Rethinking Mutual Fund Performance: From Traditional Alpha to Achievable Alpha*

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Abstract

Mutual-fund performance is traditionally measured by alpha, reflecting the utility gain of an *unconstrained* investor who has access to the fund in addition to the benchmark factors. Yet 88% of fund assets are held by retail investors, who are effectively shortsale constrained. We show that their relevant performance measure is *achievable alpha*, computed using only factors with strictly positive weights in the constrained benchmark portfolio. Empirically, achievable alpha and value-added reveal weaker absolute performance and starkly different rankings. Achievable alphas predict fund flows—especially during market turmoil—and indicate that funds are less scalable than implied by traditional alpha.

Keywords: Retail investors, Active management, Performance evaluation, Value-added, Shortsale constraints, Market frictions, Fund flows, Scale and skill.
JEL Classification: G11, G23.

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1 Introduction

As of 2024, the U.S. mutual-fund industry managed over 28.5 trillion dollars in assets, of which 88% were held by retail investors (ICI Fact Book, 2025, p. 45), who rarely take short positions due to share-borrowing costs and a general aversion to shorting risks.[1] Despite this, the literature continues to evaluate mutual funds using traditional alpha—the intercept from a regression of fund returns on benchmark factor returns—which assumes that investors can freely short the benchmark factors. The motivation for alpha stems from Gibbons, Ross, and Shanken (1989), who show that it measures the utility gain of an investor who has access to the fund in addition to the benchmark factors. But if the benchmark portfolio includes short positions on any factor, this alpha is not achievable by the overwhelming majority of mutual-fund investors. If performance is measured using an unachievable benchmark, then half a century of evidence on mutual-fund performance—starting with the seminal work of Jensen (1968)—may not reflect the experience of actual investors.

In this paper, we provide a new framework for evaluating mutual-fund performance when investors face shortsale constraints. We define the *achievable alpha* of a fund as the marginal mean-variance utility a shortsale-constrained investor can obtain by adding the fund to her opportunity set. We show theoretically that achievable alpha equals the fund's regression alpha with respect to the *subset* of benchmark factors with strictly positive weight in the shortsale-constrained mean-variance portfolio. This measure accounts for the shortsale constraints of the vast majority of retail investors, and thus provides a more realistic yardstick of fund performance than traditional alpha.

Intuitively, one might expect a fund's achievable alpha to exceed its traditional alpha because dropping factors weakens the benchmark, which should increase the measured alpha. However, we show theoretically that achievable alpha can be smaller. To understand the intuition underlying this result, consider, for instance, the extreme example of a mutual fund that achieved a negative annual return of −2% over the evaluation period, but is evaluated

[1] Kelley and Tetlock (2017, p. 805) find that out of 144 billion dollars of retail trades only 5.54% correspond to shortsales, and Gamble and Xu (2017) find only 1.2% of the retail trades in their dataset are short sales. Institutional investors may also face shortsale constraints. For instance, the state of Georgia prohibits its public pension funds from investing more than 5% in alternative investments such as hedge funds (Molk and Partnoy, 2019, p. 851). Even pension funds whose mandate allows them to short, tend to hold only small short positions—in a sample of pension funds of Fortune 1000 companies, only 6–8% of assets were invested in hedge funds and other assets that involve short selling (Molk and Partnoy, 2019, p. 853).

with respect to a single benchmark factor that achieved a return of -3%. Then, assuming a unit beta, the mutual-fund alpha is positive ($+1\%$), but to earn this positive alpha, an investor must be able to short the benchmark factor. For a shortsale-constrained investor, the achievable alpha is only the fund's mean return, -2%.

Our main theoretical result is to identify precisely when achievable alpha is smaller than traditional alpha—when a fund loads positively on the factors with zero weight in the shortsale-constrained benchmark portfolio. The intuition underlying this result is that the zero-weight factors underperform, and thus an unconstrained investor would like to short them to hedge fund risk and take a larger position in the fund. However, shortsale constraints prevent this hedge, reducing the optimal allocation to the fund and thereby lowering its achievable alpha. Hence, whether active funds are more or less valuable to shortsale-constrained investors is ultimately an empirical question.[2]

To evaluate empirically the gap between traditional and achievable alphas, we use six prominent factor models as benchmarks—CAPM, Carhart four-factor (FFC), Fama-French five-factor (FF5) and six-factor (FF6), and Hou-Xue-Zhang four-factor (HXZ) and five-factor (HXZM) models. A seventh benchmark model we consider consists of Vanguard funds, as in Berk and van Binsbergen (2015), who point out that the factors in prominent models do not account for transaction costs, and thus, are not an accurate representation of the alternative investment opportunity of mutual-fund investors.[3]

Two of the seven factor models we consider (CAPM and VANG) consist of long-only factors that are easily accessible to shortsale-constrained investors, but the other five models (FFC, FF5, FF6, HXZ, HXZM) rely on long-short portfolios that are largely inaccessible to them. For instance, An, Huang, Lou, and Shi (2023, table 1) show that long-short mutual funds account for less than 3% of industry assets, and those with short positions employ far less leverage than the long-short factors in asset-pricing models.[4] Similarly, long-short ETFs

[2] We illustrate this intuition with a numerical example at the end of Section 2.

[3] Consequently, Berk and van Binsbergen (2015) propose using a benchmark consisting of 11 Vanguard funds that invest in domestic and foreign equities. Of these funds, we consider a factor model that includes the returns of the eight funds that invest solely in domestic equity.

[4] While factor portfolios typically balance long and short legs, only 8% of mutual funds in An et al. (2023) hold any short positions, and just 3% short more than 20% of assets. This limited shortselling is explained by Johansson, Sabbatucci, and Tamoni (2025), who show that the short legs of factors such as "investment" and "profitability" are impractical to implement because they concentrate in stocks with extreme factor exposures that are rarely traded, and few funds invest in "losers," "weak profitability," or "aggressive" firms needed to replicate academic factors.

represent a tiny fraction of the overall ETF market—as of November 2025, the ETF database lists only 18 ETFs in their long-short category, with aggregate assets under management of just 6.2 billion dollars (ETF Database, 2025). Finally, although investors could use options to replicate the short leg of a long-short factor, Bryzgalova, Pavlova, and Sikorskaya (2023) show that retail investors who trade options face "whopping" average bid-ask spreads of 12.6%. To address the concern that long-short factor models do not represent the alternative investment opportunity of shortsale-constrained investors, we evaluate the five long-short models using long-only versions of the factors in the original models.[5]

Empirically, we find that the distinction between traditional and achievable alpha matters greatly, with performance *deteriorating* sharply when measured using achievable alpha. For instance, the top plot in Figure 1 shows that while the proportion of funds with positive traditional gross-of-fees alpha with respect to the long-short version of the factor models ranges from 47% for HXZ to 61% for VANG, the proportion of funds with positive achievable gross alpha with respect to the long-only models is just 10% for HXZ and 35% for VANG.[6]

These striking results also hold when we measure mutual-fund performance in terms of "value-added" (Berk and van Binsbergen, 2015).[7] For instance, the bottom plot in Figure 1 shows that while the proportion of mutual funds with positive traditional gross value-added ranges from 30% for HXZ to 46% for VANG, the proportion of mutual funds with positive achievable value-added is just 6% for HXZ and 19% for VANG. Section IA.5 of the Internet Appendix shows that the deterioration in traditional alpha and value-added is even stronger when measured using net-of-fees returns instead of gross returns.

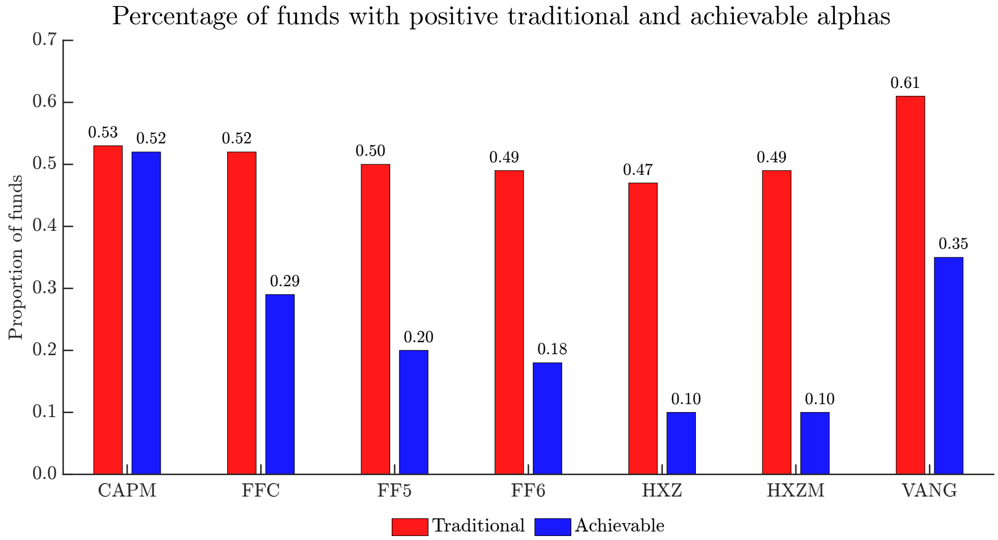
[5] Johansson et al. (2025) construct long-short factors whose short leg is a short-only portfolio of ETFs. They show that transaction and shortselling costs lead to an implementation shortfall of 2–4% annually, relative to the academic (on paper) factors. However, the resulting factors require shorting ETFs and thus do not represent the alternative investment opportunity set of shortsale-constrained investors. Motivated by Johansson et al. (2025), in Section IA.2 of the Internet Appendix, we construct factors that do not require shorting by using the long-only version of the original factor to replicate the long leg and a long-only portfolio of mutual funds with negative exposure to the original factor to replicate the short leg. We then show that our findings are robust when these factors are used as the benchmark, rather than just the long-only versions of the original factors.

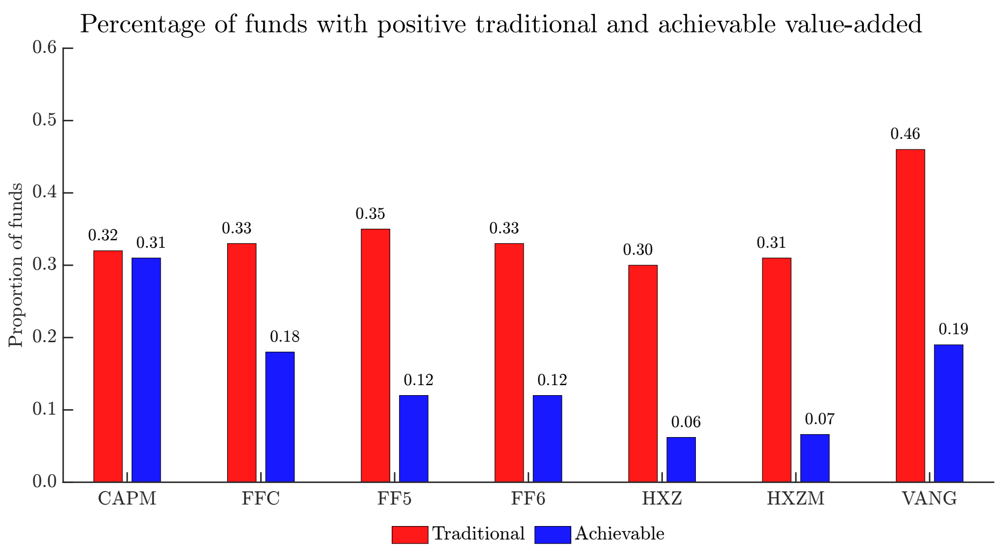
[6] Note that the CAPM and VANG models are long-only, however the traditional alpha with respect to the VANG model is still much larger than the achievable alpha because the mean-variance portfolio of the VANG factors includes several short positions, as we show below.

[7] Berk and van Binsbergen (2015) explain the importance of measuring mutual-fund performance in terms of *value-added*, defined as the average of the product between a fund's gross abnormal returns and its assets under management. Following their approach, we define achievable value-added as the average of the product between achievable abnormal returns and assets under management.

Figure 1: Traditional and achievable gross alpha and value-added

This figure depicts the proportion of funds with positive traditional and achievable gross alphas (top plot) and value-added (bottom plot) with respect to the seven factor models we consider. Traditional alphas are computed by regressing fund returns on all long-short factors for each model, and achievable alphas on just those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). Traditional value-added is the average of the product of assets under management and abnormal returns, obtained by regressing fund returns on all long-short factors in each model, and achievable value-added is computed using fund abnormal returns with respect to just those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio.





We also estimate the gap between traditional and achievable alphas over time using 36-month rolling averages, the standard window employed by platforms like Morningstar. We observe that this gap widens markedly during periods of financial turmoil—such as the

1980 and 1981–82 recessions, the dot-com crash, the 2009 financial crisis, and the COVID pandemic—when shortsale constraints are most binding. Overall, these findings provide compelling evidence that the value of active mutual-fund management is substantially lower for shortsale-constrained investors.

Having shown that shortsale constraints sharply reduce absolute performance, we next examine their effect on *relative* performance. Comparing rankings based on traditional versus achievable alpha or value-added, we find that over 70% of funds change rank deciles across all factor models except CAPM. Thus, the top-performing funds for shortsale-constrained investors differ from those for unconstrained investors.

