile have a higher return than those in the highest quintile, so that there is a negative MULT premium. However, the pattern across quintiles is not monotonic. The return premium associated with the growth index, GR, is also negative. Recall the GR is an average of five fundamental growth rates, long-term expected earnings, current earnings, book values, sales, and cash flows. Panel A of Table 11 shows that return premia of all fundamental growth rate are negative, hence we conclude that stocks with low growth rates earn higher returns than stocks with high growth rates. In addition to the book-to-market ratio, long/short portfolios of high earnings-to-price, cash-flow-to-price, and sales-to-price ratios stocks minus stocks with low values of respective price-ratios carry a positive return premium, while the expected-earnings-to-price and dividend-price ratios are associated with negative return premia.[21] Note that the weight of the expected-earnings-to-price ratio in the Morningstar GR index is 50%, while the other four multiples have a weight of 12.5%. Since the expected-earnings-to-price ratio carries by far the lowest return premium of all price-multiples, it is not surprising that the return premium of the MULT index is negative and that of the MS index close to zero.

The results for mutual funds are in the middle panels of Tables 10 and 11. In each quarter, we sort funds according to their characteristic scores by intervals 1-2, 2-3, 3-4, and 4-5, compute their returns in the following quarter, and then report the average fund returns in each of the four intervals. Intervals that contain on average less than 10 funds per quarter are less reliable and are indicated by a $^{\dagger}$ superscript. The overall patterns of funds returns sorted by characteristics is less clear-cut than those of stock returns as mean returns are not monotonic in scores for most characteristic. The only exceptions in Panel B of Table 10 is the BM ratio and its return spread of 1.04% is larger than that for stock returns. Note, however, that there are few mutual funds with a BM score above 4 in our sample,

[21] The data available on Kenneth French's website https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html produces similar results.

so the mean return of the 4-5 interval is based on few observations. There is no evidence of a return spread associated with the MS and MULT indices. Returns of mutual funds with low momentum scores below 2 are on average negative, however, this result is based on a small number of funds. Returns of mutual funds based on the characteristics in Table 11 exhibit similar patterns. In most cases, the characteristics with positive (negative) return spreads for stocks also have positive (negative) return spreads for mutual funds. For example, the EP, CFP, and SP ratios carry positive returns spreads, while the $\widehat{\text{E}}$P and DP ratios carry a negative spread for mutual funds as well stocks. Growth rates are also associated with negative high-minus-low returns in both cases.

Next, we study the characteristics-return link more formally using Fama-MacBeth regressions. Let $\mathbf{X}_{i,t}$ be a vector of characteristics of stock or mutual fund $i$ at time $t$ and let $R_{i,t+1} - R_{f,t+1}$ be the excess return of asset $i$ in quarter $t+1$. In each quarter $t$, we estimate the cross-sectional regression

$$R_{i,t+1} - R_{f,t+1} = a_t + \boldsymbol{\beta}_t' \mathbf{X}_{i,t} + e_{i,t+1}, \tag{6}$$

for all stocks or funds that are in our sample in the quarter. Sample betas of the characteristics in $\mathbf{X}_{i,t}$ are the time-series averages of $\widehat{\boldsymbol{\beta}}_t$, $\widehat{\boldsymbol{\beta}} = \sum_t \widehat{\boldsymbol{\beta}}_t / T$. The model is estimated for individual stocks and mutual funds and the results are in Table 12. The first rows of Panels A and B show results for the model with ME, BM, and MOM scores. For stock returns, the book-to-market and momentum coefficients are positive and highly significant, while the size coefficient is negative but insignificant. These results are consistent with the literature (e.g. Lewellen (2015)) as well as with the mean returns reported in Table 8. In the regressions with mutual funds data, the size beta is negative and statistically significant but the beta of the book-to-market is negative but insignificant. Hence, *ceteris paribus*, high-BM mutual funds do not earn a higher return than low-BM funds, so that there is not value premium for mutual funds even though the value premium for stocks is positive and significant. The momentum beta of mutual funds is positive and of a similar magnitude as that of stocks but only marginally significant.

Next, consider regressions with with ME, MS, and MOM scores. The Morningstar beta of stocks in about half the size of the BM beta in the top row and statistically insignificant indicating that the value premium associated with the MS "value"/"growth" index is smaller than the book-to-market premium. The ME beta is smaller than in the first regression and marginally significant while the momentum beta is slightly higher. The ME and MOM loadings for mutual funds are also largely unchanged compared to the regression with BM instead of MS. However, the mutual fund Morningstar beta is negative confirming the result for the book-to-market ratio that there is no "value" premium for mutual funds. In fact, none of the mutual fund betas of price-ratios in regressions with ME and MOM are significant, while the EP, CFP, and SP betas for stocks are positive and significant. The stock beta of $\widehat{\text{E}}$P is negative and strongly significant, which is not surprising since its univariate return premium is also negative (Table 11, Panel A).

The bottom rows in Panels A and B report results for regressions with the two components of the Morningstar index, MULT and GR, in addition to size and momentum scores. The beta of the MULT index that is constructed as an average of price multiples is positive for stocks but negative

for mutual funds, in line with the results for individual price multiples. The GR index of growth rates coefficients are negative for stocks as well as mutual funds. However, none of the MULT and GR betas are significant.

## 8. Conclusion

This paper provides a comprehensive analysis of characteristics of mutual fund portfolios. Some facts stand out. First, the BM distribution of mutual funds is strongly skewed towards low BM ratios. While there are many funds that have a BM ratio comparable to that of the L portfolio in HML, there very no funds with a BM ratio close to H. Moreover, the skew towards low BM values is more pronounced for mutual funds than for individual (large) stocks. Second, "growth" funds hold almost exclusively low BM stocks in their portfolios. In contrast, portfolios of "value" funds include stocks across the entire BM distribution. In fact, on average mutual funds hold a higher share of stocks with low BM ratios that stocks with high BM ratios. The BM distributions of ETFs and hedge funds are similar to that of mutual funds. Third, mutual funds are on average almost momentum-neutral. While momentum of "growth" funds varies over time, in contrast to momentum of "value" funds, there are very few mutual funds with consistently high momentum. Fourth, size, book-to-market and momentum return spreads are smaller for mutual funds than for individual stocks and insignificant in Fama-MacBeth regressions.

These stylized facts raise a number of questions about active mutual funds:

1. Why is the distribution of mutual fund portfolios so strongly tilted towards low book-to-market ratios and why are there virtually no high BM funds at all even though high BM stocks are associated with higher returns than low BM stocks?

2. Why do funds that label themselves as "value" funds hold more low BM stocks than high BM stocks while "growth" funds hold almost exclusively low BM stocks?

3. Why are portfolios of active mutual funds not more tilted towards characteristics that are associated with high returns, i.e. small, high BM and high momentum stocks?

4. Why don't mutual funds combine multiple strategies (e.g., high BM/high momentum) that have been shown to be more profitable than univariate strategies (Asness, Moskowitz, and Pedersen (2013))?

5. Why do mutual funds and ETFs follow strategies that emulate the Morningstar value/growth definition even though it has no return premium?

Our results have also broader implications for equity markets. Aside from the issue of delisting of funds and the implied survivorship bias, the literature takes the set of mutual funds as given and there is little research about why new funds are created. In other words, what economic forces determine the set of funds and strategies that we observe? Is the mutual fund market driven by investor's demand for certain strategies or by the supply of profitable strategies? Are there so many "growth" funds because investor's demand for "growth" stocks and the absence of high-BM funds

is due to low demand? How can the stylized facts presented in this paper be reconciled with the evidence that capital flows react strongly to past performance? Since returns of high-BM stocks are on average higher than returns of low BM stocks, capital should flow from low-BM funds into high-BM mutual funds over the sample and the number of high-BM funds should increase relative to the number of low-BM funds. Yet, there is no evidence support this conjecture.

Portfolios of active mutual funds account for about 13% of total market cap (as of 2016) and their portfolio allocations are likely to have an effect on equilibrium prices. Whether factor premia are permanent or diminishing over time due to higher demand for underpriced stocks is still an open question. Our results suggest that active mutual funds do not systematically hold the stocks with characteristics associated with high returns and thus are unlikely to contribute to any shrinking of factor premia during the sample period. Our sample of mutual funds and ETFs is exhaustive but we only observe portfolio holdings of a very small subset of small hedge funds, so we cannot rule out that (larger) hedge funds tilt their portfolios towards profitable characteristics.

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## Appendix A. Data and Fund Selection

*Mutual Funds*

Our sample of mutual funds builds upon several databases. Net assets (TNA), investment objective codes, realized returns, expense ratios, turnover, launch dates, and other fund characteristics are collected from the Center for Research in Security Prices (CRSP) Survivorship Bias Free Mutual Fund Database. After collecting these characteristics at the CRSP_FUNDNO[22] level, we merge the resulting table to the Wharton Financial Institution Center Number identifiers (WFICN), which provides a common identifier for different share classes investing in the same portfolio. This is carried out using the MFLINKS table developed by Wermers (2000) and available on WRDS. We then collapse this database to the WFICN level by aggregating the total net assets across different share classes. Other quantitative characteristics are aggregated using the average of the characteristic across share classes, weighted by their total assets. Qualitative characteristics are aggregated using the characteristic of the oldest share available.

We collect holdings data from two different sources. First, we take data on portfolio weights from CRSP, merging it with the WFICN codes using the MFLINKS table. CRSP provides the most comprehensive data about mutual funds holdings in terms of number of portfolios, with the downside that it is available only since 2002. In order to cover the largest time spam possible, we also use data from the Thomson Reuters Mutual Fund Holdings (formerly CDA/Spectrum S12). Thomson Reuters tables contain data from funds holdings since 1980, when the U.S. Securities and Exchange Commission (SEC) made the disclosure of mutual funds portfolios mandatory. We merge the Thomson Reuters fund codes to the WFICN codes using the MFLINKS table. Finally, if a given fund have holdings available in both CRSP and Thomson Reuters, we keep only the CRSP holdings. In practice, discrepancies between the CRSP holdings and the Thomson Reuters at the WFICN level are very rare.

In the final step of our database construction, we merge the non-portfolio characteristics to the portfolio characteristics at the WFICN level. We then apply the following screens to select the funds of our benchmark sample of mutual funds:

- Discard ETFs and pure index funds
- Discard funds that, in the average, invest in less than 10 stocks in a given quarter
- Discard funds with average assets smaller than $5M
- Discard funds with average weight in domestic equities smaller than 50%
- Discard funds with less than 16 quarters of observations
- Discard funds not classified as "Domestic Equity" funds according to the CRSP classification CRSP_OBJ_CD

Table D.1 reports the number of funds remaining after each one of the screens is applied.

*ETFs*

The construction of the ETF database is similar to the construction of the database of mutual funds, with three basic differences. First, instead of identifying fund by their WFICN, we identify them by their CRSP_PORTNO. This choice was motivated by the fact that MFLINK does not cover all ETFs. Second, given that ETFs are reasonably recent, we use portfolio holdings data from CRSP instead of Thomson-Reuters.

[22] Unique identifier created by CRSP for each mutual fund.

*Hedge Funds*

We use two different samples of hedge funds in this paper. The first sample comes from the Hedge Funds Research (HFR), with information about performance, strategy, net assets (TNA), fees and other fund characteristics. We include only US-based funds investing 50% or more of their assets in US stocks, obtaining a sample with 973 hedge funds.

The HFR data do not include portfolios holdings. We address this limitation by building a second hand-collected sample of hedge funds from the 13F filings of institutional institutional investors managing more than $100 million in value. After restricting this universe to institutional investors that (i) are hedge funds, and (ii) manage a single fund, we obtained quarterly holdings of 114 hedge funds.

## Appendix B. Definition of Fund Types

We classify the mutual funds and the ETFs in our sample in five investment style groups: "growth", "value", "balanced", "cap-based", and "sector":

1. First, we use key words in the name of the fund to classify funds:
   (a) Funds with the term "value" in their names are classified as "value" funds
   (b) Funds with the term "growth" in their names are classified as "growth" funds
   (c) Funds with the terms "metal", "natural", "resource", "energy", "industrials", "financ", "tech", "utilit", "communication", "consumer", "cyclical", "defensive", "estate", "health", "infrastructure", or "sector" are classified as "sector" funds.
2. Funds that could not be classified only with their names are then classified using one of the following objective codes: CRSP Objective Code, the Wiesenberger Objective Code, the Lipper Objective Code, or the Strategic Insight Objective code:
   (a) A fund is classified as a "value" fund if the Strategic Insight Objective is 'OPI', or if the Wiesenberger Objective Code is 'IEQ', or if the Lipper Objective Code is 'EI', or if the CRSP Objective Code is 'EDYI'.
   (b) A fund is classified as a "growth" fund if the Strategic Insight Objective code is one of 'AGG','GRO', or if the Wiesenberger Objective Code is one of 'G', 'LTG', 'MCG', or if the Lipper Objective Code is one of 'CA', 'G', or if the CRSP Objective Code is 'EDYG'.
   (c) A fund is classified as a "balanced" fund if the Strategic Insight Objective code is one of 'GRI', 'ING', or if the Wiesenberger Objective Code is 'GCI', or if the Lipper Objective Code is 'GI', or if the CRSP ObjectiveCode is 'EDYB'.
   (d) A fund is classified as a "balanced" fund if the CRSP Objective Code is one of 'EDCL', 'EDCM', 'EDCS', 'EDCI', 'EDYG', 'EDYB', 'EDYH', 'EDYS', 'EDYI'.
   (e) A fund is classified as a "sector" fund if the Strategic Insight Objective code is one of 'UTI', 'TEC', 'SEC', 'HLT', 'FIN', 'ENV', or if Wiesenberger Objective Code is one of 'UTL', 'TCH', 'HLT', 'FIN', 'ENR', or if the CRSP Objective Code is one of 'EDSH', 'EDSF', 'EDSN', 'EDST', 'EDSU', 'EDSG', 'EDSC', 'EDSS', 'EDSI', 'EDSM', 'EDSA'.
   (f) If the fund could not be classified at this point, the fund is classified as "unclassified"

If the classification of a fund changes over the life of the fund, we require the classification to be consistent for at least 75% of the observations. If this is not the case, we designate the fund as "unclassified".