Finally, we show that the distinction between achievable and traditional alphas is critical for two central questions in mutual-fund research. First, we examine fund flows and find that both traditional and achievable alphas predict flows individually and jointly; however, in volatile markets, the predicting power of achievable alpha strengthens, while that of traditional alpha weakens. This evidence suggests that, even after controlling for traditional alpha, the decisions of at least some investors are correlated with achievable alpha, particularly during periods of market turmoil. Second, we study mutual-fund skill and scale using the flexible and bias-adjusted approach of Barras, Gagliardini, and Scaillet (2022). We find that while estimates of fund skill are similar whether based on traditional or achievable alpha, estimates of scalability based on achievable alpha are much smaller, revealing that active strategies are far less scalable for shortsale-constrained investors.

We conduct several robustness checks in the Internet Appendix. First, we allow investors to short the market factor (e.g., via an inverse ETF) or to short all benchmark factors, subject to a leverage constraint. Second, we repeat our analysis after replacing each academic factor's short leg with a long-only mutual fund portfolio negatively exposed to it. Third, we estimate value-added using the approach of Barras et al. (2022). Fourth, we re-estimate fund alphas using 36-month rolling windows instead of the entire sample for which there is data for each fund. Fifth, we repeat our entire analysis considering net-of-fees returns. Sixth, we repeat the analysis considering separately retail and institutional fund share classes. Seventh, we evaluate mutual-fund performance across different fund styles. Eighth, we evaluate fund skill and scalability using the log of assets under management as the explanatory variable. Ninth, we evaluate mutual-fund performance across different subperiods. Tenth, we consider factor models that allow investors to go long both the long and the short leg of academic factors. Eleventh, we consider an alternative approach to impute missing observations in the Vanguard model. Across all these variations, our results hold: achievable alpha and value-added remain far smaller than their traditional counterparts, and relative fund rankings are substantially different.

Our work has implications for research, practice, and policy. For research, we show that traditional performance measures are inconsistent with investor constraints and overstate the value of active management. For practitioners and investment platforms, we show that reporting should incorporate achievable alpha, especially for investors who do not short. For regulators, we highlight the importance of disclosure standards that reflect the frictions faced by retail investors and shortsale-constrained pension funds. More broadly, our results bridge the mutual-fund and asset-pricing literatures by showing that ignoring shortsale constraints can severely bias inferences about the value of active management.

An extensive literature evaluates mutual-fund performance using traditional alpha. This research typically shows that the average active fund earns negative alpha net of fees (Jensen, 1968; Elton, Gruber, and Blake, 1996; Ferreira, Keswani, Miguel, and Ramos, 2013). However, several studies document the existence of a subset of managers that outperform their benchmarks (Wermers, 2000; Barras, Scaillet, and Wermers, 2010; Fama and French, 2010; Kacperczyk, Nieuwerburgh, and Veldkamp, 2014). Assuming there are diseconomies of scale in fund management, Berk and Green (2004) explain that fund net alpha should be zero in equilibrium because investors allocate capital to funds with positive net alpha until diseconomies of scale drive their net alpha to zero. Thus, a manager's skill should be measured in terms of gross alpha. Berk and van Binsbergen (2015) propose using the value a mutual fund extracts from capital markets as the appropriate measure of skill, and find that the average value-added of a mutual fund is about $3.2 million per year. They also show that more than 40% of the funds generate a positive value-added. Barras et al. (2022) develop a flexible and bias-adjusted approach to examine value-added and find that the majority of funds generate a positive value-added. We contribute to this literature by demonstrating that the performance of a mutual fund for shortsale-constrained investors is measured by achievable alpha, and showing that the proportion of funds with positive alpha or value-added is much smaller from the perspective of a shortsale-constrained investor.

Several papers document the barriers to shortselling faced by investors. Daniel, Klos, and Rottke (2025) show that over the last several decades, the cost of borrowing stocks for shortselling has increased dramatically. Andrews, Henderson, and Reed (2024) find that ETFs are even more expensive to borrow than the stocks the ETFs hold. Engelberg, Reed, and Ringgenberg (2018) show that shortselling is risky because stock loans may become costly or be recalled. We highlight that the majority of retail investors holding mutual funds rarely short (Kelley and Tetlock, 2017; Gamble and Xu, 2017), but are agnostic about whether this is due to share-borrowing costs or to an aversion to shorting risks.

Our work also relates to the literature on the effects of market frictions on the benefits to investors of holding different asset classes. For instance, De Roon, Nijman, and Werker (2001) show that in the presence of transaction costs and shortsale constraints, U.S. investors no longer benefit from investing in emerging markets. Brown, Gonçalves, and Hu (2024) show that illiquidity and underdiversification in private markets reduce the benefits to investors from holding private-capital assets, such as buyout, venture capital, and real estate. We contribute to this literature by examining whether shortsale-constrained investors benefit from holding actively managed mutual funds and characterizing the precise conditions under which their achievable alpha is smaller than the traditional alpha.

Finally, our work is related to the literature on market frictions in asset pricing (Novy-Marx and Velikov, 2016; DeMiguel, Martin-Utrera, Nogales, and Uppal, 2020; Barroso and Detzel, 2021; Chen and Velikov, 2023; Muravyev, Pearson, and Pollet, 2025).[8] While this literature focuses on the impact of market frictions on the performance of asset-pricing models, we focus on the effects of market frictions on the performance of mutual funds.

The rest of the paper is organized as follows. In Section 2, we show theoretically how to measure mutual-fund alpha in the presence of shortsale constraints and provide an example to illustrate the theoretical results. In Section 3, we first describe our data and methodology for constructing multifactor benchmark portfolios and then present our empirical results. In Section 4, we examine the economic implications of the distinction between traditional and achievable alphas for two of the main questions in mutual-fund research. Section 5 concludes. Proofs of all our theoretical results are provided in the appendix. Additional empirical results and extensive robustness checks are reported in the Internet Appendix.

[8]See also Detzel, Novy-Marx, and Velikov (2023); DeMiguel, Martin-Utrera, and Uppal (2024); Li, DeMiguel, and Martin-Utrera (2024).

2 Achievable Alpha: Theoretical Results

In this section, we provide our theoretical results that show that one can interpret the traditional and achievable mutual fund alphas as the marginal mean-variance utility improvement in the absence and presence of shortsale constraints of an investor who has access to the fund in addition to the benchmark factors. Our main theoretical result is to characterize the difference between the traditional and achievable alphas and identify the conditions under which the achievable alpha will be smaller than the traditional alpha. We also provide a simple example to illustrate the intuition for this result.

Mutual-fund performance is traditionally measured using the fund's alpha (Jensen, 1968), defined as the intercept from regressing the fund's returns on the returns of the benchmark factors. The use of the traditional alpha as a fund performance measure is economically justified by the work of Gibbons et al. (1989), who show that a quadratic form of the alpha equals the increase in the squared Sharpe ratio of a mean-variance investor that has access to the fund in addition to the benchmark factors.

Berk and Green (2004) show that if markets are competitive and there are diseconomies of scale in mutual-fund management, in equilibrium, a fund's gross alpha should be equal to its management fee, and thus, investors should (on the margin) be indifferent between investing in the fund or not. Therefore, it is useful to relate a fund's alpha to the *marginal* utility improvement it generates for an investor with access to the benchmark factors. This interpretation is highlighted in the following well-known result (Chen and Knez, 1996; Ferson, 2010; Ardia and Barras, 2024), with our notation summarized in Table 1.

Proposition 1 *The marginal mean-variance utility improvement of an unconstrained investor who has access to a fund, in addition to the benchmark factors, is the* traditional *alpha, $\alpha_{\mathcal{T}}$, measured as the intercept from regressing the mutual-fund return in excess of the risk-free rate $R_{mf,t}$ on the benchmark factor returns $R_{b,t}$,*

$$R_{mf,t} = \alpha_{\mathcal{T}} + \beta_{\mathcal{T}} R_{b,t} + \epsilon_{b,t}. \tag{1}$$

The marginal utility improvement measured by the traditional alpha, as shown in Proposition 1, can only be realized if the investor can invest in the optimal mean-variance portfolio of the benchmark factors. However, this portfolio may require taking a short position in some of the benchmark factors and many investors face shortsale impediments

Table 1: Guide to notation

This table describes the notation we use in the paper to describe the excess returns of a mutual fund and benchmark factors, the traditional and achievable alpha, and the slope coefficients (betas) obtained from various regressions of excess returns. The first column of the table gives the symbol we use, and the second column its definition.

Notation	Definition
$R_{mf,t}$	mutual-fund return in excess of the risk-free rate
$R_{b,t}$	excess return of benchmark factors
$R_{b_+,t}$	excess return of benchmark factors with positive weight in the shortsale-constrained mean-variance portfolio
$R_{b_0,t}$	excess return of benchmark factors with zero weight in the shortsale-constrained mean-variance portfolio
$\alpha_{\mathcal{T}}$	traditional alpha, intercept from regressing $R_{mf,t}$ on $R_{b,t}$
$\alpha_{\mathcal{A}}$	achievable alpha, intercept from regressing $R_{mf,t}$ on $R_{b_+,t}$
α_{0_+}	intercept from regressing $R_{b_0,t}$ on $R_{b_+,t}$
$\beta_{\mathcal{T}}$	slope from regressing $R_{mf,t}$ on $R_{b,t}$
$\beta_{\mathcal{A}}$	slope from regressing $R_{mf,t}$ on $R_{b_+,t}$
$\beta_{\mathcal{T},+}$	slope coefficient on $R_{b_+,t}$ when regressing $R_{mf,t}$ on $R_{b_+,t}$ and $R_{b_0,t}$
$\beta_{\mathcal{T},0}$	slope coefficient on $R_{b_0,t}$ when regressing $R_{mf,t}$ on $R_{b_+,t}$ and $R_{b_0,t}$

in practice. The following proposition shows that the marginal utility improvement that a fund generates for a shortsale-constrained investor is the *achievable* alpha, measured by the intercept from regressing the fund returns on the returns of those benchmark factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio.

Proposition 2 *The marginal mean-variance utility improvement of a shortsale-constrained investor who has access to a fund, in addition to the benchmark factors, is the* achievable *alpha, $\alpha_{\mathcal{A}}$, measured as the intercept from regressing the fund excess return on the returns of the benchmark factors with positive weight in the shortsale-constrained mean-variance portfolio, $R_{b_+,t}$,*

$$R_{mf,t} = \alpha_{\mathcal{A}} + \beta_{\mathcal{A}} R_{b_+,t} + \epsilon_{b_+,t}. \tag{2}$$

The theoretical result in Proposition 2 is closely related to that of De Roon et al. (2001), who study the impact of shortsale constraints on the benefits from international portfolio diversification. In contrast, we focus on mutual-fund performance and go beyond their analysis by identifying in the following proposition the precise conditions under which the achievable alpha will be smaller than the traditional alpha.

Proposition 3 *Let $R_{b_+,t} \in R^{K_+}$ denote the return of the benchmark factors with strictly positive weight and $R_{b_0,t} \in R^{K_0}$ the return of the benchmark factors with zero weight in the shortsale-constrained mean-variance portfolio. Regressing the mutual fund excess returns, $R_{mf,t}$, on the benchmark factor returns, we have that:*

$$R_{mf,t} = \alpha_{\mathcal{T}} + \beta_{\mathcal{T},+} R_{b_+,t} + \beta_{\mathcal{T},0} R_{b_0,t} + \epsilon_{b,t},$$

where $\alpha_{\mathcal{T}}$ is the traditional alpha, and regressing the zero-weight factor returns, $R_{b_0,t}$, on the positive-weight factor returns, $R_{b_+,t}$, we have that:

$$R_{b_0,t} = \alpha_{0,+} + \beta_{0,+} R_{b_+,t} + \epsilon_{0,+,t}. \tag{3}$$

Then, the difference between the traditional and achievable alphas is

$$\alpha_{\mathcal{T}} - \alpha_{\mathcal{A}} = -\beta_{\mathcal{T},0}\, \alpha_{0,+}. \tag{4}$$

Moreover, $\alpha_{0,+} < 0$, and thus, the achievable alpha is smaller than the traditional alpha if the fund has strictly positive exposure to at least one zero-weight factor and nonnegative exposure to the rest.

Intuitively, one would expect that the achievable alpha is larger than the traditional alpha because the achievable alpha in equation (2) of Proposition 2 is the abnormal return with respect to a *subset* of the factors used to compute the traditional alpha in equation (1) of Proposition 1. However, Proposition 3 shows that if the fund has a positive exposure to the factors for which the shortsale-constrained mean-variance portfolio assigns a zero weight, then the achievable alpha will actually be *smaller* than the traditional alpha. The economic intuition for this result is that the zero-weight factors underperform relative to the other factors, and thus an unconstrained investor would like to short them to hedge fund risk and take a larger position in the fund. However, shortsale constraints prevent this hedge, reducing the optimal allocation to the fund and thereby lowering its achievable alpha.

In the remainder of this section, we provide a numerical example to illustrate this intuition. In particular, we consider a setting with only two factors: the market (MKT) and the long-only version of momentum (UMD). All quantities are estimated using the returns of the two factors and the mutual fund for the entire sample from January 1975 to December 2024. We find that an unconstrained mean-variance investor with relative risk aversion $\gamma = 5$ assigns a weight of -0.57 to MKT and 1.20 to UMD. This is because the correlation between

Table 2: An example to illustrate the key intuition

This table reports various statistics for Columbia Acorn Fund with respect to a simple benchmark model with only two factors: the market (MKT) and the long-only version of momentum (UMD). The first column indicates whether the statistics are for the unconstrained portfolio (traditional alpha) or the shortsale-constrained portfolio (achievable alpha). Columns (2)–(5) report the utility and portfolio weights of the mean-variance portfolio of the two factors and the mutual fund. Columns (6)–(8) report the annual alpha and the beta of the mutual fund with respect to the two factors. We consider an investor with relative risk aversion $\gamma = 5$. All quantities are obtained using the returns of the two factors and the mutual fund for a sample spanning January 1975 to December 2024.

	Mean-variance portfolio				Regression		
	Utility	w_{MKT}	w_{UMD}	w_{mf}	α	β_{MKT}	β_{UMD}
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Unconstrained: Traditional	0.0044	−0.67	1.06	0.25	0.0059	0.40	0.57
Shortsale-constrained: Achievable	0.0041	0	0.71	0.06	0.0015	—	0.88

the MKT and the long-only version of UMD is 92% but the monthly mean return of the long-only UMD (1.08%) is much higher than that of MKT (0.75%). However, once shortsale constraints are imposed, the investor assigns a weight of zero to MKT and only 0.76 to UMD. This is because she cannot short the MKT factor to hedge the risk of the UMD factor, and thus, has to reduce her overall exposure to UMD.

Now, suppose this investor uses the simple two-factor benchmark to evaluate the performance of the Columbia Acorn Fund. Column (6) of Table 2 shows that the traditional annual alpha of Columbia with respect to the two-factor model is 0.59%, but the achievable annual alpha drops to 0.15%. This is consistent with Proposition 3 because, as shown in Columns (7) and (8) of Table 2, the Columbia fund has positive betas of 0.40 and 0.57 with respect to the MKT and long-only UMD factors.

To understand why the achievable alpha is smaller than the traditional alpha, compare the unconstrained and shortsale-constrained mean-variance portfolio weights of the two benchmark factors and the mutual fund. Columns (3)–(5) of Table 2 show that the portfolio of an unconstrained investor would assign weights of −0.67 to MKT, 1.06 to UMD, and 0.25 to the mutual fund. In contrast, the portfolio of a shortsale-constrained investor would assign weights of zero to MKT, 0.71 to UMD, and only 0.06 to the mutual fund. That is, the shortsale-constrained investor is forced to reduce her exposure to the UMD factor and the Columbia fund because she cannot use the MKT factor to hedge the risk of her portfolio.

Consistent with the alpha in the motivating example, which, in the presence of short-sale constraints, drops from 0.59% to 0.15% (see Column (6) of Table 2), in the next section, we find empirically that the achievable alpha is, on average, smaller than traditional alpha.

3 Achievable Alpha: Empirical Results

In this section, we present our empirical results. In Section 3.1, we describe the data we use for our analysis. In Section 3.2, we analyze the characteristics of the mean-variance portfolios for the different benchmark factor models. In Section 3.3, we examine the performance of mutual funds in terms of achievable and traditional alpha and value-added.

3.1 Data

Table 3 lists the seven models we consider as benchmark, which include six prominent factor models: the CAPM model of Sharpe (1964), the four-factor model obtained by adding momentum to the three factors of Fama and French (1993) as in Carhart (1997), FFC, the five-factor model of Fama and French (2015), FF5, the six-factor model of Fama and French (2018), FF6, the four-factor model of Hou, Xue, and Zhang (2015), HXZ, and a five-factor model with the Hou et al. (2015) factors plus momentum, HXZM. We also consider an eight-factor model based on the net-of-fees returns of eight US domestic equity Vanguard funds, VANG, as in Berk and van Binsbergen (2015), who point out that the factors in prominent models do not account for transaction costs, and thus, are not an accurate representation of the alternative investment opportunity of mutual-fund investors.[9]

Two of the seven factors models we consider (CAPM and VANG) consist of long-only factors that are easily accesible to shortsale-constrained investors, but the other five models (FFC, FF5, FF6, HXZ, HXZM) rely on long-short portfolios that are largely inaccessible to them. To address this concern, for models that contain long-short factors, we consider

[9]When constructing the benchmark based on Vanguard funds, we consider the eight funds that invest only in *domestic* equity out of the 11 funds considered by Berk and van Binsbergen (2015). In particular, we consider the following funds: VBINX (balanced), VFINX (large-cap blend), VEXMX (mid-cap blend), VVIAX (large-cap value), NAESX (small-cap blend), VISVX (small-cap value), VISGX (small-cap growth), and VIMSX (mid-cap blend). As in Berk and van Binsbergen (2015), when using these funds to construct the benchmark, we consider net-of-fees returns, but our findings are robust to considering gross-of-fees returns.

Table 3: List of factor models considered

This table lists the factor models we consider. The first column gives the acronym of the model, the second column the number of factors in the model (K), the third column the authors who proposed the model, and the fourth column the date and journal of publication. The last column lists the acronyms of the factors included in the model.

Acronym	K	Authors	Date, Journal	Factor acronyms
CAPM	1	Sharpe	1964, JF	MKT
FFC	4	Carhart	1997, JF	MKT, SMB, HML, UMD
FF5	5	Fama and French	2015, JFE	MKT, SMB, HML, RMW, CMA
FF6	6	Fama and French	2018, JFE	MKT, SMB, HML, RMW, CMA, UMD
HXZ	4	Hou, Xue, and Zhang	2015, RFS	MKT, ROE, IA, ME
HXZM	5	Hou, Xue, and Zhang	2015, RFS	MKT, ROE, IA, ME, UMD
VANG	8	Berk and van Binsbergen	2015, JFE	VBINX, VFINX, VEXMX, VVIAX, NAESX, VISVX, VISGX, VIMSX

two versions, one with the original long-short factors and the other with long-only factors, constructed using only the long leg of the original factors.[10]

We construct a dataset for actively managed U.S. equity mutual funds as follows.[11] We download monthly fund returns, expense ratios, total net assets (TNA), and investment objectives from the CRSP Survivor-Bias-Free Mutual Fund Database. We aggregate all share classes belonging to the same fund by adding their TNAs and computing TNA-weighted averages of fund-level variables.[12] We retain diversified domestic equity funds identified by the CRSP objective code and exclude index, international, balanced, sector, bond, and money-market funds. The resulting panel spans January 1975 to December 2024 and comprises 2,939 distinct funds. We compute monthly gross fund returns by adding one-twelfth of the annual expense ratio to the net-of-fees monthly returns. Following Berk and van Binsbergen (2015) and Barras et al. (2022), we express TNA and value-added in January 1, 2000 dollars.

3.2 Mean-Variance Portfolio of Benchmark Factors

In Section 2, we showed that the performance of a mutual fund for a shortsale-constrained investor should be measured using the achievable alpha, defined as the alpha of the mutual fund with respect to only those factors in the benchmark model that have a strictly positive

[10]In Section IA.2 of the Internet Appendix, we show that our findings are robust to considering benchmark factors constructed by using the long-only version of the original factor to replicate the long leg and a long-only portfolio of mutual funds with negative exposure to the original factor to replicate the short leg.

[11]We are grateful to Mikhail Simutin for sharing the SAS code that reproduces the results in Doshi, Elkamhi, and Simutin (2015). We use this SAS code as a starting point for constructing our dataset.

[12]In Section IA.6 of the Internet Appendix, we show that our results are robust to considering retail and institutional share classes separately.

weight in the mean-variance portfolio. To see if shortsale constraints are important for mutual-fund performance, we first compare the weights of the unconstrained and shortsale-constrained mean-variance portfolios for each of the seven benchmark factor models. If the unconstrained and shortsale-constrained portfolios are identical, then the traditional and achievable alphas will coincide.

We consider an investor with relative risk-aversion parameter $\gamma = 5$ and compute the mean-variance portfolios using data for our entire sample from January 1975 to December 2024.[13] Figure 2 depicts the weights of the mean-variance portfolio of the factors for each of the seven models listed in Table 3. Panels A and B of this figure depict the *unconstrained* portfolio weights for models based on long-short and long-only factors, respectively. Panel C depicts the *shortsale-constrained* portfolio weights for models based on the long-only factors.

Panel A of Figure 2 shows that the unconstrained mean-variance portfolio weights for the *long-short* version of the FFC, FF5, FF6, HXZ, and HXZM models do not include substantially negative weights. In particular, the portfolio weights for the FFC, HXZ, and HXZM models are all strictly positive, and those for the FF5 and FF6 models include a single negative weight for the value factor (HML), which is also small in magnitude compared to the other portfolio weights. In contrast, Panel B shows that the unconstrained mean-variance portfolios for the *long-only* version of the factor models contain significant negative weights. For instance, the portfolio weights for the MKT and SMB factors are negative for the FFC, FF5, and FF6 models, and those for the MKT and ME factors are negative for the HXZ and HMXZ models. Panel C depicts the weights of the *shortsale-constrained* mean-variance portfolio of the long-only factors. Comparing the unconstrained and shortsale-constrained portfolios of long-only factors in Panels B and C of Figure 2, we note that the shortsale-constrained portfolio weights are positive for only a few of the long-only factors for each model. For instance, in Panel C, the FFC portfolio assigns positive weights only to HML and MOM; the FF5 portfolio to HML and RMW; the FF6 portfolio to HML, RMW, and MOM; and the HXZ and HXZM portfolios to ROE alone.

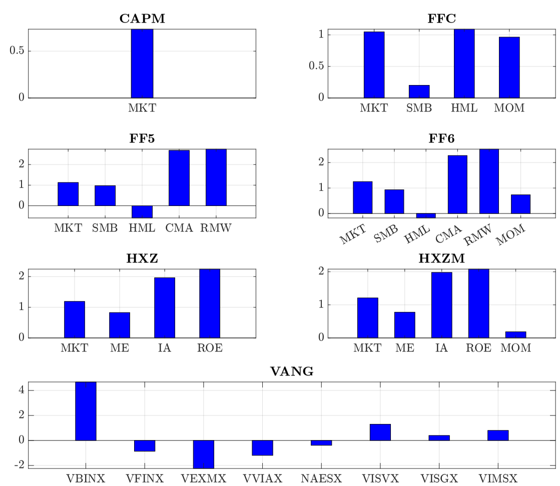
To understand the reason for the difference between the unconstrained mean-variance portfolio weights of the long-short and long-only factor models, we report in Table 4 the time-

[13]Note that our findings are robust to considering other values of γ because it is straightforward to show that, even in the presence of shortsale constraints, the weight invested in any risk asset relative to the total investment in risky assets does not depend on γ.

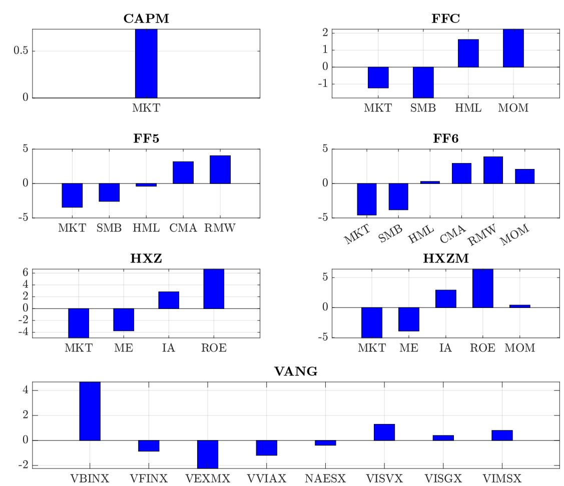
Figure 2: Mean-variance portfolio of benchmark factors

This figure depicts the weights of the mean-variance portfolio of the factors for each of the seven models listed in Table 3. Panels A and B depict the unconstrained portfolio weights for models based on long-short and long-only factors, respectively. Panel C depicts the shortsale-constrained portfolio weights for the model based on long-only factors. We consider an investor with relative risk-aversion parameter $\gamma = 5$ and construct shortsale-constrained mean-variance portfolios for our sample from January 1975 to December 2024.

Panel A: Unconstrained long-short factors



Panel B: Unconstrained long-only factors



Panel C: Constrained long-only factors

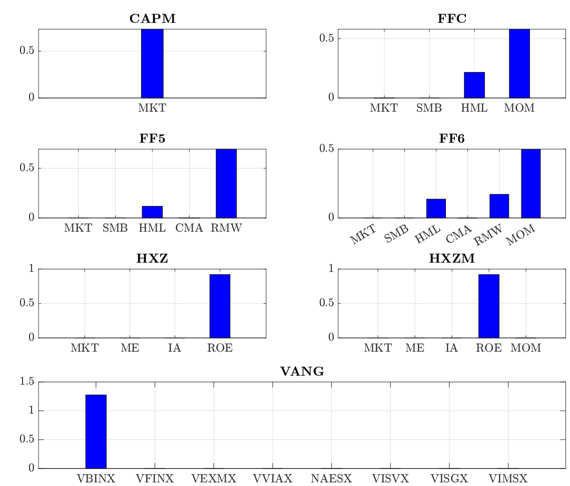


Table 4: Factor correlations

This table reports time-series correlation for the factors of the CAPM, FFC, FF5, FF6, HXZ, and HXZM models described in Table 3. Panel A reports the correlation for the long-short factors considered in the original version of these models, and Panel B for the long-only version of the factors. In both panels, we also include the market (MKT), which is a long-only factor.