## Appendix C. Construction of Characteristics

- The **market equity (ME)** of each stock is defined as the product between the number of shares outstanding and the closing stock price.
- The **momentum index (MOM)** of each stock is defined as the return over the past twelve months, ignoring the immediate past month (2-12).
- The **earnings-to-price ratio (EP)** of each stock is defined as the total net income scaled by the total market equity.
- The **earnings-to-price ratio $\widehat{\text{E}}$P** of each stock is the most recent share price to the IBES expected earnings per share for the current fiscal year.
- The **sales-to-price ratio (SP)** of each stock is defined as the total annual scaled by the total market equity.
- The **cashflow-to-price ratio (CFP)** is defined as the income before extraordinary items plus depreciation and amortization scaled by the total market equity.
- The **dividend-to-price ratio (DP)** is defined as the total dividends paid in the previous 12 months, scaled by the total market equity.
- The **expected long term earnings growth (ELTG)** is the percentage difference between the IBES long term (three- to five-year) expected earnings per share and the current earnings per share.
- The **earnings growth (EG)** is the percentage growth in the total net income.
- The **growth in sales (GRS)** is the percentage growth in the total sales.
- The **growth in book value (GRB)** is the percentage growth in the total book value of the firm.
- The **growth in the cashflow (GRCF)** is defined as the percentage growth in the total cashflow. The total cashflow is the income before extraordinary items plus depreciation and amortization.
- The **multiples index (MULT)** is defined as

  $$\text{MULT} = 0.5\ \text{PR}(\widehat{\text{E}}\text{P}) + 0.125\ \text{PR}(\text{BM}) + 0.125\ \text{PR}(\text{SP}) + 0.125\ \text{PR}(\text{CFP}) + 0.125\ \text{PR}(\text{DP}),$$

  where $\text{PR}(\cdot)$ is the percentile rank function between 1 and 100.
- The **growth index (GR)** is defined as

  $$\text{GR} = 0.5\ \text{PR}(\text{ELTG}) + 0.125\ \text{PR}(\text{EG}) + 0.125\ \text{PR}(\text{GRS}) + 0.125\ \text{PR}(\text{GRCF}) + 0.125\ \text{PR}(\text{GRB}),$$

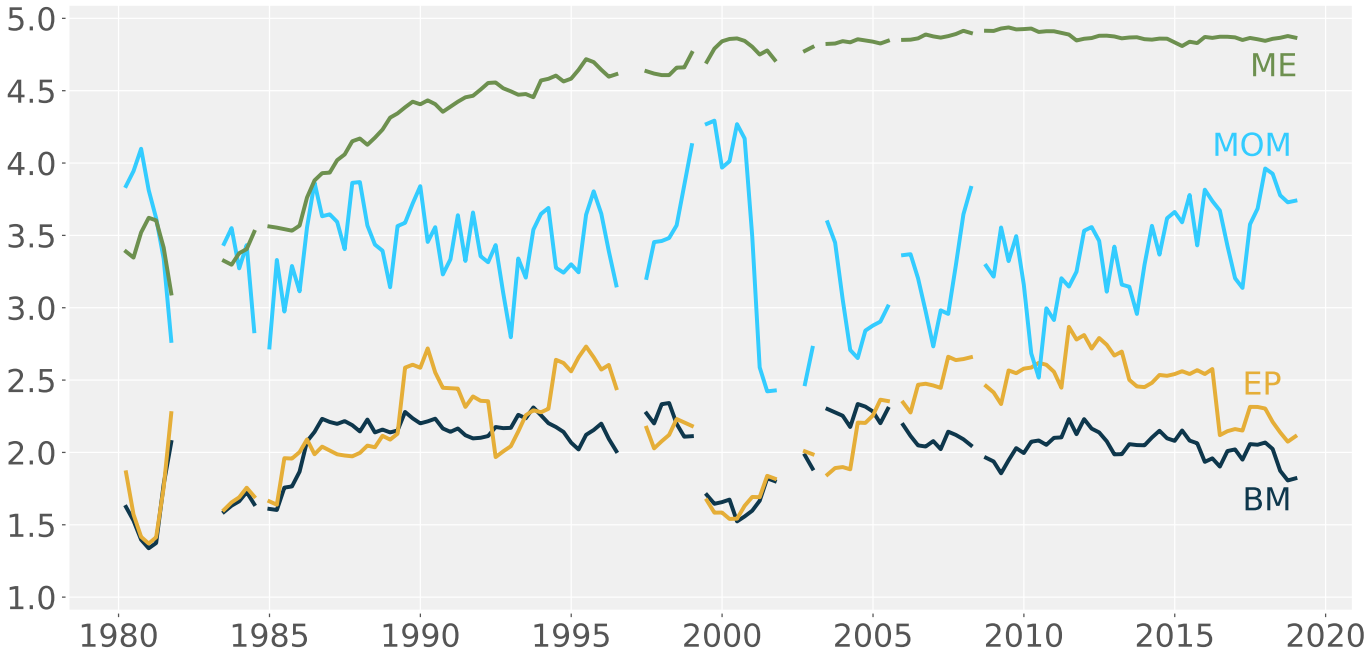
  where $\text{PR}(\cdot)$ is the percentile rank function between 1 and 100.
- The **Morningstar index (MS)** is defined as the difference between the multiples index (MULT) and the growth index (GR), so it ranges from -100 to 100.
- The **MSCI quality index (QUAL)** for each stock is calculated by combining $Z$-scores of three winsorized fundamental variables, namely Return on Equity, Debt to Equity and Earnings Variability. After standardizing each of the three variable values for each security, we calculate a composite Quality $Z$-score for each security. The Quality $Z$- scores are computed by averaging the $Z$scores of all the three fundamental variables. The Quality score is then computed from the composite Quality $Z$-score as follows:

  $$\text{Quality} = \begin{cases} 1 + Z & \text{if } Z \geq 0 \\ (1 - Z)^{-1} & \text{if } Z < 0 \end{cases}$$

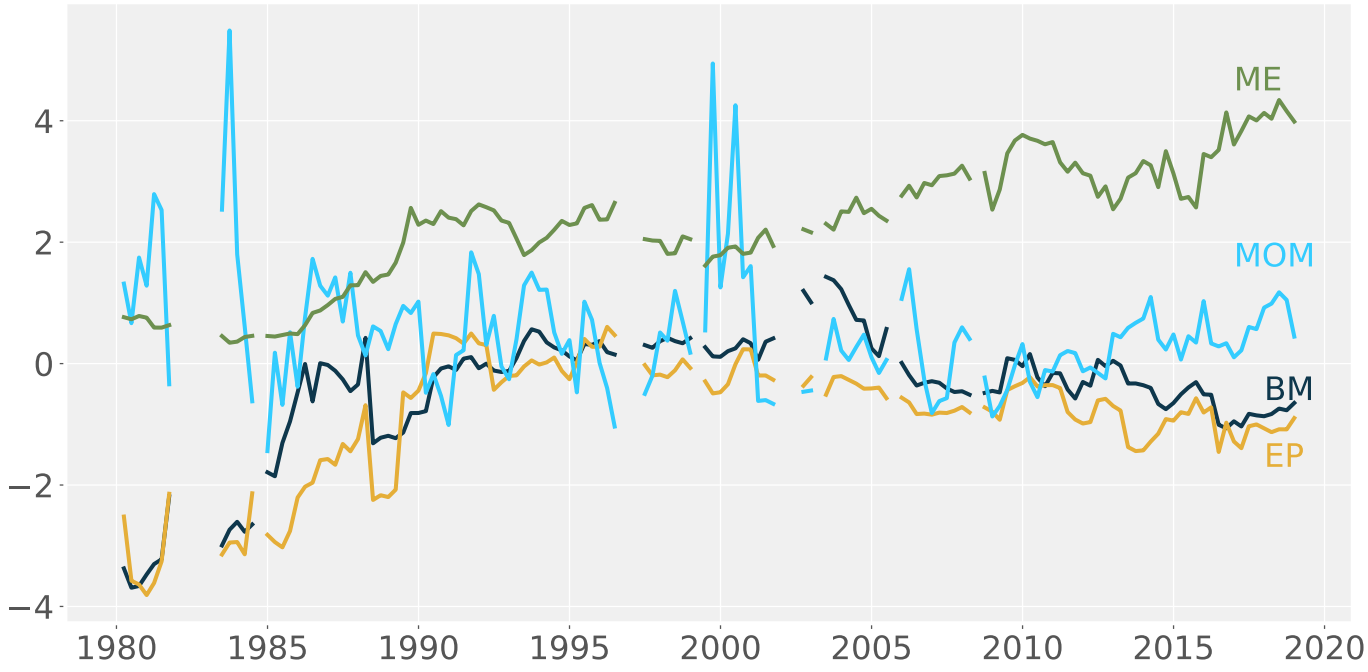
- The **operating profitability (OP)** for each stock is defined as the total revenue net of cost of goods sold and net of selling, general, and administrative expenses, scaled by the total book value.
- The **investment index (INV)** for each stock is defined as the change in total assets divided by the lagged total assets.
- The **Pastor-Stambaugh Liquidity Index (PSLIQ)** is defined for each stock as follow. We run one regression for each calendar month based on each stock's daily return, using the current daily return in the left-hand side. The right-hand side variables are the lagged daily return as well as the lagged daily return interacted with the lagged traded dollar volume. The coefficient of the interaction term is the measure of liquidity – for each stock and each month.
- The **turnover (TURN)** for each stock is defined the monthly traded volume scaled by the total number of shares outstanding.
- The **traded volume in dollars (DVOL)** is defined as the number of shares traded in a given month multiplied by the closing stock price.