	SMB	HML	CMA	RMW	UMD	ME	IA	ROE
Panel A: Long-short factor correlations								
MKT	0.28	-0.25	-0.33	-0.22	-0.18	0.26	-0.31	-0.24
SMB		-0.18	-0.10	-0.48	-0.04	0.95	-0.18	-0.44
HML			0.67	0.26	-0.17	0.01	0.71	-0.00
CMA				0.02	0.03	-0.00	0.91	-0.06
RMW					0.08	-0.37	0.17	0.67
UMD						-0.02	0.03	0.51
ME							-0.05	-0.33
IA								0.08
Panel B: Long-only factor correlations								
MKT	0.88	0.88	0.93	0.96	0.92	0.88	0.93	0.96
SMB		0.93	0.96	0.94	0.93	0.99	0.96	0.94
HML			0.95	0.92	0.85	0.91	0.94	0.89
CMA				0.95	0.92	0.96	0.99	0.95
RMW					0.93	0.93	0.95	0.98
UMD						0.93	0.92	0.95
ME							0.97	0.94
IA								0.95

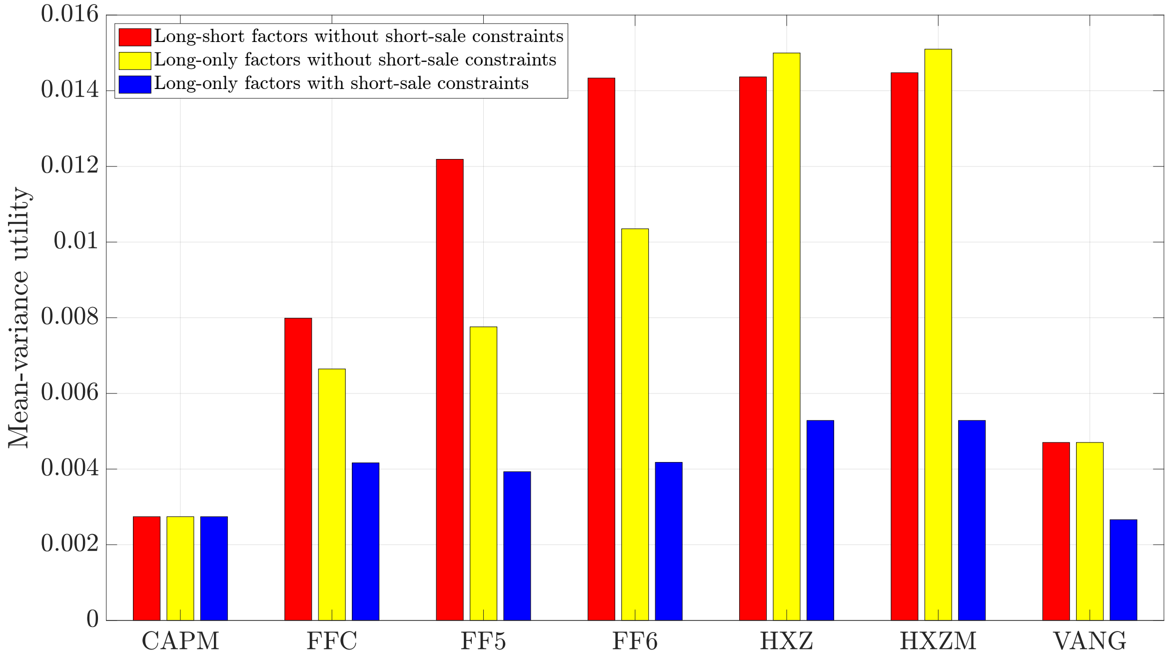
series correlation for the factors of the CAPM, FFC, FF5, FF6, HXZ, and HXZM models described in Table 3. Panel A reports the correlation for the long-short factors considered in the original version of these models, and Panel B for the long-only version of the factors. We see from Panel A that the long-short factor correlations are generally small, which explains why the mean-variance investor tends to assign a positive weight to each long-short factor. In contrast, Panel B shows that the correlations between the long-only factors are all positive and above 0.85, and thus, the mean-variance investor goes long some factors and short others to diversify the portfolio risk.[14]

Note that the CAPM and VANG models are composed of long-only factors, and thus, the portfolio weights for these models are identical in Panels A and B of Figure 2. Com-

[14] Green and Hollifield (1992) explain that the mean-variance portfolio is likely to contain substantial long and short positions if asset returns are driven by a common factor. The long-only factors for each of the six models are all exposed to the market factor, and thus, it is not surprising that the unconstrained mean-variance portfolio of the long-only benchmark factors includes substantial negative and positive weights. Moreover, considering a model with a large number of long-only factors would not change this intuition, as the factors would still be exposed to the market, and thus, the mean-variance portfolio would contain both long and short positions.

Figure 3: Mean-variance utility of factor models

This figure depicts the mean-variance utility of the different factor models for three cases: (i) long-short factors without shortsale constraints, (ii) long-only factors without shortsale constraints, and (iii) long-only factors with shortsale constraints.



paring the unconstrained (Panel A or B) and shortsale-constrained (Panel C) mean-variance portfolio weights of the CAPM and VANG models, we observe that, as one would expect, the CAPM model is unaffected by shortsale constraints because the investor optimally assigns a strictly positive weight to the MKT factor even in the absence of shortsale constraints. However, the mean-variance portfolio of the VANG factor model changes dramatically in the presence of shortsale constraints. While in the absence of shortsale constraints (Panels A or B), the VANG portfolio has substantial negative weights for the VFINX, VEXMX, VVIAX, and NAESX funds and positive weights on the other four funds, in the presence of shortsale constraints (Panel C), it contains a single positive weight on the VBINX fund. The portfolio weights in Panels B and C are a consequence of the VANG factors being highly correlated with each other, which is because all eight VANG factors are long-only portfolio returns.

Figure 3 depicts the mean-variance utility of the different factor models for the following three cases: (i) long-short factors without shortsale constraints, (ii) long-only factors without shortsale constraints, and (iii) long-only factors with shortsale constraints. A few observations are in order. First, the mean-variance utility of long-only factor models in the presence of shortsale constraints (blue bars) is much smaller than that of long-short models in the absence of shortsale constraints (red bars) for every model except the CAPM. This shows that shortsale constraints have a substantial impact on the mean-variance utility generated by most benchmark factor models. Second, while the performance of the CAPM model is not affected by shortsale constraints, its performance compares poorly to that of the other factor models (except VANG) both in the absence and presence of shortsale constraints, and so it is a weak benchmark. Third, in the absence of shortsale constraints, the mean-variance utility generated by the long-short factors (red bars) is higher than that generated by the long-only factors (yellow bars) for three of the long-short factor models (FFC, FF5, and FF6), but it is lower for the other two long-short models (HXZ and HXZM). This shows that, at least for the HXZ and HXZM models, the long leg of the factors is more important than the short leg.

3.3 Achievable Mutual-Fund Performance

In this section, we discuss the achievable mutual-fund performance of a shortsale-constrained investor in terms of gross-of-fees alpha and value-added. We also examine whether shortsale constraints change the rankings of funds.

3.3.1 Achievable alpha

Table 5 reports cross-sectional statistics for the traditional and achievable fund gross alphas with respect to the seven factor models listed in Table 3. Panel A reports cross-sectional statistics for the traditional alpha with respect to the long-short factors, obtained by regressing the fund returns on all long-short factors for each model, and Panel B for the achievable alpha with respect to the long-only factors, obtained by regressing fund returns on just those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund).[15] We report the average alpha across funds, its t-statistic, the time-weighted average alpha (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of

[15] In Section IA.3 of the Internet Appendix, we show that our findings are robust to estimating alphas using a 36-month rolling window, instead of using the entire sample period for which we have return data for the fund.

Table 5: Traditional and achievable mutual-fund alphas

This table reports cross-sectional statistics for the traditional and achievable fund gross alphas with respect to the seven factor models listed in Table 3. Panel A reports cross-sectional statistics for the traditional alpha with respect to the long-short factors, obtained by regressing the fund returns on all long-short factors for each model, and Panel B for the achievable alpha with respect to the long-only factors, obtained by regressing fund returns on just those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). We report the average alpha across funds, its t-statistic, the time-weighted average alpha (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of fund alpha and the percentage of funds with positive alpha and t-statistic greater than two. Alphas are annualized and reported in percentage. As in Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range (difference between the 90th and 10th percentiles) away from the median.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional alpha with respect to long-short factors							
Average alpha	0.05	0.01	0.25	0.15	-0.06	-0.00	0.47
t-stat	1.06	0.16	4.77	3.14	-1.14	-0.10	10.82
Time-weighted average alpha	0.33	0.30	0.45	0.34	0.19	0.22	0.82
t-stat	4.16	4.27	4.39	4.22	3.18	3.62	4.81
10th percentile	-3.07	-2.35	-2.60	-2.44	-2.84	-2.60	-2.04
50th percentile	0.13	0.09	0.01	-0.02	-0.12	-0.06	0.48
90th percentile	3.06	2.40	3.45	3.01	3.05	2.89	2.97
Percentage of funds with α >0	52.50	51.70	50.24	49.47	47.46	49.05	61.30
Percentage of funds with $t(\alpha)$ >2	4.26	5.04	8.82	7.08	5.21	5.93	11.74
Panel B: Achievable alpha with respect to long-only factors							
Average alpha	-0.02	-2.04	-2.32	-2.58	-3.60	-3.59	-1.33
t-stat	-0.44	-29.55	-37.74	-39.09	-53.06	-52.10	-22.18
Time-weighted average alpha	0.29	-1.32	-1.71	-1.96	-3.13	-3.12	-0.51
t-stat	4.01	-4.83	-4.88	-4.89	-4.91	-4.91	-4.46
10th percentile	-3.17	-6.36	-5.89	-6.49	-7.67	-7.64	-5.07
50th percentile	0.10	-1.37	-1.76	-1.95	-3.00	-3.00	-0.82
90th percentile	2.98	1.48	0.95	0.87	0.05	0.07	1.84
Percentage of funds with α >0	51.65	29.24	20.09	18.28	10.25	10.42	34.65
Percentage of funds with $t(\alpha)$ >2	3.85	2.01	0.75	0.85	0.27	0.24	2.76

fund alpha and the percentage of funds with positive alpha and t-statistic greater than two. Alphas are annualized and reported in percentage. As in Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range (difference between the 90th and 10th percentiles) away from the median.

Comparing Panels A and B of Table 5, we find that mutual-fund performance measured in terms of the achievable alpha (of a shortsale-constrained investor) with respect to the long-only versions of the factor models is substantially worse than that measured in terms of traditional alpha with respect to the long-short factor models. For instance, while the proportion of mutual funds with positive traditional alpha with respect to the long-short factor models ranges from 47.46% for HXZ to 61.30% for VANG, the proportion of mutual funds with positive achievable alpha with respect to the long-only models is 10.25% for HXZ and 34.65% for VANG.[16] This finding is robust to evaluating mutual-fund performance in terms of the alpha t-statistic. For instance, comparing the last rows in Panels A and B of Table 5, we find that while the proportion of mutual funds with significant ($t(\alpha) > 2$) traditional alpha with respect to the long-short factor models is 5.21% for HXZ and 11.74% for VANG, the proportion of mutual funds with significant achievable alpha with respect to the long-only models is only 0.27% for HXZ and 2.76% for VANG.

To facilitate the comparison with the closely related literature on mutual-fund skill (e.g., Berk and van Binsbergen, 2015; Barras et al., 2022), Table 5 evaluates fund performance in terms of *gross* alpha. However, it is also informative to evaluate mutual-fund performance in terms of net-of-fees alpha because this is the relevant economic criterion from an investor's perspective. Table IA.9 in Section IA.5 of the Internet Appendix shows that our findings are robust to evaluating mutual-fund performance in terms of net-of-fees alpha: the proportion of funds with positive achievable *net* alpha is substantially smaller than the proportion of funds with positive traditional net alpha.

Overall, the takeaway from the analysis in this section is that mutual-fund performance measured in terms of the achievable alpha of a shortsale-constrained investor with respect to the long-only versions of the factor models is substantially *worse* than that measured in terms of traditional alpha with respect to long-short factor models. Consequently,

[16] The CAPM is the only benchmark relative to which mutual-fund performance using the traditional alpha is similar to that using the achievable alpha. However, as shown in Figure 3, the CAPM is a weak benchmark compared to the other factor models. Observe also that the difference between the traditional and achievable alphas [and value-added] with respect to the CAPM in Panels A and B of Table 5 [and Table 6] are small but not zero. To understand the reason for this, note that we compute the alpha for each fund separately over the entire subsample of months for which we have return data for the fund. Although for our entire sample, it is optimal to long the market as shown in Panels A and B of Figure 2, for the specific subsamples for which we have data for some of the mutual funds, it is optimal to short the market. Therefore, for those specific mutual funds, the achievable and traditional alphas are different. This is illustrated in the first subfigure in Figure 4, which shows that the weight on the MKT for the CAPM model is zero for a very small percentage of mutual funds (the red bar is around 1%).

the value of active fund management for shortsale-constrained investors is much smaller than previously thought.

3.3.2 Achievable value-added

Berk and van Binsbergen (2015) explain the importance of measuring mutual-fund performance in terms of value-added, which they define as the average of the product between a fund's gross abnormal returns and its assets under management. Table 6 reports cross-sectional statistics for the traditional and achievable fund value-added (in January 2000 million dollars) with respect to the seven factor models listed in Table 3. For each fund, we compute the *traditional* value-added as the average of the product of assets under management and abnormal returns, obtained by regressing the fund returns on all factors in each model, and the *achievable* value-added computed using the fund abnormal returns with respect to only those factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio. We report the average value-added, its t-statistic, the time-weighted average value-added (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of value-added and the percentage of funds with positive average value-added. Value added is annualized.

Similar to Table 5 for traditional and achievable alphas, Table 6 contains two panels: Panel A reports the average traditional value-added for the long-short factor models, and Panel B the average achievable value-added for the long-only factor models. Consistent with the findings of Berk and van Binsbergen (2015), Panel A of Table 6 shows that the average *traditional* value-added in the cross-section of mutual funds is generally negative when computed with respect to conventional factor models, ranging from -0.98 million dollars for the FF5 model to -3.32 million dollars for the CAPM model, but it is positive with respect to the VANG model at 0.69 million dollars, with a significant t-stat of 3.51. Similarly, the time-weighted average traditional value-added is negative for all the conventional factor models, but positive with respect to the VANG model at 1.49 million dollars, with a significant t-stat of 3.97.[17]

[17]Note that we consider only funds investing in US equities, whereas Berk and van Binsbergen (2015) consider funds investing in all equities, that is, including international equities. As a result, their cross-sectional average value-added estimate is slightly larger than ours. In table 3 of their internet appendix, they show that the average value-added decreases when considering funds investing in only US equities.

Table 6: Traditional and achievable mutual-fund value-added

This table reports cross-sectional statistics for the traditional and achievable fund value-added with respect to the seven factor models listed in Table 3. Panel A reports cross-sectional statistics for the traditional value-added computed as the average of the product of assets under management and abnormal returns, obtained by regressing the fund returns on all long-short factors in each model, and Panel B the achievable value-added computed using the fund abnormal returns with respect to just those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). We report the average value-added, its t-statistic, the time-weighted average value-added (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of value-added and the percentage of funds with positive average value-added. Value added is annualized and expressed in January 2000 million dollars. Like Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range away from the median.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional value-added with respect to long-short factors							
Average value-added	-3.32	-1.33	-0.98	-1.26	-2.51	-2.08	0.69
t-stat	-12.57	-6.55	-4.02	-6.00	-11.00	-9.77	3.51
Time-weighted average value-added	-3.60	-0.99	-0.97	-1.29	-2.79	-2.26	1.49
t-stat	-4.60	-3.18	-2.83	-3.67	-4.52	-4.38	3.97
10th percentile	-15.84	-9.72	-9.70	-9.64	-11.78	-11.04	-6.26
50th percentile	-0.73	-0.45	-0.45	-0.52	-0.72	-0.63	-0.08
90th percentile	4.22	4.52	6.44	4.92	3.83	3.96	8.29
% of funds with average value-added >0	31.59	33.44	34.94	32.57	30.21	30.98	45.70
Panel B: Achievable value-added with respect to long-only factors							
Average value-added	-3.49	-7.02	-10.38	-10.02	-16.60	-16.53	-5.66
t-stat	-12.95	-18.17	-24.73	-24.94	-28.47	-28.42	-17.82
Time-weighted average value-added	-3.72	-7.38	-12.56	-12.07	-21.24	-21.18	-5.15
t-stat	-4.61	-4.80	-4.91	-4.91	-4.94	-4.94	-4.70
10th percentile	-16.42	-25.73	-30.50	-30.38	-46.56	-46.22	-20.86
50th percentile	-0.80	-2.28	-3.27	-3.40	-5.30	-5.30	-1.87
90th percentile	4.11	1.55	0.10	0.11	-0.16	-0.15	1.68
% of funds with average value-added >0	30.52	18.33	11.56	11.64	6.23	6.61	19.00

Comparing Panels A and B in Table 6, the key insight is that, consistent with the results in the previous section based on achievable and traditional alphas, the performance of mutual funds based on achievable value-added is substantially worse than that in terms of traditional value-added. For instance, we find that while in Panel A the *proportion* of mutual funds with positive traditional value-added with respect to the long-short factor models ranges from 30.21% for HXZ to 45.70% for VANG, in Panel B the proportion of mutual funds with positive achievable value-added with respect to the long-only models is only 6.23% for HXZ and 19.00% for VANG. Also, while Panel A shows that the average and time-weighted average *traditional* value-added with respect to the VANG model are positive, consistent with Berk and van Binsbergen (2015), Panel B shows that the average and time-weighted average *achievable* value-added with respect to the VANG model are both significantly negative.[18]

3.3.3 Discussion: Why is achievable performance worse?

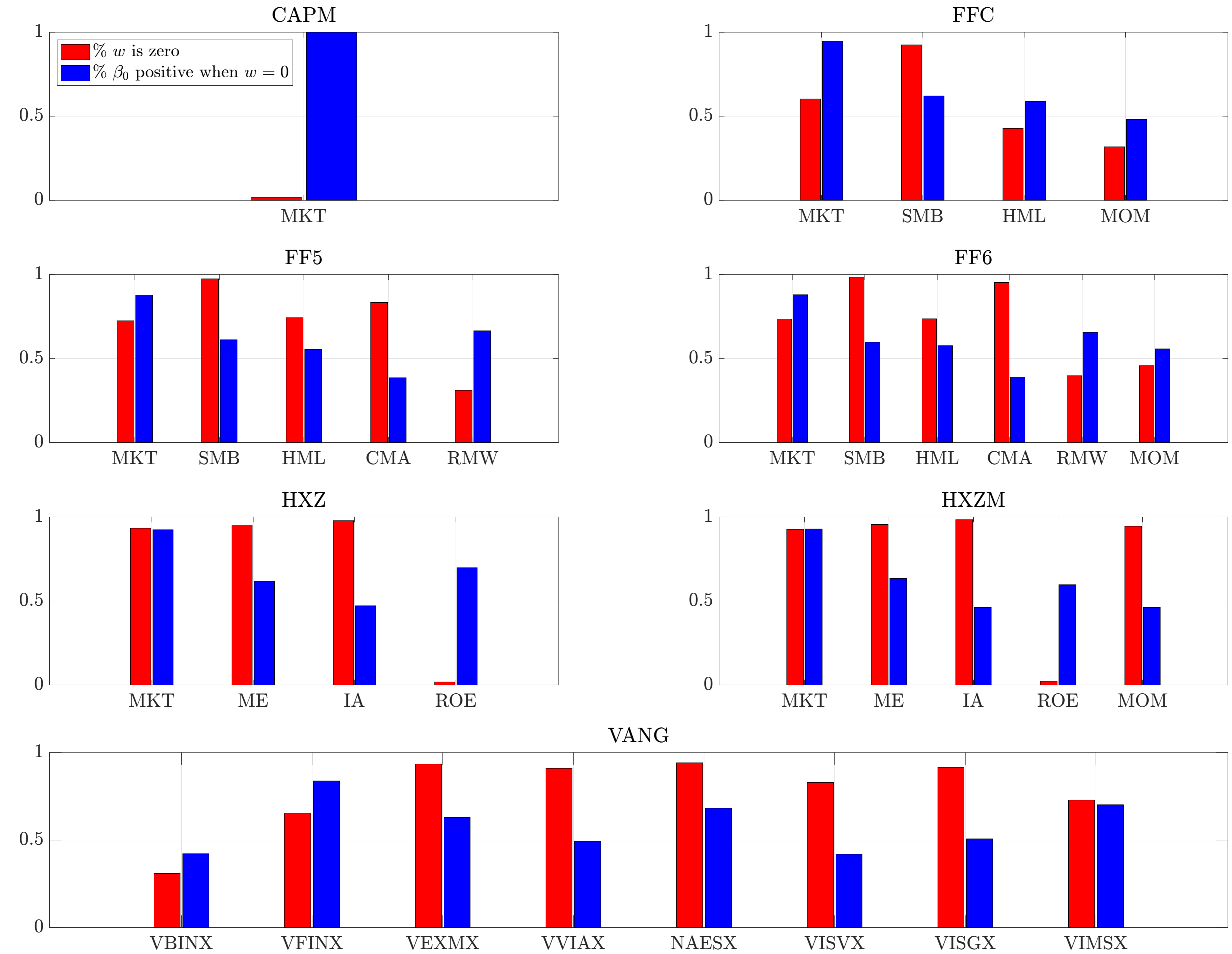
Our results consistently show that the achievable alpha and value-added are smaller than their traditional counterparts for the long-only version of the factor models. This is a counter-intuitive finding because we compute the achievable alphas by dropping from the benchmark the factors with zero weight in the shortsale-constrained mean-variance portfolio, and one would expect that dropping factors from the benchmark would lead to higher estimated abnormal returns. However, Proposition 3 shows that if a fund has positive exposure to the factors with a zero weight in the shortsale-constrained mean-variance portfolio, then the achievable alpha is smaller than the traditional alpha; the numerical example following the proposition illustrates the economic intuition for this result. In this section, we show that benchmark factors often have zero weight in the mean-variance portfolio, and that mutual funds often have positive exposure to the factors with zero weight in the mean-variance portfolio.

Figure 4 depicts several statistics for the regression of fund returns on the returns of the long-only benchmark factor models. Each panel reports the results for the long-only version of the seven models in Table 3. For each factor in each panel, we report the proportion of funds for which the factor has a zero weight in the shortsale-constrained mean-variance portfolio of the benchmark factors for the sample period for which we have return data for the fund (red bars). We also report the proportion of funds for which the loading on a factor with zero weight in the shortsale-constrained mean-variance portfolio is positive (blue bars). The red bars show that, except for the CAPM, many factors often have a zero weight in the mean-variance portfolio. For instance, for FFC, both MKT and SMB have zero weight in the mean-variance portfolio for more than 50% of the mutual funds. Similarly, for HXZM, we observe that MKT, ME, IA, and MOM have zero weight for almost 100% of

[18]Section IA.4 of the Internet Appendix shows that our findings are robust to estimating value-added using the flexible and bias-adjusted approach of Barras et al. (2022).

Figure 4: Statistics from regression of fund returns on long-only factors

This figure depicts several statistics for the regression of fund returns on the returns of the long-only benchmark factor models. Each panel reports the results for the long-only version of the seven models in Table 3. For each factor in each panel, we report the proportion of funds for which the factor has a zero weight in the shortsale-constrained mean-variance portfolio of the benchmark factors for the sample period for which we have return data for the fund (red bars). We also report the proportion of funds for which the loading on a factor with zero weight in the shortsale-constrained mean-variance portfolio is positive (blue bars). The legend for the figure is displayed in the first plot (for CAPM).



the funds. For VANG, we also observe that every factor except VBINX has zero weight in the mean-variance portfolio for more than 50% of the mutual funds. In addition, the blue bars show that many mutual funds have positive exposure to factors with zero weight in the mean-variance portfolio. For instance, for FFC, FF5, and FF6, we observe that conditional on the MKT and SMB factors having a zero weight in the mean-variance portfolio for the sample period for which we have data for a fund, more than 50% of the funds have positive exposure to MKT and SMB.

Figure 5: Contribution of each factor to alpha deterioration

This figure depicts the contribution of each factor to the difference between the traditional and achievable alphas averaged across all funds using Equation (5). Each panel reports the results for the long-only version of the seven models in Table 3.