**Figure 2: Characteristics of "Growth Fund of America" (AGTHX)**

**Panel A:** Characteristics Scores

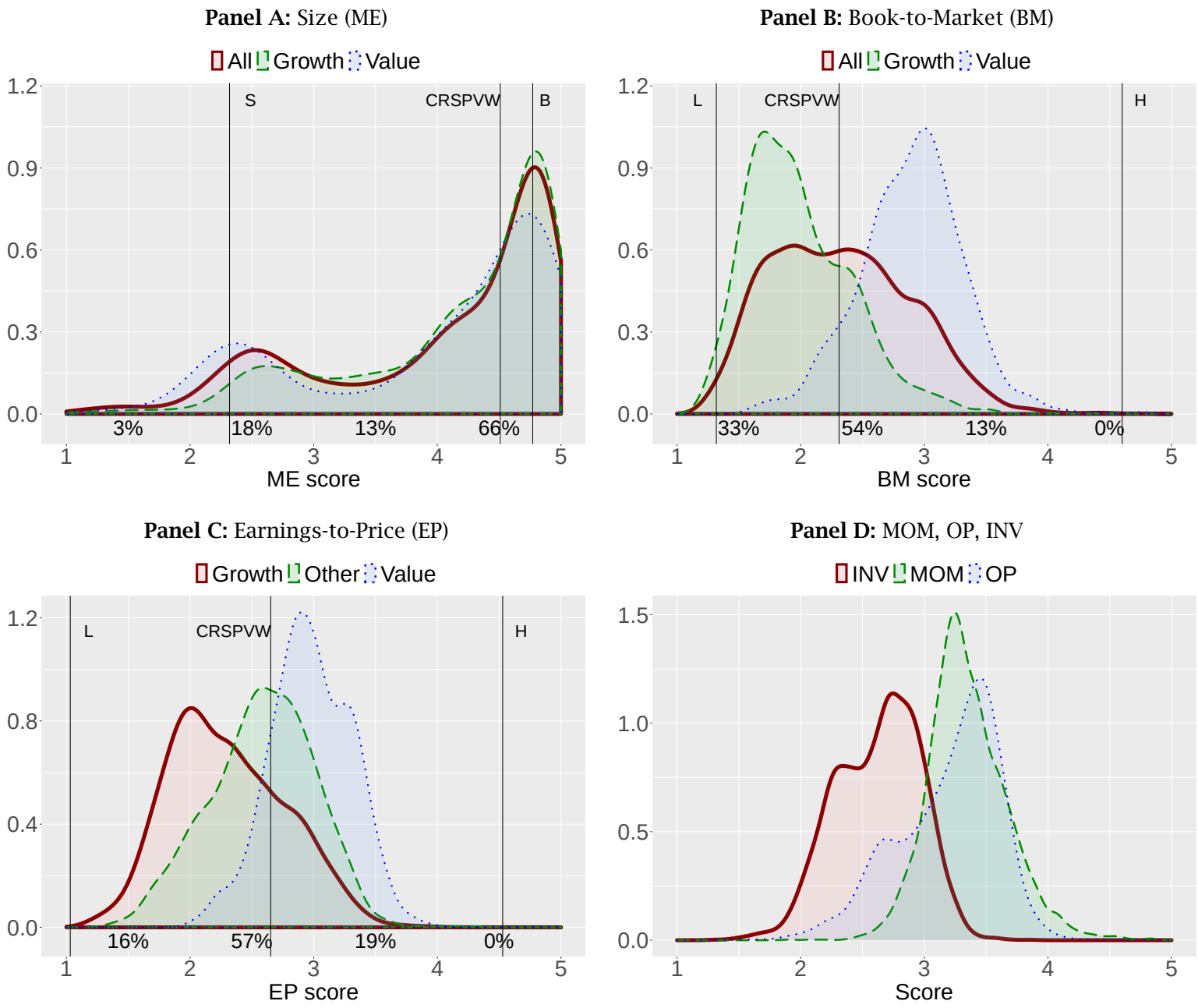



**Panel B:** Market-adjusted Characteristics



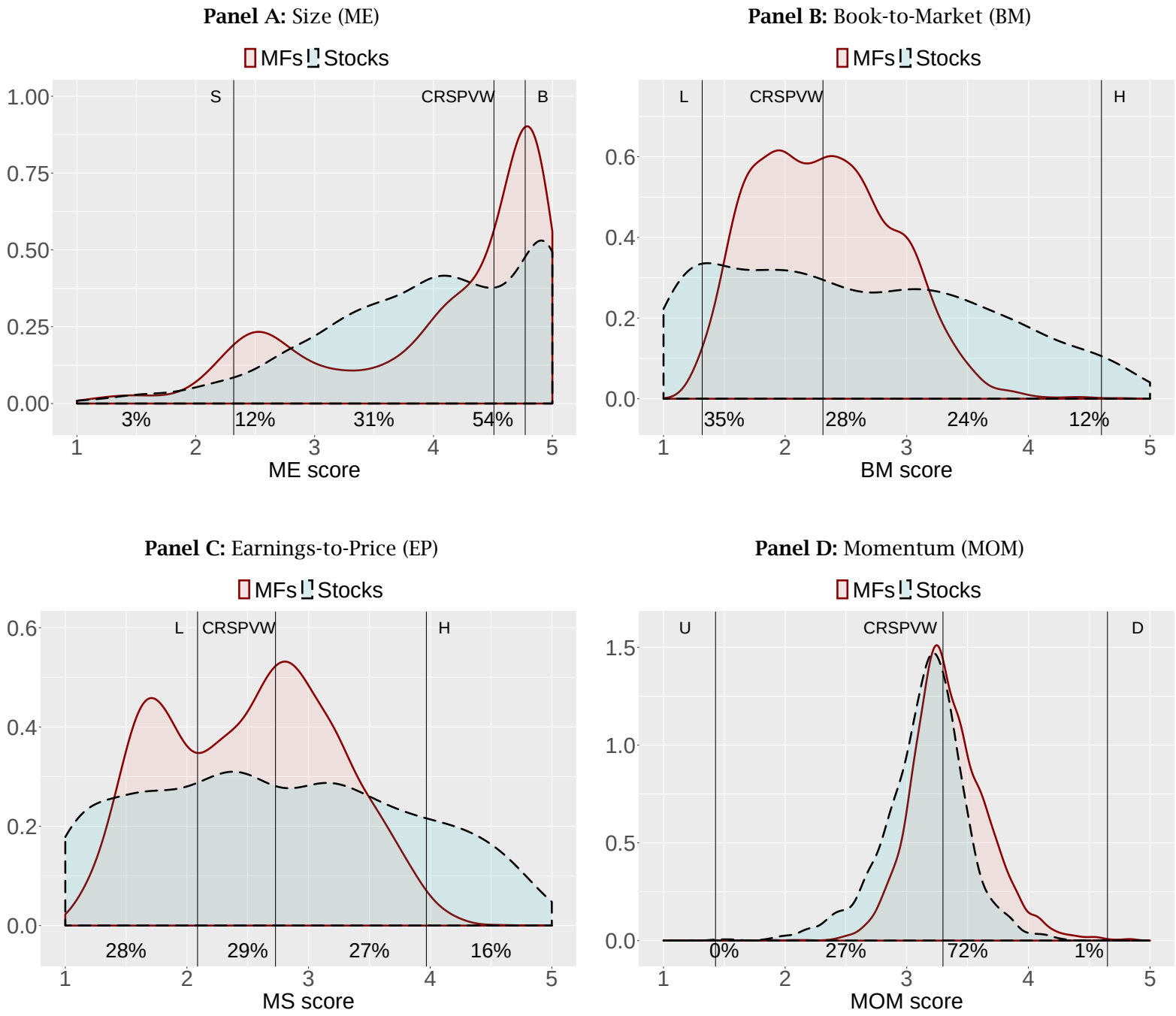

Note: This figure shows the time series of Market Equity (ME), Book-to-Market (BM), Morningstar Index (MS) and Momentum (MOM) characteristics of the "Growth Fund of America"(AGTHX) mutual fund. Panel A shows the characteristic scores. The market-adjusted characteristics are normalized to a unit standard deviation and are plotted in Panel B.

**Figure 3: Characteristics of Mutual Funds**



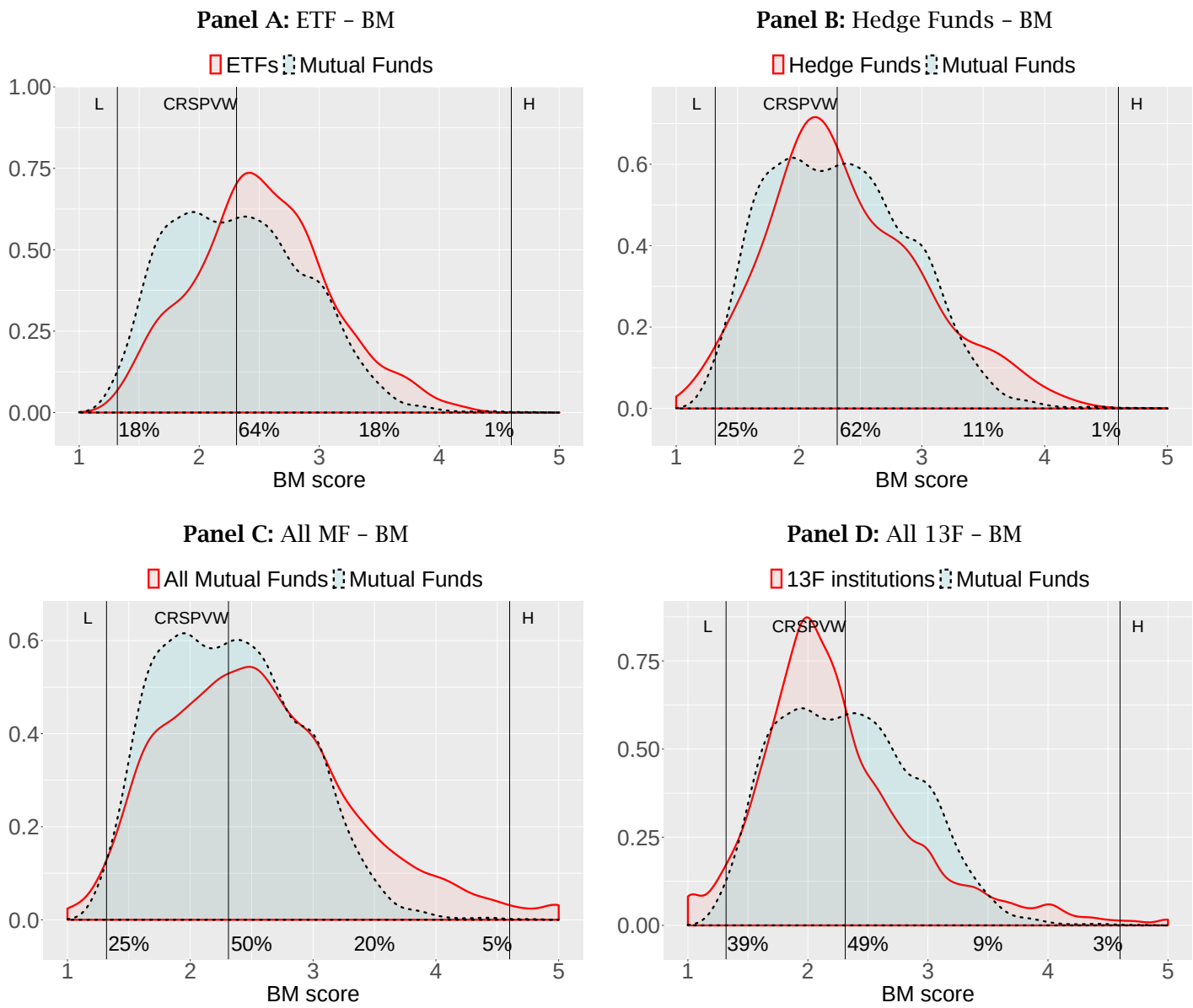

Note: This plot shows the density of the distribution of Size (ME), book-to-market (BM), earnings-to-price (EP), and Momentum (MOM) characteristics scores of the mutual funds in the sample. Scores are calculated first at the stock level and then aggregated at the mutual fund portfolio level. The scores of individual stocks are computed using Fama-French quintile breakpoints. An index of '1' indicates firms in the lowest characteristic quintile and firms with a score of '5' are in the highest characteristic quintile. In each quarter, the characteristic score is computed as the value-weighted average of scores of holdings of the fund. For each mutual fund in our sample, we compute the average characteristic score over the periods that the fund is in the sample. Plotted are the densities of the average characteristic scores over three categories of mutual funds: all funds (i.e. without any screens, solid red line), growth funds (dashed green line), and value funds (dotted blue line). Horizontal lines correspond to the average characteristic scores of seven value-weighted passive portfolios: 'S' (50% stocks with lowest ME), 'B' (50% stocks with highest ME), 'L' (30% stocks with lowest BM), 'H' (30% stocks with highest BM), 'D' (30% stocks with lowest MOM), 'U' (30% stocks with highest MOM), and 'CRSPVW' (all CRSP stocks). The percentages bellow the x-axis correspond to the proportion of sample mutual funds in each characteristic score bucket $[1, 2)$, $[2, 3)$, $[3, 4)$, or $[4, 5]$. The sample is from 1980Q1 to 2018Q4.

**Figure 4: Characteristics of Mutual Funds and Stocks**



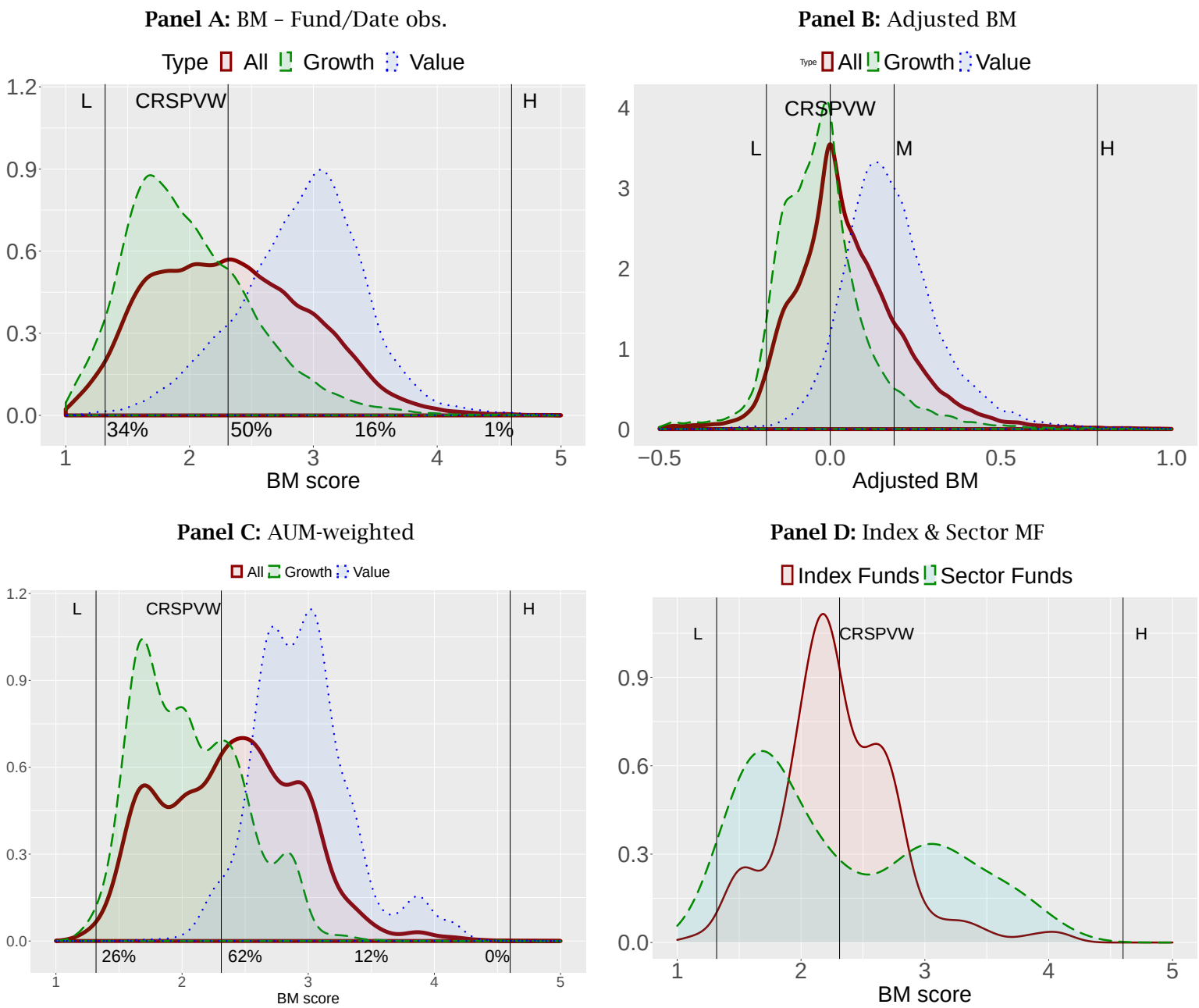

Note: This plot shows the density of the distribution of Size (ME), Book-to-Market (BM), earnings-to-price (EP), and Momentum (MOM) characteristics scores of S&P 500 stocks and mutual funds in the sample. Scores are calculated first at the stock level and then aggregated at the mutual fund portfolio level. The scores of individual stocks are computed using Fama-French quintile breakpoints. An index of '1' indicates firms in the lowest characteristic quintile and firms with a score of '5' are in the highest characteristic quintile. In each quarter, the characteristic score is computed as the value-weighted average of scores of holdings of the fund. For each mutual fund and each stock in our sample, we compute the average characteristic score over the periods that the fund or the stock is in the sample. Plotted are the densities of the average characteristic scores. Horizontal lines correspond to the average characteristic scores of seven value-weighted passive portfolios: 'S' (50% stocks with lowest ME), 'B' (50% stocks with highest ME), 'L' (30% stocks with lowest BM), 'H' (30% stocks with highest BM), 'D' (30% stocks with lowest MOM), 'U' (30% stocks with highest MOM), and 'CRSPVW' (all CRSP stocks). The percentages bellow the x-axis correspond to the proportion of stocks in each characteristic score bucket $[1,2)$, $[2,3)$, $[3,4)$, or $[4,5]$. The sample is from 1980Q1 to 2018Q4.