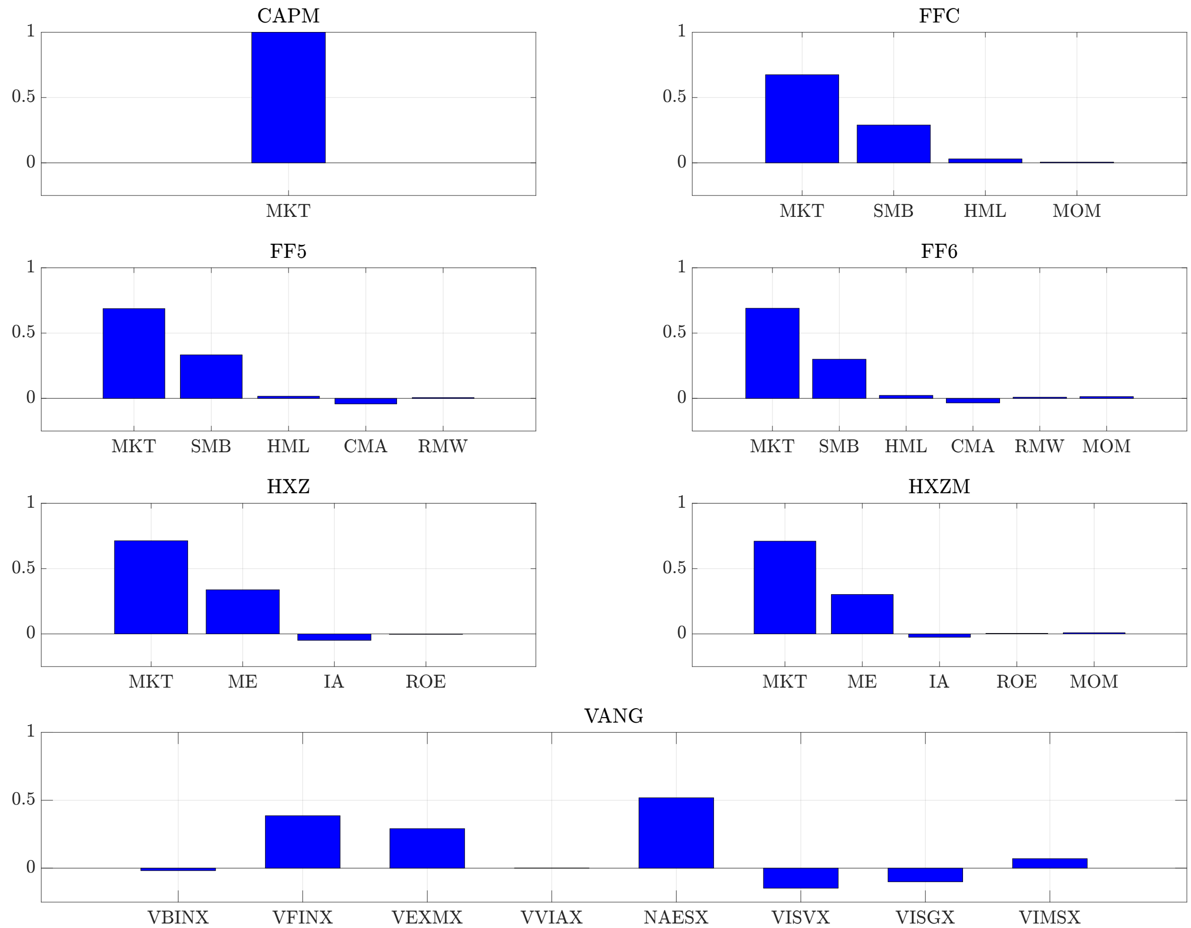


Figure 5 reports the contribution of the kth factor to the difference between the traditional and achievable alphas averaged across all N funds. We compute the contribution of each factor using the following expression based on Equation (4) of Proposition 3:

$$\text{Contribution of } k\text{th factor} = \frac{\sum_{n=1}^{N}(-\beta_{\mathcal{T},0,k,n}\alpha_{0,+,k})}{\sum_{n=1}^{N}(-\beta_{\mathcal{T},0,n}\alpha_{0,+})} = \frac{\sum_{n=1}^{N}(-\beta_{\mathcal{T},0,k,n}\alpha_{0,+,k})}{\sum_{n=1}^{N}\sum_{k}^{K_0}(-\beta_{\mathcal{T},0,k,n}\alpha_{0,+,k})}, \tag{5}$$

where $\alpha_{0,+}$ is the intercept from regressing the factors with zero weight in the shortsale-constrained mean-variance portfolio on those with positive weight, $\beta_{\mathcal{T},0,n}$ is the slope on the factors with zero weight in the shortsale-constrained mean-variance portfolio from regressing the nth fund returns on the benchmark factor returns, and $\alpha_{0,+,k}$ and $\beta_{\mathcal{T},0,k,n}$ are their kth elements. Figure 5 shows that the market and size factors contribute most to the difference between the traditional and achievable alphas. The intuition for this is that they not only often have a zero weight in the mean-variance portfolio and the mutual funds have a positive beta on them, but also that they have a large negative alpha with respect to the other factors in the model. In particular, note that the factors with the largest contribution to the difference in traditional and achievable alpha are the MKT and SMB factors for the FFC, FF5, and FF6 models, MKT and ME for the HXZ and HXZM models, and the VFINX (large-cap blend), VEXMX (mid-cap blend), and NAESX (small-cap blend) funds for the VANG model.

Taken together, Proposition 3 and Figures 4 and 5 identify precisely why achievable alpha and value-added tend to be smaller than their traditional counterparts in our sample.

3.3.4 Relative performance of funds

The previous sections show that the *average* performance of mutual funds deteriorates significantly from the perspective of shortsale-constrained investors. In this section, we examine whether the *relative* performance of different mutual funds changes for shortsale-constrained investors.

To do this, we sort mutual funds into deciles based on either the traditional or the achievable metric (alpha or value-added). This is an economically relevant classification because investors often allocate capital to mutual funds based on their Morningstar rating (Del Guercio and Tkac, 2008).[19] Then, we count the number of mutual funds that are assigned to different deciles when sorted using the traditional versus the achievable metric:

$$\text{Diff} = \frac{1}{N} \sum_{n \in N} \delta(d_T(n) \neq d_A(n)), \tag{6}$$

where $\delta(\cdot)$ is an indicator function equal to one if the condition is true and zero otherwise, $d_T(n)$ and $d_A(n)$ is the decile of the nth fund when sorted using the traditional or achievable metric, and N is the number of funds. The value of "Diff" ranges between zero and one, with zero indicating that every mutual fund is assigned to the same decile in both rankings and one indicating that every mutual fund is assigned to a different decile in the two rankings.

Table 7 presents the differences between mutual-fund deciles based on traditional versus achievable alpha and value-added, as measured by the variable Diff in Equation (6).

[19] Del Guercio and Tkac (2008, p. 907) explain that "It is the discrete change in the star rating itself and not the change in the underlying performance measures that drives flow."

Table 7: Difference between deciles based on traditional and achievable metrics

This table reports the percentage of funds whose decile rank changes when, instead of sorting funds by their traditional alpha and value-added computed with respect to the long-short version of the seven factor models listed in Table 3, we sort the funds by their achievable alpha (Panel A) and achievable value-added (Panel B) with respect to the long-only version of the seven factor models. For each factor model, we report the measure Diff defined in Equation (6) as a percentage.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Difference in deciles based on alpha							
Diff (%)	4.83	77.93	81.54	82.29	83.38	82.87	73.25
Panel B: Difference in deciles based on value-added							
Diff (%)	3.55	76.25	85.74	83.30	84.87	85.27	80.28

Panel A reports results for alpha, and Panel B for value-added. In both panels, more than 70% of funds shift to a different decile under every factor model except CAPM. This indicates that relative fund performance looks substantially different from the viewpoint of a short-sale-constrained investor, with important implications for capital flows, which are known to depend on relative performance (Sirri and Tufano, 1998; Del Guercio and Tkac, 2008).

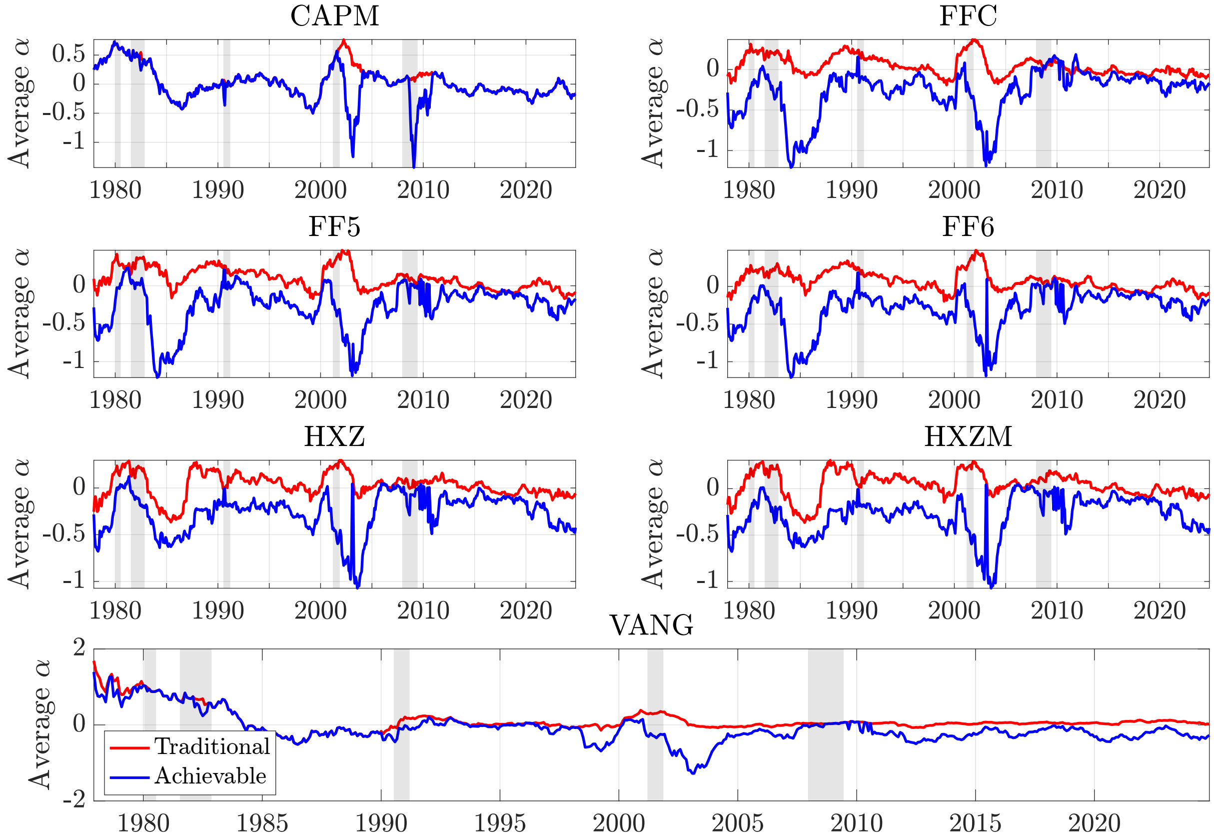
3.3.5 Time Series of Traditional and Achievable Alphas

Above, we showed that there is a substantial difference between the traditional and achievable alphas. To understand whether this difference varies with macroeconomic conditions, Figure 6 depicts the time series of the cross-sectional average traditional and achievable alpha computed on a 36-month rolling window for the seven models in Table 3. Our choice of a 36-month rolling window is motivated by Morningstar and other investment platforms that often report mutual-fund performance over the past three years. The traditional alpha is computed with respect to all long-short factors for each model and the achievable alpha with respect to just those long-only factors that have a positive weight in the shortsale-constrained mean-variance portfolio. Gray shaded areas represent NBER recession periods.

Figure 6 shows that the difference between the average traditional and achievable alphas widens during periods of financial turmoil such as the two back-to-back recessions in 1980 and 1981–82, the dot-com bubble of the early 2000's, the Great Financial Crisis of 2009, and the COVID pandemic. This implies that the difference between traditional and achievable alpha is particularly significant during periods of financial crises, when shortsale constraints are likely to be more binding.

Figure 6: Time series of traditional and achievable alpha

This figure depicts the time series of the cross-sectional average traditional and achievable alpha computed on a 36-month rolling window for the seven models in Table 3. The traditional alpha is computed with respect to all long-short factors for each model and the achievable alpha with respect to just those long-only factors that have a positive weight in the shortsale-constrained mean-variance portfolio. Gray-shaded areas represent NBER recession periods.



We also formally estimate the relationship between (i) the difference between the traditional alpha and the achievable alpha, and (ii) market risk, using the following panel regression:

$$\Delta\alpha_{mf,b,t} = \beta \cdot \text{Risk}_t + B_b + \text{MF}_{mf} + \varepsilon_{mf,b,t}, \tag{7}$$

where $\Delta\alpha_{mf,b,t}$ is the difference between the traditional and achievable alpha of mutual fund mf estimated under model b at time t, Risk_t is the market volatility estimated from monthly market returns over the prior 36-month period at time t, B_b represents model fixed effects to account for systematic differences across benchmark models, MF_{mf} represents mutual fund fixed effects to capture fund-specific characteristics, and $\varepsilon_{mf,b,t}$ is the idiosyncratic error term.

Table 8 reports the slope coefficient for the market-risk variable in (7), along with its standard error and the regression R-squared. The independent variable is standard-

Table 8: Difference in alphas during periods of financial turmoil

This table reports the slope coefficient for the market-risk variable in (7), along with its standard error and the regression R-squared. The independent variable is standardized, allowing the coefficients to be interpreted as the change in the difference between the traditional and achievable alphas (in basis points) resulting from a one-standard-deviation increase in market volatility. The first seven columns report the results for pooled regressions for each model, and the eighth column across all models. Model fixed effects are included only for the pooled regression across all models. Standard errors are clustered by fund.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG	ALL
Slope (bps)	11.640	5.142	10.336	9.870	11.500	12.612	8.586	9.955
Standard errors (bps)	0.116	0.230	0.235	0.232	0.253	0.247	0.218	0.186
Model FE	No	No	No	No	No	No	No	Yes
Fund FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared (%)	12.287	1.693	4.677	4.265	8.273	9.569	4.594	5.234

ized, allowing the coefficients to be interpreted as the change in the difference between the traditional and achievable alphas (in basis points) resulting from a one-standard-deviation increase in market volatility. The first seven columns report the results for pooled regressions for each model, and the eighth column across all models. Table 8 shows that the effect of a one-standard-deviation increase in market volatility on the difference between the traditional and achievable alphas is significantly positive for every model, ranging from 5.142 basis points for the FFC model to 12.612 basis points for the HXZM model. This confirms the observation from Figure 6 that the difference between the traditional and achievable alphas increases with market volatility, i.e., during periods of financial crises.

4 Economic Implications of Achievable Alpha

In this section, we examine the economic implications of the distinction between the achievable and traditional alphas for two central questions in mutual-fund research. First, we study the importance of traditional and achievable alphas in predicting future mutual-fund flows. Second, we study how the skill and scalability of mutual funds depend on whether one estimates them using traditional or achievable alphas.

4.1 Fund Flows

We now study whether past performance—measured by either traditional or achievable alpha—explains future mutual-fund flows, and how the relative importance of these two alphas is affected by macroeconomic conditions. This analysis allows us to test whether investors are using traditional or achievable alpha (or both) when making mutual-fund investment decisions.

We define the flows for fund mf in month t as the percentage growth of new assets:

$$\text{Flow}_{mf,t} = \frac{\text{TNA}_{mf,t} - \text{TNA}_{mf,t-1} \times (1 + R_{rf,t} + R_{mf,t})}{\text{TNA}_{mf,t-1}}, \tag{8}$$

where $\text{TNA}_{mf,t}$ are the total net assets under management of mutual fund mf at the end of month t, $R_{rf,t}$ is the risk-free return, and $R_{mf,t}$ is the mutual-fund return in excess of the risk-free rate.

To study the relation between past performance and fund flows, we run the following panel regression for each benchmark model:

$$\text{Flow}_{mf,t} = a \cdot \alpha_{mf,t-1} + \text{T}_t + \text{MF}_{mf} + \epsilon_{mf,t}, \tag{9}$$

where $\alpha_{mf,t-1}$ is the alpha of fund mf estimated using the returns of the 36 prior months, T_t are time fixed effects, MF_{mf} are mutual-fund fixed effects, and $\epsilon_{mf,t}$ is the error term.[20]

We run panel regression (9) first considering the traditional and achievable alphas individually, and then including both jointly as explanatory variables. Panel A of Table 9 reports the results from estimating the panel regression (9) considering the traditional alpha individually. Consistent with the existing literature, for every model we find that the traditional alpha is highly significant in explaining mutual-fund flows, with t-statistics above 20. Moreover, we also find that, consistent with Barber, Huang, and Odean (2016) and Berk and van Binsbergen (2016), the CAPM traditional alpha explains mutual-fund flows at least as well as any of the other models, with an R-squared value of 1.670%, which is higher than those of the other models.

Panel B of Table 9 reports the results from estimating the panel regression (9) considering the *achievable* alpha individually. As for the traditional alpha, we find that for every model, achievable alpha is highly significant in explaining mutual-fund flows, with t-statistics above 10. In addition, we also find that the CAPM *achievable* alpha explains mutual-fund flows at least as well as the achievable alphas of the other models, with an R-squared value of 1.586%, which is higher than those of the other models.

[20] We account for time and fund fixed effects by first subtracting the time-series average and then the cross-sectional average of our flow and alpha variables.

Table 9: Achievable and Traditional Alphas and Fund Flows

This table reports slope coefficients and their t-statistics for several versions of panel regression (9). Panel A considers the regression of fund flows on traditional alpha, Panel B the regression of fund flows on achievable alpha, Panel C the regression of fund flows jointly on traditional and achievable alphas, and Panel D the regression of fund flows jointly on traditional and achievable alphas and their interactions with a "Risk" indicator variable that takes a value of one for months in the top decile of months sorted by realized market volatility in the prior 36 months, and zero otherwise. For all regressions, we consider time and fund fixed effects, control for lagged values of fund flows up to 12 months, and double-cluster standard errors by time and fund. Fund flows and alphas are scaled by their full-sample standard deviation, computed across all fund-month observations.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional alpha							
Slope	0.129	0.137	0.119	0.114	0.127	0.129	0.116
	[26.650]	[34.519]	[24.253]	[23.964]	[22.737]	[32.361]	[24.921]
R-squared (%)	1.670	1.864	1.412	1.307	1.607	1.658	1.336
Panel B: Achievable alpha							
Slope	0.124	0.115	0.119	0.117	0.123	0.120	0.119
	[13.250]	[12.714]	[12.768]	[12.706]	[12.722]	[12.624]	[13.874]
R-squared (%)	1.549	1.330	1.427	1.379	1.502	1.444	1.420
Panel C: Traditional and achievable alpha							
Slope $\alpha_{\mathcal{T}}$	0.125	0.109	0.077	0.074	0.081	0.088	0.064
	[6.401]	[17.034]	[14.242]	[13.628]	[10.188]	[15.081]	[9.886]
Slope $\alpha_{\mathcal{A}}$	0.005	0.039	0.079	0.080	0.067	0.063	0.075
	[0.235]	[5.007]	[15.448]	[15.918]	[8.213]	[9.698]	[9.174]
R-squared (%)	1.670	1.942	1.859	1.795	1.849	1.888	1.642
Panel D: Traditional and achievable alpha with risk-interaction terms							
Slope $\alpha_{\mathcal{T}}$	0.129	0.111	0.079	0.076	0.084	0.091	0.068
	[6.379]	[16.625]	[13.566]	[13.137]	[10.613]	[15.590]	[9.759]
Slope $\alpha_{\mathcal{A}}$	-0.004	0.036	0.076	0.077	0.062	0.059	0.071
	[-0.171]	[4.622]	[14.604]	[15.204]	[8.027]	[9.364]	[8.698]
Slope $\alpha_{\mathcal{T}}\times$Risk	-0.041	-0.017	-0.024	-0.022	-0.022	-0.026	-0.022
	[-2.295]	[-2.013]	[-3.686]	[-3.499]	[-3.131]	[-4.608]	[-2.701]
Slope $\alpha_{\mathcal{A}}\times$Risk	0.056	0.023	0.030	0.027	0.035	0.034	0.027
	[3.092]	[2.983]	[5.068]	[4.514]	[5.722]	[6.165]	[4.037]
R-squared (%)	1.698	1.956	1.893	1.824	1.903	1.938	1.669

To study whether achievable alpha contains information about mutual-fund flows that is independent from that in traditional alpha, Panel C of Table 9 reports the results from estimating the panel regression (9) considering *jointly* the traditional and achievable alphas. We find that both traditional and achievable alphas are generally highly significant, with t-statistics exceeding five across models, except for the CAPM. Moreover, we find that the R-squared values in Panel C are higher than those in Panels A and B for every model except the CAPM. These findings demonstrate that traditional and achievable alphas contain independent information and suggest that at least some investors use achievable alpha to make investment decisions.

To examine whether the relative importance of traditional and achievable alphas to explain fund flows depends on market conditions, Panel D of Table 9 reports the results from estimating a panel regression that considers jointly the traditional and achievable alphas and includes *also* their interactions with a "Risk" indicator variable that takes a value of one for months in the top decile of months sorted by realized market volatility in the prior 36 months, and zero otherwise. We find that the sensitivity of fund flows to traditional alpha generally *weakens* during periods of elevated market volatility, with the coefficient on the interaction between past traditional alpha and the Risk indicator variable being significantly negative for every model. In contrast, the relation between fund flows and achievable alpha *strengthens* when market volatility is high, with the coefficient for the interaction between the past achievable alpha and the Risk indicator variable being significantly positive for every model. These findings suggest that investors believe that achievable alpha is a more informative measure of future performance during periods of financial turmoil, and thus, during such periods, they allocate more capital to funds with high achievable alpha.

4.2 Skill and Scalability

We now compare the skill and scalability of mutual funds estimated using traditional and achievable alphas. To do this, we use the flexible and bias-adjusted econometric approach of Barras, Gagliardini, and Scaillet (2022), who write a fund's realized gross alpha at time t as a function of its skill and scalability:

$$\alpha_{mf,t} = a_{mf} - b_{mf} \times \text{TNA}_{mf,t-1}, \tag{10}$$

where a_{mf} and b_{mf} are the skill and scalability parameters for fund mf, and $\text{TNA}_{mf,t-1}$ is the total net assets (in year 2000 dollars) of fund mf at time $t-1$. Note that while a larger a_{mf} indicates higher skill, a larger b_{mf} implies lower scalability. For each fund, we estimate the time-series regression in equation (5) of Barras et al. (2022) separately for the cases with traditional and achievable realized alphas.

Table 10 reports cross-sectional statistics for the skill and scalability parameters obtained from the traditional and achievable alphas. Panel A shows that the average skill computed using the traditional and achievable alpha are not very different. In particu-

Table 10: Achievable skill and scalability

This table reports cross-sectional statistics for the scale and scalability parameters estimated from the traditional and achievable alphas using the approach of Barras et al. (2022), with respect to the seven factor models listed in Table 3. For each fund, we estimate the time-series regression in equation (5) of Barras et al. (2022) separately for the cases with traditional and achievable realized alphas. We report the average scale and scalability parameters across funds, their t-statistic, the time-weighted average scale and scalability parameters, where the weight is proportional to the length of the sample period for which we have return data for the fund, and their t-statistic. We also report percentiles of the cross-sectional distribution of fund scale and scalability parameters and the percentage of funds with positive scale and scalability parameters and t-statistic greater than two. Scale and scalability parameters are annualized and reported in percentage. Like Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range (difference between the 90th and 10th percentiles) away from the median.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Skill based on traditional alpha							
Average	3.88	2.30	2.48	2.31	2.68	2.47	2.67
T-stat	34.96	30.89	28.44	28.75	28.29	29.50	31.49
10th percentile	-1.54	-1.61	-1.95	-1.87	-2.18	-1.99	-1.46
50th percentile	3.26	2.21	2.16	2.06	2.23	2.23	2.41
90th percentile	10.19	6.55	7.48	6.90	7.99	7.40	7.39
Percentage funds $a > 0$	80.45	77.58	74.68	74.87	74.26	74.25	79.56
Panel B: Skill based on achievable alpha							
Average	3.92	2.07	2.11	1.25	1.25	1.18	3.24
T-stat	34.57	17.42	16.02	10.75	10.15	9.66	23.72
10th percentile	-1.53	-3.48	-3.83	-4.30	-4.54	-4.63	-2.95
50th percentile	3.36	1.91	1.52	1.01	0.74	0.72	2.60
90th percentile	10.30	7.99	8.47	7.02	7.47	7.25	10.15
Percentage funds $a > 0$	80.47	68.23	65.70	61.70	57.19	57.10	73.38
Panel C: Scale based on traditional alpha							
Average	57.65	34.33	35.59	34.97	38.96	36.61	30.65
T-stat	20.03	16.56	15.94	17.16	16.67	16.95	14.61
10th percentile	-5.39	-5.07	-6.50	-3.51	-8.56	-9.29	-5.62
50th percentile	128.97	99.19	107.07	89.74	108.20	102.77	56.66
90th percentile	320.05	231.00	248.49	224.65	257.99	241.81	204.05
Percentage funds $b > 0$	88.80	87.78	86.14	87.60	87.04	86.51	85.46
Panel C: Scale based on achievable alpha							
Average	59.78	62.15	60.51	56.77	74.22	72.60	66.71
T-stat	20.61	18.18	18.38	17.55	19.70	19.52	18.40
10th percentile	-3.16	-10.47	-8.63	-11.20	-14.44	-14.95	-12.62
50th percentile	135.94	94.40	111.20	96.74	75.72	75.22	117.65
90th percentile	325.86	353.28	347.24	335.52	383.79	379.54	385.43
Percentage funds $b > 0$	87.87	83.98	85.60	84.84	83.68	84.25	85.22

lar, we observe that while the average skill computed using achievable alpha is smaller for some factor models (FF5, FF6, HXZ, HXZM), it is larger for others (FFC and VANG). In contrast, Panel B shows that the average scale parameter b *increases* substantially (almost doubles) when estimated from achievable alpha for every model except CAPM. This increase in b suggests that the trading strategies of active mutual funds are *less scalable* from the perspective of a shortsale-constrained investor, and that their returns decline more steeply as scale increases. Overall, these findings indicate that accounting for shortsale constraints substantially reduces the scalability of mutual-fund strategies.

5 Conclusion

The traditional performance-evaluation literature evaluates mutual funds by their alpha relative to benchmark factors. Yet when benchmarks include short positions, this alpha is unattainable for the 88% of fund assets held by retail investors, who are effectively shortsale constrained. We propose a simple alternative: *achievable alpha*, defined as the fund's alpha with respect to only those benchmark factors that carry positive weights in the constrained mean-variance portfolio.