**Figure 5: Characteristics: Alternative Samples**



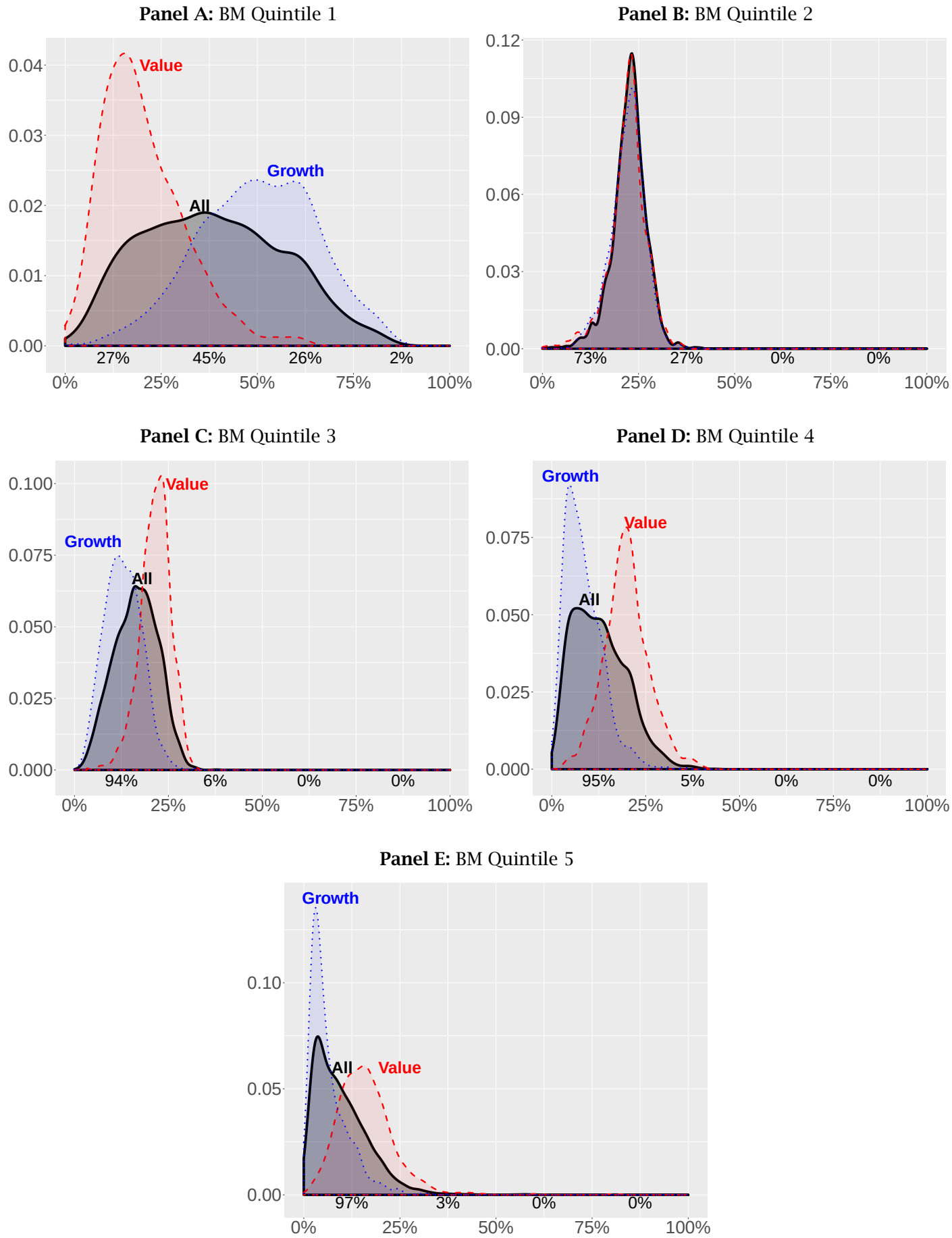

Note: This plot shows the density of the distribution of book-to-market (BM) of ETFs (Panel A), hedge funds (Panel B), all mutual funds (without applying any screens, Panel C), and all 13F institutions (Panel D). Scores are calculated first at the stock level and then aggregated at the portfolio level. The scores of individual stocks are computed using Fama-French quintile breakpoints. An index of '1' indicates firms in the lowest characteristic quintile and firms with a score of '5' are in the highest characteristic quintile. In each quarter, the characteristic score is computed as the value-weighted average of scores of holdings of the fund. For each fund in our sample, we compute the average characteristic score over the periods that the fund is in the sample. Plotted are the densities of the average characteristic scores over the relevant category (red solid line) and over the sample mutual funds (dotted blue line). Horizontal lines correspond to the average characteristic scores of three value-weighted passive portfolios: 'L' (30% stocks with lowest BM), 'H' (30% stocks with highest BM), The percentages bellow the x-axis correspond to the proportion of funds in each characteristic score bucket $[1, 2)$, $[2, 3)$, $[3, 4)$, or $[4, 5]$. The sample is from 1980Q1 to 2018Q4.

**Figure 6: Characteristics of Mutual Funds – Robustness**




Note: Panel A plots the densities of the quarterly BM scores of the sample mutual funds. Panel B plots the density of the average industry-adjusted-BM scores computed over the periods that the mutual fund is in the sample. The industry-adjusted-BM is the standard BM minus the sector average BM, computed within the Fama-French 48 sectors. Panel C plots the AUM-weighted densities of the average BM scores computed over the periods that the mutual fund is in the sample. The density estimation uses the total net assets of each mutual fund as weights. Panel D plots the value-weighted densities of the average BM scores computed over the periods that the mutual fund is in the sample for three categories: index funds (red solid line), mutual funds (green dashed line), and sector funds (blue dotted line). The sample is from 1980Q1 to 2018Q4.

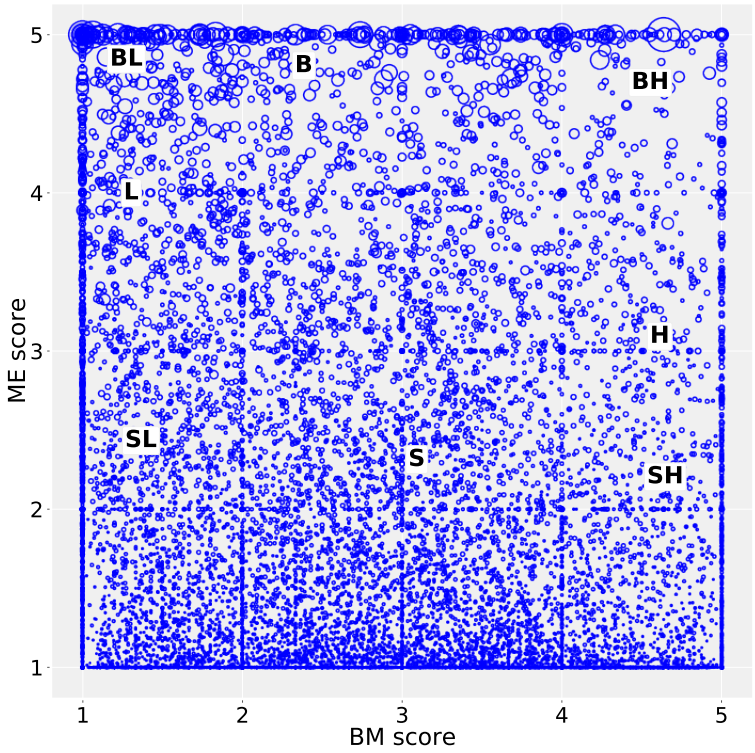
**Figure 7: Portfolio Shares of Mutual Funds by BM-Quintile**



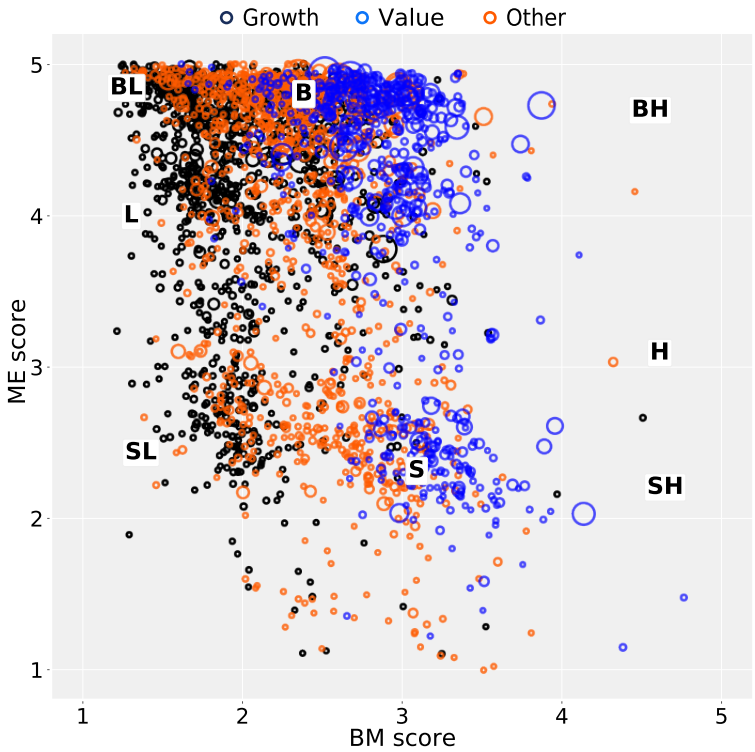

Note: For each quarter, we compute the total number of sample mutual funds and the total amount of assets managed by sample mutual funds with quarterly Book-to-Market (BM) score in each one of the following buckets: $[1, 2)$, $[2, 3)$, $[3, 4)$, and $[4, 5]$. Panel A reports the count of funds, while panel B reports the total net assets.

**Figure 8: Joint Characteristics Distributions – BM/ME**

**Panel A:** Stocks



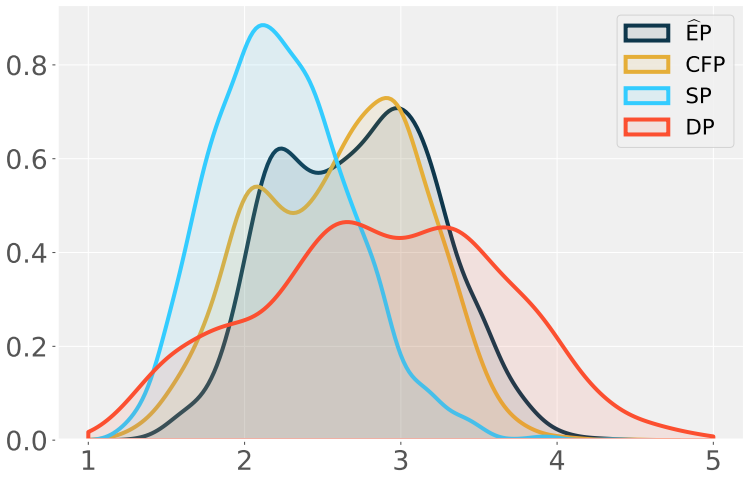

**Panel B:** Mutual Funds



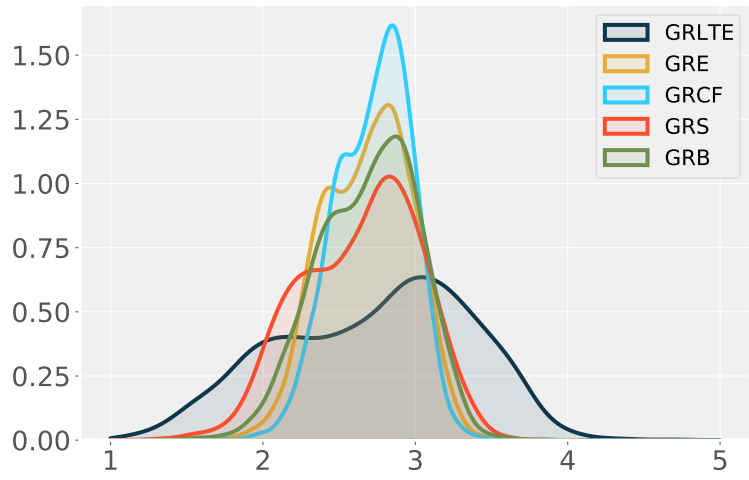

Note: This figure shows scatter plots of the joint distribution of book-to-market (BM) scores ($x$-axis) and size (ME) scores ($y$-axis) of all CRSP stocks (Panel A) and mutual funds (Panel B). The radius of the circles are proportional to the size (panel A) or to the total net assets (panel B). In Panel B, black circles reprtesents growth funds, blue circles represent value funds, and orange circles represent the other funds. The black letters represent the values for the following value-weighted passive portfolios: BL (big and low), B (big), BH (big and high), L (low), H (high), SL (small and low), S (small), and SH (small and high). Small stocks are defined as having size in the bottom 50%, while growth stocks are defined as having BM in the bottom 30%. Big and value stocks are defined similarly.

**Figure 9: Other Characteristics**

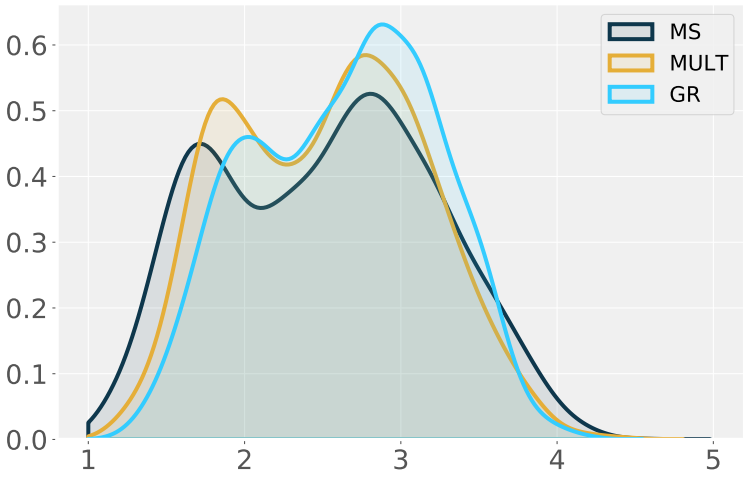
**Panel A:** Price Multiples



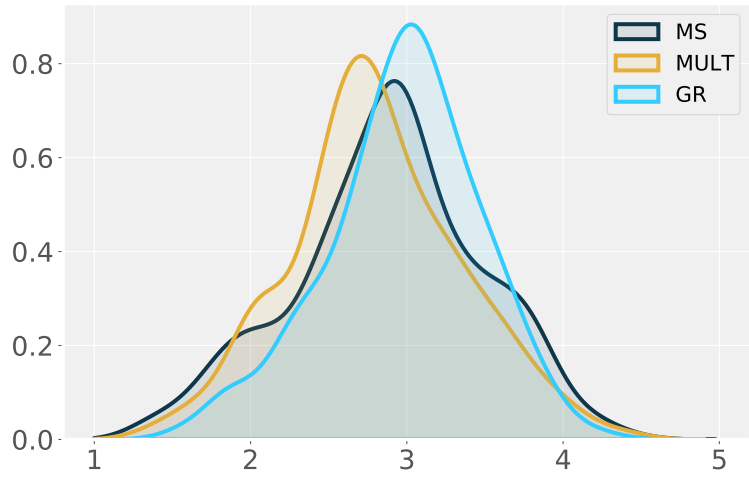

**Panel B:** Growth Rates




**Panel C:** Morningstar – Mutual Funds

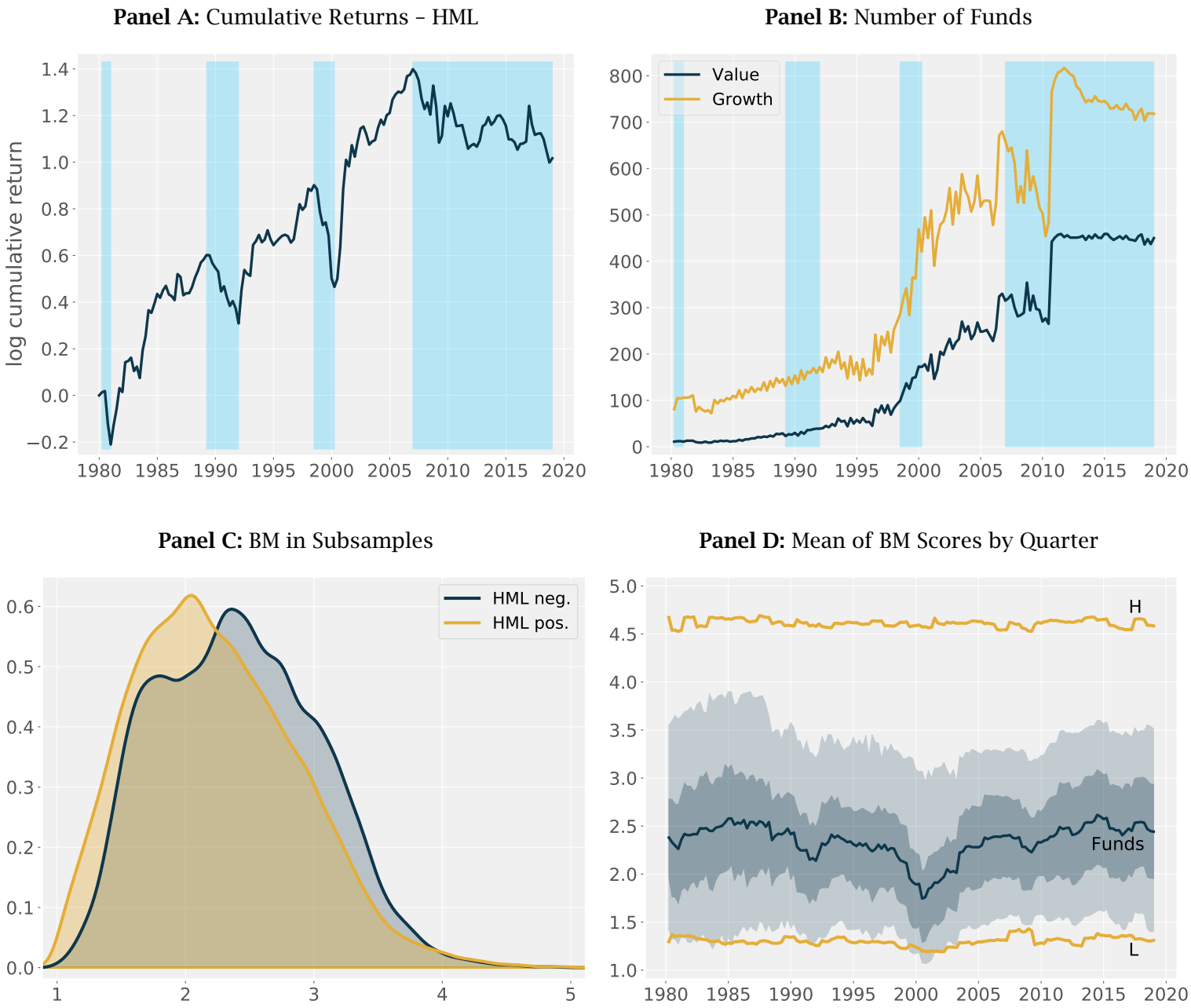



**Panel D:** Morningstar – ETFs



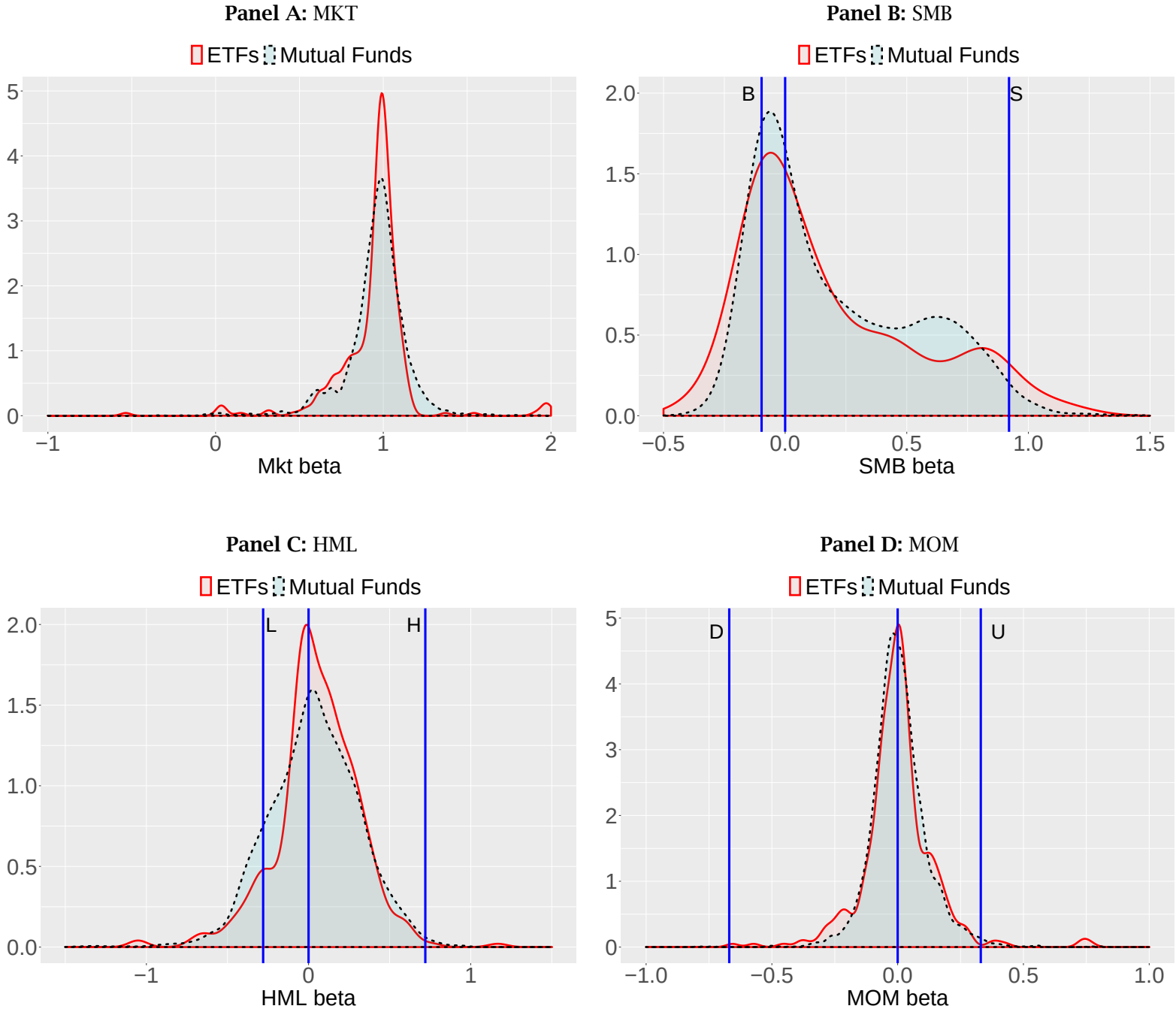

Note: Note: Panel A plots the densities of the average characteristic scores computed over the periods that the mutual fund is in the sample for four price ratios: expected earnings-to-price (ÊEP), cash flow-to-price (CFP), sales-to-price (SP), and dividends-to-price (DP). Panel B shows the distribution of expected long-term earnings growth (GRLTE), current earnings (GRE), cash flows (GRCF), sales (GRS), and the book value (GRB). Panels C and D show the distributions of the Morningstar index and its two component indices MULT and GR of mutual funds and ETFs, respectively. The sample is from 1980Q1 to 2018Q4.

**Figure 10: Subsamples**




Note: Panels A and B plots the log cumulative return of HML and the number of "value" and "growth" funds from 1980Q1 to 2018Q4, respectively. The areas shaded in blue represent extended periods of negative HML returns: 1980Q1-1980Q4, 1989Q1-1991Q4, 1998Q2-2000Q1, and 2006Q4-2018Q4. Panel C shows the BM histograms for the extended periods with negative HML returns (in black) and the other periods (in orange). Panel D plots the mean of the BM distribution of mutual fund (black line), the (25%, 75%) quantile range in dark grey, and the (5%, 95%) quantile range in light grey. The BM scores of the H and L portfolios are plotted in orange. The sample is from 1980Q1 to 2018Q4.

**Figure 11: Histograms - Loadings of Mutuals Funds and ETFs**




Note: This plot shows the histograms of betas of mutual funds and ETFs in 4-factor regressions of fund excess returns on the market excess returns, SMB, HML, and MOM. The vertical lines indicate betas of the components of SMB, HML, and MOM. The sample is from 1980Q1 to 2018Q4.

**Figure 12: Other Characteristics**

| | S&P500 Stocks | | | | Mutual Funds | | | | Growth Funds | | | | Value Funds | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | [1-2) | [2-3) | [3-4) | [4-5] | [1-2) | [2-3) | [3-4) | [4-5] | [1-2) | [2-3) | [3-4) | [4-5] | [1-2) | [2-3) | [3-4) | [4-5] |
| ME | 3% | 12% | 31% | 54% | 3% | 18% | 13% | 66% | 1% | 13% | 15% | 70% | 2% | 21% | 11% | 66% |
| BM | 35% | 28% | 25% | 12% | 33% | 54% | 13% | 0% | 59% | 39% | 2% | 0% | 2% | 57% | 40% | 1% |
| EP | 29% | 41% | 24% | 5% | 16% | 65% | 19% | 0% | 30% | 62% | 8% | 0% | 0% | 54% | 46% | 0% |
| MOM | 0% | 27% | 72% | 1% | 0% | 10% | 87% | 3% | 0% | 5% | 88% | 6% | 0% | 21% | 78% | 0% |
| MS | 28% | 29% | 27% | 16% | 29% | 44% | 26% | 1% | 53% | 38% | 9% | 0% | 1% | 28% | 69% | 3% |
| MULT | 34% | 29% | 22% | 15% | 25% | 50% | 25% | 0% | 47% | 46% | 7% | 0% | 0% | 31% | 67% | 1% |
| GR | 9% | 39% | 32% | 19% | 0% | 30% | 51% | 18% | 32% | 56% | 12% | 0% | 0% | 27% | 72% | 1% |
| SP | 26% | 35% | 26% | 13% | 15% | 60% | 25% | 0% | 28% | 63% | 9% | 0% | 0% | 38% | 61% | 0% |
| CFP | 37% | 27% | 21% | 15% | 31% | 65% | 5% | 0% | 53% | 45% | 2% | 0% | 2% | 88% | 10% | 0% |
| DP | 28% | 20% | 30% | 22% | 16% | 39% | 39% | 6% | 26% | 47% | 26% | 1% | 1% | 27% | 52% | 19% |
| BMIND | 28% | 36% | 27% | 9% | 14% | 74% | 12% | 0% | 27% | 71% | 3% | 0% | 0% | 68% | 31% | 0% |
| GRLTE | 16% | 33% | 30% | 22% | 1% | 38% | 46% | 15% | 27% | 57% | 16% | 0% | 0% | 16% | 82% | 2% |
| GRE | 1% | 40% | 54% | 5% | 0% | 15% | 85% | 1% | 2% | 94% | 4% | 0% | 0% | 59% | 41% | 0% |
| GRCF | 1% | 41% | 54% | 4% | 0% | 13% | 87% | 0% | 1% | 96% | 3% | 0% | 0% | 66% | 34% | 0% |
| GRS | 3% | 42% | 44% | 11% | 0% | 19% | 76% | 5% | 10% | 84% | 6% | 0% | 0% | 49% | 51% | 0% |
| GRB | 3% | 41% | 47% | 9% | 0% | 18% | 80% | 2% | 4% | 89% | 7% | 0% | 0% | 57% | 43% | 0% |
| OP | 15% | 28% | 35% | 22% | 1% | 28% | 71% | 1% | 1% | 23% | 75% | 1% | 0% | 33% | 67% | 0% |
| INV | 3% | 40% | 46% | 10% | 0% | 13% | 83% | 3% | 0% | 4% | 89% | 7% | 0% | 36% | 64% | 0% |
| QUAL | 16% | 27% | 34% | 23% | 0% | 14% | 85% | 1% | 0% | 4% | 94% | 2% | 0% | 38% | 62% | 0% |
| PSLIQ | 0% | 23% | 77% | 0% | 0% | 17% | 83% | 0% | 0% | 11% | 89% | 0% | 0% | 21% | 79% | 0% |
| TURN | 5% | 24% | 39% | 33% | 1% | 35% | 58% | 7% | 0% | 24% | 63% | 12% | 1% | 56% | 43% | 0% |
| DVOL | 2% | 10% | 31% | 57% | 2% | 14% | 16% | 68% | 1% | 7% | 18% | 74% | 2% | 21% | 12% | 65% |

Note: The figure shows heatmaps of the distribution of characteristics scores of S&P 500 stocks, mutual funds, growth funds, and value funds. For each fund or stock, we use the average of the quarterly scores in the periods when stocks or fund are in the sample. ME is market capitalization, BM is the book-to-market ratio, MS is the Morningstar index, EP is the earnings-to-price ratio, SP is the sales-to-price ratio, CFP is the cash flow-to-price ratio, DP is the dividend-to-price ratio, MOM is momentum, OP is profitability, INV is investment, QUAL is the MSCI quality index, PSLIQ is the Pastor-Stambaugh liquidity measure, TURN is the share turnover, and DVOL is trading volume. Each cell shows the percentage of stocks or funds with characteristic scores in the intervals [1-2), [2-3), [3-4), and [4-5]. The sample is from 1980Q1 to 2018Q4.

**Table 1: Descriptive Statistics of Mutual Funds and Hedge Funds**

| | MFs | Value | Growth | Other | ETFs | 13F HFs |
|---|---|---|---|---|---|---|
| Number of funds before screens | 8892 | 1429 | 2274 | 5189 | 1640 | NA |
| Number of funds in sample | 2993 | 636 | 1257 | 1100 | 575 | 79 |
| Number of funds 1980Q1 | 200 | 14 | 91 | 95 | 0 | 0 |
| Number of funds 2018Q4 | 1552 | 385 | 596 | 571 | 461 | 28 |
| Medium number of observations | 46 | 44 | 44 | 50 | 13 | 29 |
| Medium number of stocks | 74 | 76 | 68 | 80 | 208 | 32 |
| Total TNA 1980Q1 ($B) | 25 | 1 | 8 | 16 | 0 | 0 |
| Total TNA 2018Q4 ($B) | 3819 | 586 | 1660 | 1572 | 1295 | 31 |
| Median TNA ($M) | 222 | 261 | 216 | 206 | 51 | 191 |
| Mean TNA ($M) | 939 | 866 | 993 | 919 | 1329 | 990 |
| Median return over S&P 500 (% p.a.) | -0.70 | -0.90 | -0.38 | -1.01 | -1.18 | NA |
| Median CAPM beta | 0.99 | 0.95 | 1.04 | 0.95 | 1.00 | NA |
| Median 4-factor alpha (% p.a.) | -0.70 | -0.59 | -0.73 | -0.75 | -0.41 | NA |

Note: The table report descriptive statistics of mutual funds, ETFs and hedge funds. For each fund in our sample, we first compute averages across all observations of the fund that are in our sample. Unless otherwise stated, the statistics in the table are taken across fund averages. Since we do not have "total net asset value" (TNA) for hedge funds, we report the total market value of equities computed from 13F portfolio holdings.

**Table 2: Characteristics of Passive Benchmark Portfolios**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | **Panel A** | | | | | |
| | CRSP-VW | S&P 500 | CRSP-EW | S | B | H | L | U | D |
| ME | 4.51 | 4.90 | 1.90 | 2.31 | 4.80 | 3.09 | 4.00 | 3.68 | 3.08 |
| BM | 2.31 | 2.26 | 2.91 | 3.09 | 2.38 | 4.61 | 1.30 | 2.70 | 2.81 |
| EP | 2.65 | 2.70 | 2.34 | 2.72 | 2.78 | 3.24 | 2.20 | 2.72 | 2.62 |
| MOM | 3.30 | 3.29 | 2.85 | 3.11 | 3.27 | 3.15 | 3.23 | 4.65 | 1.40 |
| | | | | **Panel B** | | | | | |
| | SL | BL | SH | BH | SD | BD | **SU** | **BU** | |
| ME | 2.43 | 4.85 | 2.20 | 4.70 | 2.10 | 4.68 | 2.44 | 4.79 | |
| BM | 1.36 | 1.27 | 4.65 | 4.55 | 3.05 | 2.43 | 3.04 | 2.40 | |
| EP | 2.12 | 2.26 | 3.08 | 3.49 | 2.58 | 2.71 | 2.71 | 2.75 | |
| ME | 3.12 | 3.30 | 3.10 | 3.21 | 1.34 | 1.52 | 4.72 | 4.58 | |

Note: This table shows average characteristic scores of the CRSP-VW, CRSP-EW, and S&P500 indices and Fame-French portfolios. Characteristics used in this table are Size (ME), Book-to-Market (BM), Morningstar Index (MS) and Momentum (MOM). Scores are calculated first at the stock level and then aggregated at the portfolio level. The scores of individual stocks are computed using Fama-French quintile breakpoints. An index of '1' indicates firms in the lowest characteristic quintile and firms with a score of '5' are in the highest characteristic quintile. In each quarter, the characteristic score is computed as the value-weighted average of scores of holdings of the portfolio. 'CRSPEW' denotes the portfolio composed by all CRSP stocks with equal weights. The following value-weighted portfolios are used: 'CRSPVW' (all CRSP stocks), 'S&P500', 'S' (50% stocks with lowest ME), 'B' (50% stocks with highest ME), 'L' (30% stocks with lowest BM), 'H' (30% stocks with highest BM), 'D' (30% stocks with lowest MOM), 'U' (30% stocks with highest MOM). The concatenation of two letters (e.g. SL) denotes the value-weighted intersection of two portfolios.

## Table 3: Characteristics of Mutual Funds and Hedge Funds

| | Panel A: Mutual Funds (sample) | | | | | | Panel B: S&P 500 Stocks | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | mean | 10% | 25% | 50% | 75% | 90% | mean | 10% | 25% | 50% | 75% | 90% |
| ME score | 4.03 | 2.47 | 3.42 | 4.45 | 4.80 | 4.89 | 3.95 | 2.72 | 3.35 | 4.06 | 4.75 | 5.00 |
| BM score | 2.33 | 1.62 | 1.88 | 2.30 | 2.72 | 3.08 | 2.62 | 1.20 | 1.69 | 2.50 | 3.45 | 4.22 |
| EP score | 2.55 | 1.87 | 2.16 | 2.58 | 2.91 | 3.19 | 2.54 | 1.44 | 1.89 | 2.48 | 3.12 | 3.73 |
| MOM score | 3.35 | 3.00 | 3.15 | 3.31 | 3.54 | 3.76 | 3.16 | 2.69 | 2.95 | 3.18 | 3.36 | 3.56 |
| OP score | 3.20 | 2.61 | 2.93 | 3.29 | 3.50 | 3.64 | 3.09 | 1.63 | 2.32 | 3.12 | 3.87 | 4.52 |
| INV score | 3.38 | 2.96 | 3.12 | 3.34 | 3.64 | 3.83 | 3.11 | 2.28 | 2.66 | 3.09 | 3.59 | 4.02 |

| | Panel C: Value Funds | | | | | | Panel D: Growth Funds | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | mean | 10% | 25% | 50% | 75% | 90% | mean | 10% | 25% | 50% | 75% | 90% |
| ME score | 3.97 | 2.31 | 3.21 | 4.42 | 4.77 | 4.87 | 4.16 | 2.73 | 3.77 | 4.49 | 4.81 | 4.90 |
| BM score | 2.89 | 2.35 | 2.64 | 2.92 | 3.15 | 3.38 | 1.99 | 1.51 | 1.68 | 1.92 | 2.25 | 2.55 |
| EP score | 2.98 | 2.58 | 2.77 | 2.96 | 3.23 | 3.39 | 2.30 | 1.73 | 1.95 | 2.25 | 2.63 | 2.96 |
| MOM score | 3.13 | 2.88 | 3.02 | 3.14 | 3.24 | 3.35 | 3.48 | 3.09 | 3.27 | 3.46 | 3.67 | 3.89 |

| | Panel E: ETF | | | | | | Panel F: Hedge Funds | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | mean | 10% | 25% | 50% | 75% | 90% | mean | 10% | 25% | 50% | 75% | 90% |
| ME score | 4.04 | 2.24 | 3.51 | 4.52 | 4.80 | 4.92 | 3.68 | 2.43 | 3.22 | 3.81 | 4.34 | 4.68 |
| BM score | 2.52 | 1.76 | 2.15 | 2.50 | 2.88 | 3.27 | 2.38 | 1.63 | 2.00 | 2.24 | 2.80 | 3.22 |
| EP score | 2.79 | 2.26 | 2.52 | 2.80 | 3.07 | 3.36 | 2.31 | 1.63 | 2.04 | 2.37 | 2.57 | 2.96 |
| MOM score | 3.32 | 2.97 | 3.14 | 3.29 | 3.48 | 3.68 | 3.31 | 2.81 | 3.02 | 3.26 | 3.59 | 3.95 |

| | Panel G: All MFs | | | | | | Panel H: 13F Institutions | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | mean | 10% | 25% | 50% | 75% | 90% | mean | 10% | 25% | 50% | 75% | 90% |
| ME score | 4.00 | 2.50 | 3.52 | 4.32 | 4.74 | 4.90 | 4.13 | 2.67 | 3.78 | 4.51 | 4.81 | 4.92 |
| BM score | 2.55 | 1.64 | 1.99 | 2.48 | 3.00 | 3.58 | 2.30 | 1.59 | 1.89 | 2.19 | 2.60 | 3.17 |
| EP score | 2.64 | 1.78 | 2.19 | 2.66 | 3.04 | 3.45 | 2.57 | 1.72 | 2.22 | 2.61 | 2.98 | 3.29 |
| MOM score | 3.28 | 2.81 | 3.07 | 3.28 | 3.51 | 3.79 | 3.30 | 2.81 | 3.11 | 3.33 | 3.53 | 3.82 |

Note: The table reports means and 10th, 25th, 75th and 90th percentiles of the distributions of average characteristic scores for our sample of mutual funds, individual S&P 500 stocks, value and growth funds, ETFs, hedge funds, all funds (i.e. without any screens), and all 13F institutions. Scores are calculated first at the stock level and then aggregated at the mutual portfolio level. The scores of individual stocks are computed using Fama-French quintile breakpoints. An index of '1' indicates firms in the lowest characteristic quintile and firms with a score of '5' are in the highest characteristic quintile. In each quarter, the characteristic score is computed as the value-weighted average of scores of holdings of the fund. For each fund in our sample, we compute the average characteristic score over the periods that the fund is in the sample. The summary statistics in this table are calculated for these average characteristic score. Characteristics used in this table are size (ME), book-to-market (BM), earnings-to-price (EP), momentum (MOM), operating profitability (OP), and investment (INV).

**Table 4: Characteristics of highest/lowest BM Mutual Funds**

| | BM | EP | ME | TNA ($M) |
|---|---|---|---|---|
| **Panel A: Highest BM Funds** | | | | |
| High BM H portfolio | 4.60 | 3.49 | 3.45 | NA |
| Aegis Value | 4.76 | 2.59 | 1.49 | 195 |
| Mellon Capital SP SMid 60 | 4.51 | 3.30 | 2.67 | 449 |
| Vanguard High Yield | 4.45 | 4.33 | 4.16 | 87 |
| Franklin MicroCap Value | 4.38 | 3.21 | 1.15 | 337 |
| Franklin Balance Sheet | 4.32 | 3.43 | 3.04 | 1930 |
| DFA US Small Cap Value Portfolio | 4.13 | 3.10 | 2.03 | 7701 |
| Dow Target Dividend Portfolio | 4.10 | 3.57 | 3.74 | 29 |
| LVIP SSgA Small-Mid Cap 200 | 3.97 | 3.82 | 2.16 | 220 |
| DFA US Targeted Value Portfolio | 3.95 | 3.12 | 2.61 | 3775 |
| Schneider Small Cap Value | 3.94 | 2.39 | 2.03 | 62 |
| **Panel B: Lowest BM Funds** | | | | |
| Low BM L portfolio | 1.32 | 2.60 | 3.64 | NA |
| Jensen Quality Growth | 1.21 | 2.89 | 4.85 | 2853 |
| IAI Emerging Growth | 1.21 | 1.73 | 3.24 | 253 |
| JNL/S&P Competitive Advantage | 1.22 | 3.45 | 4.68 | 1466 |
| Victory Portfolios: Growth | 1.24 | 2.26 | 4.99 | 355 |
| Touchstone Sands Capital Select Growth | 1.25 | 2.13 | 4.89 | 1867 |
| SouthTrusts: Growth | 1.25 | 2.26 | 5.00 | 80 |
| Excelsior Optimum Growth | 1.26 | 2.17 | 4.93 | 56 |
| Harris Bretall Sullivan Smith Growth Equity | 1.27 | 2.07 | 4.97 | 15 |
| Provident Investment Counsel Balanced | 1.27 | 1.95 | 4.94 | 26 |
| Pioneer Papp Strategic Growth | 1.27 | 2.48 | 4.73 | 126 |

Note: This table reports the average characteristics scores of the the 10 mutual funds with the highest BM scores as well as the scores of the 10 funds with the lowest BM scores. Total net assets are in $ mil. Reported characteristics are book-to-market (BM), earnings-to-price (EP), and size (ME).

**Table 5: Portfolio Composition by BM Quintiles**

| | BM | BM1 | BM2 | BM3 | BM4 | BM5 |
|---|---|---|---|---|---|---|
| **Panel A: Mutual Funds** | | | | | | |
| All | 2.33 | 38.53% | 22.58% | 16.41% | 12.73% | 9.75% |
| Value | 2.89 | 20.32% | 22.12% | 21.53% | 19.90% | 16.13% |
| Growth | 1.99 | 50.10% | 22.18% | 12.93% | 8.41% | 6.39% |
| ETFs | 2.52 | 32.48% | 23.14% | 15.56% | 14.65% | 14.17% |
| HFs | 2.38 | 37.63% | 21.09% | 16.20% | 13.28% | 11.81% |
| **Panel B: 5 Largest Value Funds** | | | | | | |
| Vanguard Equity Income | 2.70 | 25.02% | 22.12% | 22.75% | 18.22% | 11.90% |
| DFA US Large Cap Value | 3.87 | 1.34% | 5.85% | 26.53% | 37.11% | 29.17% |
| T. Rowe Price Value | 2.83 | 23.69% | 22.68% | 19.06% | 16.55% | 18.02% |
| T. Rowe Price Equity Income | 2.74 | 26.80% | 21.39% | 19.14% | 16.34% | 16.33% |
| JPMorgan Equity Income | 2.36 | 36.23% | 22.62% | 18.06% | 15.44% | 7.64% |
| **Panel C: 5 Largest Growth Funds** | | | | | | |
| Growth Fund of America | 2.03 | 49.71% | 21.50% | 12.37% | 9.30% | 7.12% |
| Fidelity Contrafund | 2.26 | 44.07% | 18.58% | 14.78% | 12.53% | 10.03% |
| Vanguard PRIMECAP | 2.16 | 41.17% | 27.56% | 13.46% | 9.74% | 8.07% |
| AMCAP Fund | 1.80 | 53.46% | 25.53% | 11.16% | 6.89% | 2.97% |
| T. Rowe Price Blue Chip Growth | 1.60 | 63.40% | 21.80% | 8.40% | 4.07% | 2.33% |

Note: For each portfolio and each quarter, we compute the share of the stocks' market value in each one of the five Book-to-Market (BM) quintile buckets. Then, for each fund, we compute the average shares across different quarters in the sample. The table reports the cross-sectional averages of the fund-level averages in columns 2 to 6. The first column reports the average Book-to-Market (BM) score. Panel A reports results by groups of funds, Panel B reports results of the 5 largest value funds, and Panel C reports results of the 5 largest growth funds.

**Table 6: S&P 500 Stock Ownership by Mutual Funds**

| | Sample MFs | All MFs | Value MFs | Growth MFs |
|---|---|---|---|---|
| **Panel A: Across all Stocks** | | | | |
| Mean | 8.61% | 13.22% | 1.35% | 3.89% |
| Std. Dev. | 5.34% | 8.56% | 1.37% | 3.46% |
| 10% quantile | 2.57% | 3.43% | 0.09% | 0.62% |
| 90% quantile | 16.03% | 25.49% | 3.08% | 8.73% |
| **Panel B: Median by Stock-BM scores** | | | | |
| 1-2 | 9.24% | 13.93% | 0.72% | 4.65% |
| 2-3 | 7.89% | 12.95% | 1.25% | 3.02% |
| 3-4 | 6.37% | 9.97% | 1.26% | 1.77% |
| 4-5 | 5.35% | 8.09% | 0.89% | 1.22% |
| **Panel C: Regression on Characteristic Scores** | | | | |
| const. | 3.85** | 2.97 | 0.99** | 1.99 |
| | (1.60) | (2.59) | (0.42) | (0.97) |
| ME | −0.20 | −0.07 | 0.05 | −0.38*** |
| | (0.17) | (0.28) | (0.05) | (0.10) |
| BM | −1.04*** | −1.38*** | 0.19*** | −1.20*** |
| | (0.14) | (0.23) | (0.04) | (0.09) |
| MOM | 2.61*** | 4.47*** | −0.10 | 2.07*** |
| | (0.46) | (0.74) | (0.12) | (0.28) |
| $R^2$ | 0.09 | 0.08 | 0.02 | 0.21 |

Note: This table shows results of ownership shares of mutual funds of individual stocks. For each stock and quarter we compute the percentage of the total market cap that is held by different types of mutual funds. We consider all funds in our sample (without any screens), the funds in the benchmark sample, value funds, and growth funds. The table reports data for our sample of S&P 500 stocks averaged across the quarters that the stock is in our sample. Panel A reports descriptive statistics, Panel B and C show the fund ownership by BM and MS quintile, respectively. Panel D shows the results of regressions of ownership percentages on characteristic scores across 1,390 S&P 500 stocks. $t$-statistics are reported in parentheses.

**Table 7: Liquidity by ME/BM Quintiles**

| | BM 1-2 | BM 2-3 | BM 3-4 | BM 4-5 |
|---|---|---|---|---|
| **Panel A: PSLIQ – Stocks** | | | | |
| ME 1-2 | 3.03 | 3.00 | 3.00 | 2.96 |
| ME 2-3 | 3.00 | 3.02 | 3.00 | 2.96 |
| ME 3-4 | 3.04 | 3.00 | 3.02 | 3.01 |
| ME 4-5 | 3.09 | 3.12 | 3.11 | 3.11 |
| **Panel B: PSLIQ – Mutual Funds** | | | | |
| ME 1-2 | 2.98 | 2.92 | 2.91 | 2.91$^{\dagger}$ |
| ME 2-3 | 3.00 | 2.99 | 2.97 | 2.96$^{\dagger}$ |
| ME 3-4 | 3.05 | 3.05 | 3.05 | 3.08$^{\dagger}$ |
| ME 4-5 | 3.15 | 3.15 | 3.14 | 3.05$^{\dagger}$ |
| **Panel C: Bid-Ask Spread – Stocks** | | | | |
| ME 1-2 | 4.43 | 4.38 | 4.44 | 4.54 |
| ME 2-3 | 3.28 | 3.36 | 3.45 | 3.54 |
| ME 3-4 | 2.70 | 2.89 | 3.01 | 2.91 |
| ME 4-5 | 2.17 | 2.28 | 2.19 | 2.38 |
| **Panel D: Bid-Ask Spread – Mutual Funds** | | | | |
| ME 1-2 | 3.94 | 3.68 | 4.08 | 4.42$^{\dagger}$ |
| ME 2-3 | 2.86 | 3.00 | 3.24 | 3.47$^{\dagger}$ |
| ME 3-4 | 2.78 | 2.75 | 2.91 | 2.86$^{\dagger}$ |
| ME 4-5 | 2.03 | 2.23 | 2.33 | 5.00$^{\dagger}$ |

Note: This table shows scores of three liquidity measures of stocks and mutual funds by book-to-market (BM) and size (ME) score buckets. The following liquidity measures are used: Bid-Ask Spread and PSLIQ, which is the regression-based Pastor-Stambaugh liquidity measure. Scores are calculated first at the stock level and then aggregated at the mutual fund portfolio level. The scores of individual stocks are computed using quintile breakpoints. An index of '1' indicates firms in the lowest characteristic quintile and firms with a score of '5' are in the highest characteristic quintile. In each quarter, the characteristic score is computed as the value-weighted average of scores of holdings of the fund. For each stock and each fund in our sample, we compute the average characteristic score over the periods that the fund is in the sample. For this table, we form buckets of stocks and funds with average ME score and average BM score in each interval. Then we compute the average liquidity score across funds/stocks.

## Table 8: Value and Growth Indices

**Panel A: Characteristics**

| Index | TNA ($M) | BM | MS | EP | SP |
|---|---|---|---|---|---|
| Russell 1000 Value | 51155 | 3.26 | 3.72 | 3.28 | 2.36 |
| S&P 500 Value | 20871 | 3.04 | 3.74 | 3.30 | 2.54 |
| CRSP Large Cap Value | 16770 | 2.89 | 3.72 | 3.20 | 2.49 |
| Russell 2000 Value | 15432 | 3.75 | 3.12 | 2.64 | 2.64 |
| S&P MidCap 400 Value | 2864 | 3.32 | 3.15 | 2.79 | 2.87 |
| Russell 1000 Growth | 54697 | 1.44 | 2.17 | 2.52 | 1.81 |
| S&P 500 Growth | 29194 | 1.69 | 2.36 | 2.68 | 1.65 |
| CRSP Large Cap Growth | 21917 | 1.46 | 1.90 | 2.19 | 1.66 |
| Russell 2000 Growth | 13808 | 1.81 | 1.79 | 1.91 | 2.18 |
| S&P MidCap 400 Growth | 3209 | 2.02 | 1.91 | 2.26 | 2.02 |

**Panel B: BM Quintiles**

| Index | BM1 | BM2 | BM3 | BM4 | BM5 |
|---|---|---|---|---|---|
| Russell 1000 Value | 6.17% | 23.05% | 28.45% | 23.96% | 18.38% |
| S&P 500 Value | 16.22% | 20.71% | 23.59% | 21.77% | 17.70% |
| CRSP Large Cap Value | 14.91% | 26.92% | 25.46% | 19.29% | 13.41% |
| Russell 2000 Value | 2.01% | 8.40% | 26.40% | 38.50% | 24.69% |
| S&P MidCap 400 Value | 10.28% | 20.80% | 19.07% | 26.76% | 23.10% |
| Russell 1000 Growth | 67.75% | 23.62% | 6.50% | 1.49% | 0.64% |
| S&P 500 Growth | 56.66% | 25.70% | 12.07% | 3.85% | 1.72% |
| CRSP Large Cap Growth | 69.65% | 19.67% | 7.18% | 2.50% | 1.00% |
| Russell 2000 Growth | 46.00% | 32.97% | 15.87% | 4.03% | 1.13% |
| S&P MidCap 400 Growth | 45.34% | 27.02% | 12.20% | 11.64% | 3.80% |

**Panel C: Characteristics used in Value and Growth Indices**

| Index Provider | Multiples | Growth |
|---|---|---|
| Russell | BM | GRE, GRS |
| S&P | BM, EP, SP | $\Delta$EP, GRS, MOM |
| CRSP | BM, $\widehat{\text{E}}$P, EP, DP, SP | GRLTE, GRE, GRS, INV, ROA |
| Morningstar | BM, $\widehat{\text{E}}$P, CFP, DP, SP | GRLTE, GRE, GRS, GRCF, GRB |

Note: Panels A and B report average characteristics for five “value” and “growth” indices and portfolio shares in BM quintiles, respectively. Panel C lists the individual characteristics that are used in the construction of Russell, S&P, CRSP, and Morningstar “value” and “growth” indices.

## Table 9: Loadings in 4-Factor Regressions

**Panel A: Betas of SMB, HML, MOM Components**

| | S | B | H | L | W | L |
|---|---|---|---|---|---|---|
| $\alpha$ | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| MKT | 1.02 | 1.02 | 1.04 | 1.04 | 1.05 | 1.05 |
| SMB | **0.90** | **-0.10** | 0.41 | 0.41 | 0.50 | 0.50 |
| HML | 0.26 | 0.26 | **0.72** | **-0.28** | 0.05 | 0.05 |
| MOM | 0.00 | 0.00 | -0.01 | -0.01 | **0.35** | **-0.65** |

**Panel B: SMB Betas, 25 ME/BM Portfolios**

| | BM1 | BM2 | BM3 | BM4 | BM5 |
|---|---|---|---|---|---|
| ME1 | 1.19 | 1.33 | 1.04 | 1.01 | 0.91 |
| ME2 | 0.93 | 0.91 | 0.70 | 0.74 | 0.91 |
| ME3 | 0.71 | 0.50 | 0.35 | 0.43 | 0.44 |
| ME4 | 0.38 | 0.16 | 0.14 | 0.15 | 0.24 |
| ME5 | -0.31 | -0.20 | -0.21 | -0.22 | -0.36 |

**Panel C: HML Betas, 25 ME/BM Portfolios**

| | BM1 | BM2 | BM3 | BM4 | BM5 |
|---|---|---|---|---|---|
| ME1 | -0.47 | 0.01 | 0.27 | 0.40 | 0.61 |
| ME2 | -0.37 | 0.13 | 0.56 | 0.61 | 0.76 |
| ME3 | -0.48 | 0.29 | 0.55 | 0.70 | 0.84 |
| ME4 | -0.44 | 0.21 | 0.54 | 0.62 | 0.79 |
| ME5 | -0.41 | 0.18 | 0.37 | 0.71 | 0.71 |

Note: The table reports coefficients of the regression

$$X_t = \alpha_{\mathrm{X}} + \beta_{\mathrm{X,MKT}}\,\mathrm{MKT}_t + \beta_{\mathrm{X,SMB}}\,\mathrm{SMB}_t + \beta_{\mathrm{X,HML}}\,\mathrm{HML}_t + \beta_{\mathrm{X,MOM}}\,\mathrm{MOM}_t + e_{\mathrm{X},t},$$

where $X$ denotes one of the following value-weighted portfolios: 'S' (50% stocks with lowest ME), 'B' (50% stocks with highest ME), 'L' (30% stocks with lowest BM), 'H' (30% stocks with highest BM), 'D' (30% stocks with lowest MOM), 'U' (30% stocks with highest MOM). The sample is from 1980Q1 to 2018Q4.

**Table 10: Returns of Stocks and Mutual Funds**

| Quintile | ME | BM | EP | MOM |
|---|---|---|---|---|
| **Panel A: Stocks** | | | | |
| 1 | 3.19% | 3.09% | 2.70% | 2.11% |
| 2 | 3.37% | 3.17% | 3.17% | 2.82% |
| 3 | 3.38% | 3.13% | 3.03% | 2.92% |
| 4 | 3.42% | 3.23% | 3.50% | 3.17% |
| 5 | 2.98% | 3.49% | 3.74% | 3.74% |
| 5-1 | −0.21% | 0.41% | 1.03% | 1.62% |
| **Panel B: Mutual Funds** | | | | |
| [1,2] | 2.52% | 1.98% | 1.79% | −1.29%$^{\dagger}$ |
| (2,3] | 2.56% | 2.47% | 2.49% | 2.05% |
| (3,4] | 2.70% | 2.49% | 2.29% | 2.50% |
| (4,5] | 2.16% | 3.02%$^{\dagger}$ | 2.76%$^{\dagger}$ | 1.99% |
| (4,5]-[1,2] | −0.36% | 1.04% | 0.97% | 3.28% |
| **Panel C: ETFs** | | | | |
| [1,2] | 1.72% | 3.18% | 2.50% | 0.87% |
| (2,3] | 3.02% | 2.67% | 2.80% | 3.17% |
| (3,4] | 2.41% | 2.41% | 2.56% | 2.61% |
| (4,5] | 2.77% | 2.28% | 2.35% | 2.02% |
| (4,5]-[1,2] | 1.05% | −0.90% | −0.16% | 1.15% |

Note: The table reports the mean returns by quintile (stocks) and quintile ranges (mutual funds). For stocks, we form value-weighted portfolios based on the characteristic score of the previous quarter. Panel A reports the average returns of each one of these portfolios. In Panels B and C we select the mutual funds and ETFs with lagged characteristic score in each of the intervals in the first columns. After that we compute the value-weighted average return for each group of funds across funds and across quarters, using each fund lagged total net assets as weights. The following stock characteristics are used in this table: Size (ME), book-to-market (BM), earnings-to-price (EP), and momentum (MOM).

## Table 11: Returns of Stocks and Mutual Funds

| Quintile | MS | MULT | GR | $\hat{E}P$ | CFP | SP | DP | GRLTE | GRB | GRE | GRCF | GRS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | **Panel A: Stocks** | | | | | | |
| 1 | 3.20% | 3.61% | 3.42% | 4.24% | 2.90% | 2.77% | 3.26% | 3.23% | 3.55% | 2.73% | 3.03% | 3.23% |
| 2 | 3.18% | 2.78% | 3.19% | 2.81% | 3.14% | 3.25% | 2.22% | 3.07% | 3.45% | 3.56% | 3.50% | 3.32% |
| 3 | 3.05% | 3.14% | 3.29% | 2.76% | 3.21% | 3.35% | 3.12% | 3.23% | 3.12% | 3.48% | 3.27% | 3.50% |
| 4 | 3.15% | 2.63% | 3.08% | 2.45% | 3.27% | 3.47% | 3.24% | 3.08% | 3.33% | 3.09% | 3.14% | 3.06% |
| 5 | 3.22% | 3.07% | 2.95% | 2.50% | 3.52% | 3.75% | 3.21% | 3.14% | 2.64% | 2.57% | 2.87% | 2.74% |
| 5-1 | 0.02% | −0.54% | −0.47% | −1.74% | 0.63% | 0.98% | −0.04% | −0.09% | −0.92% | −0.15% | −0.16% | −0.50% |
| | | | | | | **Panel B: Mutual Funds** | | | | | | |
| [1,2] | 2.17% | 2.10% | 2.37% | 2.19% | 1.35% | 1.94% | 2.37% | 2.49% | 2.76% | 2.78% | 3.06% | 1.82% |
| (2,3] | 2.44% | 2.45% | 2.31% | 2.41% | 2.47% | 2.45% | 2.36% | 2.31% | 2.06% | 2.47% | 2.46% | 2.46% |
| (3,4] | 2.29% | 2.29% | 2.41% | 2.22% | 2.57% | 2.82% | 2.24% | 2.31% | 2.52% | 2.32% | 2.34% | 2.34% |
| (4,5] | 2.27% | 2.17% | 2.10% | 1.97% | 3.55% | 3.08% | 2.33% | 2.20% | 0.88% | 1.47% | 0.63% | 1.84% |
| (4,5]-[1,2] | 0.10% | 0.07% | −0.27% | −0.22% | 2.20% | 1.14% | −0.04% | −0.29% | −1.88% | −1.31% | −2.43% | 0.01% |
| | | | | | | **Panel C: ETFs** | | | | | | |
| [1,2] | 2.96% | 3.05% | 2.81% | 0.68% | 1.55% | 3.33% | 2.34% | 2.98% | 1.42% | 6.28% | 5.64% | 5.33% |
| (2,3] | 2.87% | 2.88% | 2.67% | 2.92% | 2.83% | 2.59% | 2.80% | 2.48% | 2.03% | 2.45% | 2.24% | 2.25% |
| (3,4] | 2.49% | 2.46% | 2.71% | 2.56% | 2.61% | 2.25% | 2.72% | 3.03% | 3.14% | 2.81% | 2.88% | 2.94% |
| (4,5] | 2.40% | 1.15% | 3.01% | 1.80% | 1.84% | 1.31% | 2.55% | 2.57% | 0.44% | 1.48% | 0.18% | 3.05% |
| (4,5]-[1,2] | −0.57% | −1.90% | 0.20% | 1.12% | 0.30% | −2.02% | 0.21% | −0.41% | −0.98% | −4.81% | −5.46% | −2.28% |

Note: The table reports the mean returns by quintile (stocks) and quintile ranges (mutual funds). For stocks, we form value-weighted portfolios based on the characteristic score of the previous quarter. Panel A reports the average returns of each one of these portfolios. In panel B we select the mutual funds with lagged characteristic score in each of the intervals in the first columns. After that we compute the value-weighted average return for each group of funds across funds and across quarters, using each fund lagged total net assets as weights. The following stock characteristics are used in this table: Morningstar (MS), the multiples (MULT) and growth (GR) indices, expected earnings-to-price ratio ($\hat{E}P$), cashflow-to-price ratio (CFP), dividend-to-price ratio (DP), sales-to-price ratio (SP), expected long-term growth of earnings (GRLTE), historical growth of the book value (GRB), historical growth of the sales (GRS), and historical growth of the cashflow (GRCF).

**Table 12: Fama-MacBeth Regressions**

| ME | BM | EP | MOM | MS |
|---|---|---|---|---|
| | | **Panel A: Stocks** | | |
| −0.15 | 0.52*** | | 0.40** | |
| (0.17) | (0.13) | | (0.17) | |
| −0.28* | | 0.23 | 0.42** | |
| (0.16) | | (0.14) | (0.17) | |
| −0.28 | | | 0.43** | 0.26 |
| (0.16) | | | (0.17) | (0.17) |
| −0.14 | 0.54*** | 0.09 | 0.40** | −0.15 |
| (0.15) | 0.08 | (0.10) | (0.16) | (0.12) |
| | | **B: Mutual Funds** | | |
| −0.30** | 0.09 | | 0.45* | |
| (0.14) | (0.17) | | (0.25) | |
| −0.30** | | 0.00 | 0.43* | |
| (0.13) | | (0.21) | (0.22) | |
| −0.28** | | | 0.43** | 0.22 |
| (0.12) | | | (0.21) | (0.17) |
| −0.24** | 0.21 | 0.04 | 0.42** | −0.17 |
| (0.12) | (0.16) | (0.18) | (0.21) | (0.17) |
| | | **C: ETFs** | | |
| −0.06 | −0.73** | | −0.74 | |
| (0.25) | (0.37) | | (0.51) | |
| 0.22 | | −0.61 | −0.55 | |
| (0.25) | | (0.44) | (0.40) | |
| 0.19 | | | −0.73 | −0.56 |
| (0.26) | | | (0.49) | (0.36) |
| 0.10 | −0.20 | 0.13 | −0.48 | −0.48 |
| (0.21) | (0.41) | (0.69) | (0.49) | (0.73) |

Note: Fama-MacBeth regressions of returns of individual stocks and mutual funds on characteristic scores. In each model (represented by a line in this table), we run the Fama-MacBeth regressions in the following way. For each quarter, we regress the funds quarterly returns on the relevant characteristics score. We report in this table the time-series averages of the resulting coefficients. coefficients are in percent per quarter. t-statistics are in brackets.

## Appendix D. Tables

**Table D.1: Mutual Funds Remaining After Each Screen**

| Screen | Number of Funds |
|---|---|
| Mutual Funds | |
| All mutual funds with holdings available | 8893 |
| After excluding passive funds | 7626 |
| After excluding sector funds | 6945 |
| After excluding funds holding less than 10 stocks | 5495 |
| After excluding funds with less than 5M in assets | 5116 |
| After excluding funds with less than half of assets in stocks | 4229 |
| After excluding funds with less than 4 years of data | 3073 |
| After excluding funds not classified as equity fund | 2992 |
| ETFs | |
| All ETFs with holdings available | 1640 |
| After excluding sector funds | 948 |
| After excluding funds with less than half of assets in stocks | 621 |
| After excluding funds not classified as equity fund | 575 |

Note: This table reports the number of mutual funds remaining after each sample screen is applied. The first line of the table is the universe of mutual funds with returns and holdings data available, while the last line is the number of funds in our sample.

**Table D.2: Distribution of Mutual Fund and Stock Characteristics**

| | Mutual Funds | | | | Stocks | | | |
|---|---|---|---|---|---|---|---|---|
| | [1-2] | (2-3] | (3-4] | (4-5] | [1-2] | (2-3] | (3-4] | (4-5] |
| ME | 0.03 | 0.18 | 0.13 | 0.66 | 0.03 | 0.12 | 0.30 | 0.55 |
| BM | 0.33 | 0.54 | 0.13 | 0.00 | 0.34 | 0.27 | 0.24 | 0.14 |
| MS | 0.29 | 0.44 | 0.26 | 0.01 | 0.27 | 0.28 | 0.27 | 0.17 |
| MOM | 0.00 | 0.10 | 0.87 | 0.03 | 0.01 | 0.27 | 0.69 | 0.03 |
| MULT | 0.25 | 0.50 | 0.25 | 0.00 | 0.33 | 0.28 | 0.23 | 0.16 |
| GR | 0.00 | 0.30 | 0.52 | 0.18 | 0.10 | 0.38 | 0.32 | 0.19 |
| EP | 0.16 | 0.65 | 0.19 | 0.00 | 0.29 | 0.40 | 0.24 | 0.07 |
| SP | 0.31 | 0.65 | 0.05 | 0.00 | 0.35 | 0.27 | 0.21 | 0.16 |
| CFP | 0.15 | 0.60 | 0.25 | 0.00 | 0.25 | 0.35 | 0.26 | 0.14 |
| DP | 0.16 | 0.39 | 0.39 | 0.06 | 0.27 | 0.19 | 0.29 | 0.22 |
| GRLTE | 0.01 | 0.38 | 0.46 | 0.15 | 0.15 | 0.32 | 0.29 | 0.21 |
| GRE | 0.00 | 0.15 | 0.85 | 0.01 | 0.02 | 0.39 | 0.51 | 0.06 |
| GRCF | 0.00 | 0.13 | 0.87 | 0.00 | 0.03 | 0.40 | 0.52 | 0.05 |
| GRS | 0.00 | 0.19 | 0.76 | 0.05 | 0.04 | 0.41 | 0.42 | 0.12 |
| GRB | 0.00 | 0.18 | 0.80 | 0.02 | 0.05 | 0.40 | 0.44 | 0.10 |
| OP | 0.01 | 0.28 | 0.71 | 0.01 | 0.14 | 0.24 | 0.29 | 0.19 |
| INV | 0.00 | 0.13 | 0.83 | 0.03 | 0.05 | 0.40 | 0.45 | 0.11 |
| QUAL | 0.00 | 0.13 | 0.85 | 0.01 | 0.16 | 0.27 | 0.33 | 0.23 |
| PSLIQ | 0.00 | 0.17 | 0.83 | 0.00 | 0.00 | 0.22 | 0.73 | 0.00 |
| TURN | 0.01 | 0.35 | 0.58 | 0.07 | 0.05 | 0.23 | 0.37 | 0.31 |
| DVOL | 0.02 | 0.14 | 0.16 | 0.68 | 0.02 | 0.10 | 0.28 | 0.55 |

Note: This table reports the percentage of mutual funds and stocks in with characteristic scores in the ranges 1-2, 2-3, 3-4, and 4-5 for all 21 characteristics.

**Table D.3: Distribution of Mutual Fund and Stock Characteristics: Size-weighted**

| | [1-2] | (2-3] | (3-4] | (4-5] | [1-2] | (2-3] | (3-4] | (4-5] |
|---|---|---|---|---|---|---|---|---|
| ME | 0.01 | 0.10 | 0.09 | 0.81 | 0.00 | 0.02 | 0.10 | 0.89 |
| BM | 0.26 | 0.62 | 0.12 | 0.00 | 0.49 | 0.20 | 0.19 | 0.12 |
| MS | 0.26 | 0.37 | 0.37 | 0.00 | 0.33 | 0.30 | 0.25 | 0.11 |
| MOM | 0.00 | 0.07 | 0.92 | 0.02 | 0.00 | 0.13 | 0.83 | 0.04 |
| MULT | 0.21 | 0.48 | 0.31 | 0.00 | 0.43 | 0.30 | 0.15 | 0.12 |
| GR | 0.00 | 0.42 | 0.45 | 0.12 | 0.11 | 0.32 | 0.36 | 0.21 |
| EP | 0.10 | 0.67 | 0.24 | 0.00 | 0.31 | 0.37 | 0.22 | 0.09 |
| SP | 0.29 | 0.66 | 0.05 | 0.00 | 0.50 | 0.30 | 0.13 | 0.07 |
| CFP | 0.09 | 0.56 | 0.35 | 0.00 | 0.33 | 0.31 | 0.21 | 0.15 |
| DP | 0.08 | 0.40 | 0.39 | 0.13 | 0.26 | 0.18 | 0.27 | 0.27 |
| GRLTE | 0.01 | 0.47 | 0.43 | 0.09 | 0.15 | 0.34 | 0.28 | 0.23 |
| GRE | 0.00 | 0.23 | 0.76 | 0.01 | 0.04 | 0.31 | 0.52 | 0.10 |
| GRCF | 0.00 | 0.22 | 0.77 | 0.00 | 0.00 | 0.32 | 0.60 | 0.07 |
| GRS | 0.00 | 0.28 | 0.70 | 0.03 | 0.01 | 0.38 | 0.42 | 0.17 |
| GRB | 0.00 | 0.28 | 0.71 | 0.01 | 0.02 | 0.38 | 0.45 | 0.13 |
| OP | 0.00 | 0.16 | 0.83 | 0.00 | 0.11 | 0.16 | 0.31 | 0.25 |
| INV | 0.00 | 0.21 | 0.76 | 0.02 | 0.01 | 0.32 | 0.45 | 0.20 |
| QUAL | 0.00 | 0.12 | 0.87 | 0.01 | 0.15 | 0.23 | 0.26 | 0.36 |
| PSLIQ | 0.00 | 0.08 | 0.92 | 0.00 | 0.00 | 0.06 | 0.89 | 0.00 |
| TURN | 0.01 | 0.40 | 0.57 | 0.02 | 0.16 | 0.26 | 0.30 | 0.22 |
| DVOL | 0.00 | 0.08 | 0.10 | 0.81 | 0.00 | 0.01 | 0.08 | 0.86 |

Note: See Table D.2 but distributions are AUM-weighted for mutual funds and market cap-weighted for stocks.

## Table D.4: 4-Factor Regressions

| Panel A: Betas of SMB, HML, MOM Components | | | | | | |
|---|---|---|---|---|---|---|
| | **S** | **B** | **H** | **L** | **W** | **L** |
| $\alpha$ | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| MKT | 1.02 | 1.02 | 1.04 | 1.04 | 1.05 | 1.05 |
| SMB | **0.90** | **-0.10** | 0.41 | 0.41 | 0.50 | 0.50 |
| HML | 0.26 | 0.26 | **0.72** | **-0.28** | 0.05 | 0.05 |
| MOM | 0.00 | 0.00 | -0.01 | -0.01 | **0.35** | **-0.65** |

Note: The table reports coefficients of the regression

$$X_t = \alpha_{\mathrm{X}} + \beta_{\mathrm{X,MKT}}\,\mathrm{MKT}_t + \beta_{\mathrm{X,SMB}}\,\mathrm{SMB}_t + \beta_{\mathrm{X,HML}}\,\mathrm{HML}_t + \beta_{\mathrm{X,MOM}}\,\mathrm{MOM}_t + e_{\mathrm{X},t},$$

where $X \in \{\mathrm{S, B, H, L, W, L}\}$. The sample is from 1980Q1 to 2018Q4.