Theoretically, we show that achievable alpha captures the marginal utility gain of constrained investors. While one might expect achievable alpha to exceed traditional alpha, because achievable alpha is measured with respect to a benchmark restricted to only long positions, we identify the precise condition under which achievable alpha can be smaller: when a fund loads positively on underperforming factors excluded from the constrained benchmark. Intuitively, unconstrained investors can short these factors to hedge risk and expand fund holdings, whereas constrained investors cannot, thereby reducing the optimal allocation to mutual funds and the resulting fund alpha.

Empirically, we evaluate mutual funds against seven benchmark models and find that performance is far worse from the perspective of constrained investors: while the proportion of mutual funds with positive traditional gross-of-fees alpha ranges from 47% for HXZ to 61% for VANG, the proportion of mutual funds with positive achievable alpha is only 10% for HXZ and 35% for VANG. These striking results are robust to measuring mutual-fund performance in terms of the value-added measure of Berk and van Binsbergen (2015). Moreover, the gap between traditional and achievable alphas widens during episodes of market turmoil, when constraints bind most tightly. Both traditional and achievable alphas predict fund flows, but during volatile periods, the sensitivity of flows to traditional alpha weakens, while the sensitivity to achievable alpha strengthens. Investors, therefore, appear to regard achievable alpha as the more credible signal of future performance in turbulent markets. We also find that active strategies are far less scalable for shortsale-constrained investors.

Our findings matter for research, practice, and policy. For academics, they demonstrate that conventional measures of skill are inconsistent with investor constraints and overstate the value of active management. For practitioners and platforms, they show that reporting should incorporate achievable alpha, especially for clientele who do not short. For regulators, they underscore the importance of disclosure standards that reflect the frictions faced by retail investors and pension funds. More broadly, our results bridge the mutual-fund and asset-pricing literatures by showing that ignoring shortsale constraints can severely bias inferences about the value of active management.

A Appendix: Proofs of Propositions

In this section, we provide the proof for each proposition in the main text.

A.1 Proof of Proposition 1

The return of a portfolio in excess of the risk-free rate combines the return from the mean-variance portfolio combination of the benchmark factors and the excess return of the fund, that is,

$$R_{p,t} = w_b^\top R_{b,t} + w_{mf} R_{mf,t}, \tag{A1}$$

where $R_{b,t}$ is the K-dimensional vector of benchmark excess returns at time t with mean μ_b and covariance matrix Σ_b, w_b is the portfolio of benchmark factors, $R_{mf,t}$ is the mutual-fund excess return at time t, and w_{mf} is the weight on the fund. In addition, and without loss of generality, the fund's excess return is defined according to a linear factor model as

$$R_{mf,t} = \alpha_{\mathcal{T}} + \beta R_{b,t} + \epsilon_{b,t}, \tag{A2}$$

where $\epsilon_{b,t}$ is a zero-mean random variable with standard deviation σ_ϵ. Therefore, we can redefine the portfolio excess return as

$$R_{p,t} = (\underbrace{w_b + w_{mf}\beta_i}_{=\widetilde{w}_b})^\top R_{b,t} + w_{mf}(\alpha_{\mathcal{T}} + \epsilon_{b,t}). \tag{A3}$$

Because $R_{b,t}$ and $(\alpha_{\mathcal{T}} + \epsilon_{b,t})$ are uncorrelated by construction, we can optimize $\widetilde{w}_b$ and w_{mf} independently. Accordingly, define the investor's mean-variance utility from investing in the benchmark factors and the mutual fund as

$$\mathbb{E}\left[\widetilde{w}_b^\top R_{b,t} + w_{mf}(\alpha_{\mathcal{T}} + \epsilon_{b,t})\right] - \frac{\gamma}{2}\mathrm{Var}\left[\widetilde{w}_b^\top R_{b,t} + w_{mf}(\alpha_{\mathcal{T}} + \epsilon_{b,t})\right], \tag{A4}$$

where γ is the investor's relative risk-aversion parameter. Thus, the derivative of the investor's mean-variance utility with respect to w_{mf} is:

$$\frac{\partial\left\{\mathbb{E}\left[\widetilde{w}_b^\top R_{b,t} + w_{mf}(\alpha_{\mathcal{T}} + \epsilon_{b,t})\right] - \frac{\gamma}{2}\mathrm{Var}\left[\widetilde{w}_b^\top R_{b,t} + w_{mf}(\alpha_{\mathcal{T}} + \epsilon_{b,t})\right]\right\}}{\partial w_{mf}} = \alpha_{\mathcal{T}} - \gamma w_{mf}\sigma_\epsilon^2, \tag{A5}$$

and evaluating the derivative at $w_{mf} = 0$ gives $\alpha_{\mathcal{T}}$, which completes the proof. □

A.2 Proof of Proposition 2

Let the weights of the shortsale-constrained mean-variance portfolio of the benchmark factors be $w_b^* = (w_{b_+}^*, w_{b_0}^*)$, where $w_{b_+}^* > 0$ and $w_{b_0}^* = 0$. The investor's mean-variance utility for any portfolio w is

$$\text{MVU}(w) = \begin{bmatrix} \mu_{b_+}^\top & \mu_{b_0}^\top & \mu_{mf}^\top \end{bmatrix} w - \frac{\gamma}{2} w^\top \begin{bmatrix} \Sigma_{b_+} & \Sigma_{b_+,b_0} & \Sigma_{b_+,mf} \\ \Sigma_{b_0,b_+} & \Sigma_{b_0} & \Sigma_{b_0,mf} \\ \Sigma_{mf,b_+} & \Sigma_{mf,b_0} & \Sigma_{mf} \end{bmatrix} w.$$

Once the investor has access to the fund, the portfolio $w_0 = (w_{b_+}^*, w_{b_0}^* = 0, w_{mf} = 0)$ is no longer mean-variance efficient for her. Assuming the investor is currently holding the shortsale-constrained mean-variance portfolio of the benchmark factors w_0, she would maximize the marginal improvement to her mean-variance utility by shifting her portfolio in the direction of the gradient of her mean-variance utility evaluated at w_0, that is, by shifting her portfolio as follows:

$$w = w_0 + \delta \nabla_w \text{MVU}(w_0), \tag{A6}$$

where δ is infinitesimally small and $\nabla_w \text{MVU}(w_0)$ is the gradient of the investor's mean-variance utility evaluated at w_0. Moreover,

$$\nabla_w \text{MVU}(w) = \begin{bmatrix} \mu_{b_+} \\ \mu_{b_0} \\ \mu_{mf} \end{bmatrix} - \gamma \begin{bmatrix} \Sigma_{b_+} & \Sigma_{b_+,b_0} & \Sigma_{b_+,mf} \\ \Sigma_{b_0,b_+} & \Sigma_{b_0} & \Sigma_{b_0,mf} \\ \Sigma_{mf,b_+} & \Sigma_{mf,b_0} & \Sigma_{mf} \end{bmatrix} \begin{bmatrix} w_{b_+} \\ w_{b_0} \\ w_{mf} \end{bmatrix}. \tag{A7}$$

Therefore, the gradient evaluated at w_0 is

$$\nabla_w \text{MVU}(w_0) = \begin{bmatrix} \mu_{b_+} \\ \mu_{b_0} \\ \mu_{mf} \end{bmatrix} - \gamma \begin{bmatrix} \Sigma_{b_+} & \Sigma_{b_+,b_0} & \Sigma_{b_+,mf} \\ \Sigma_{b_0,b_+} & \Sigma_{b_0} & \Sigma_{b_0,mf} \\ \Sigma_{mf,b_+} & \Sigma_{mf,b_0} & \Sigma_{mf} \end{bmatrix} \begin{bmatrix} w_{b_+}^* \\ 0 \\ 0 \end{bmatrix} \tag{A8}$$

$$= \begin{bmatrix} \mu_{b_+} - \gamma \Sigma_{b_+} w_{b_+}^* \\ \mu_{b_0} - \gamma \Sigma_{b_0,b_+} w_{b_+}^* \\ \mu_{mf} - \gamma \Sigma_{mf,b_+} w_{b_+}^* \end{bmatrix}. \tag{A9}$$

Note that $w_b^* = (w_{b_+}^*, w_{b_0}^* = 0)$ is the shortsale-constrained mean-variance portfolio for the case where the investor does not have access to the fund. Thus, the first-order optimality conditions for the investor without access to the fund imply that $\mu_{b_+} - \gamma \Sigma_{b_+} w_{b_+}^* = 0$, $\mu_{b_0} - \gamma \Sigma_{b_0,b_+} w_{b_+}^* \leq 0$, and $w_{b_+}^* = \frac{1}{\gamma} \Sigma_{b_+}^{-1} \mu_{b_+}$. Consequently

$$\nabla_w \text{MVU}(w_0) = \begin{bmatrix} 0 \\ \mu_{b_0} - \gamma \Sigma_{b_0,b_+} w_{b_+}^* \leq 0 \\ \mu_{mf} - \Sigma_{mf,b_+} \Sigma_{b_+}^{-1} \mu_{b_+} \end{bmatrix}. \tag{A10}$$

Furthermore, note that $\alpha_{\mathcal{A}} = \mu_{mf} - \Sigma_{mf,b_+}\Sigma_{b_+}^{-1}\mu_{b_+}$ is the alpha of the fund with respect to the b_+ benchmark factors, i.e., the factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio. Therefore, for an investor with relative risk-aversion γ, we have that

$$\nabla_w \text{MVU}(w_0) = \begin{bmatrix} 0 \\ \mu_{b_0} - \gamma\Sigma_{b_0,b_+}w^*_{b_+} \leq 0 \\ \alpha_{\mathcal{A}} \end{bmatrix}. \tag{A11}$$

From the above expression, note that the gradient of the investor's mean-variance utility with respect to w_{b_+} is zero, which means she has no incentive to change her weight on the b_+ factors. The gradient of her mean-variance utility with respect to the b_0 factors is negative, which implies (because of shortsale constraints) she cannot reduce the weight on the b_0 factors. Finally, the gradient of her mean-variance utility with respect to the weight on the fund is equal to the fund's alpha $\alpha_{\mathcal{A}}$. Thus, to maximize the marginal improvement to her mean-variance utility, the investor should increase her weight on the fund while keeping the weights on the benchmark factors fixed at $w^*_b = (w^*_{b_+}, w^*_{b_0} = 0)$, and the marginal improvement to her mean-variance utility per dollar invested in the fund will be $\alpha_{\mathcal{A}}$. □

A.3 Proof of Proposition 3

First, without loss of generality, we define the factors to which the shortsale-constrained mean-variance portfolio assigns a weight of zero as in Equation (3). Second, we define the shortsale-constrained mean-variance portfolio of all the K benchmark factors as

$$w_b = \Sigma_b^{-1}[\mu_b + \eta_b], \tag{A12}$$

where $\eta_b \geq 0 \in R^K$ is the vector of Lagrange multipliers associated with the non-negativity constraints. The partition covariance matrix Σ_b can then be written as

$$\Sigma_b = \begin{bmatrix} \Sigma_{b_+} & \Sigma_{b_+,b_0} \\ \Sigma^\top_{b_+,b_0} & \Sigma_{b_0} \end{bmatrix}, \tag{A13}$$

where $\Sigma_{b_+} \in R^{K_+ \times K_+}$ is the covariance matrix for the factors $R_{b_+,t}$ for which the shortsale-constrained mean-variance portfolio assigns a positive weight, $\Sigma_{b_0} \in R^{K_0 \times K_0}$ is the covariance matrix for the factors $R_{b_0,t}$ for which the shortsale-constrained mean-variance portfolio assigns a zero weight, and $\Sigma_{b_+,b_0} \in R^{K_+ \times K_0}$ is the covariance matrix between the $R_{b_+,t}$ and

$R_{b_0,t}$ factors. The partitioned vector of means is

$$\mu_b = \begin{bmatrix} \mu_{b_+} \\ \mu_{b_0} \end{bmatrix}, \tag{A14}$$

where $\mu_{b_+} \in R^{K_+}$ is the vector of mean returns for the factors $R_{b_+,t}$ for which the shortsale-constrained mean-variance portfolio assigns a positive weight and $\mu_{b_0} \in R^{K_0}$ is the vector of mean returns for the factors $R_{b_0,t}$ for which the shortsale-constrained mean-variance portfolio assigns a zero weight.

Now, using the definition for the partitioned inverse covariance matrix, its inverse is

$$\Sigma_b^{-1} = \begin{bmatrix} \Sigma_{b_+}^{-1} + \Sigma_{b_+}^{-1}\Sigma_{b_+,b_0}S^{-1}\Sigma_{b_+,b_0}^{\top}\Sigma_{b_+}^{-1} & -\Sigma_{b_+}^{-1}\Sigma_{b_+,b_0}S^{-1} \\ -S^{-1}\Sigma_{b_+,b_0}^{\top}\Sigma_{b_+}^{-1} & S^{-1} \end{bmatrix}, \tag{A15}$$

where $S = \Sigma_{b_0} - \Sigma_{b_+,b_0}^{\top}\Sigma_{b_+}^{-1}\Sigma_{b_+,b_0}$. From this, we can obtain the following closed-form expression for the weights assigned to the factors $R_{b_0,t}$,

$$w_{b_0} = S^{-1}\big[\underbrace{\mu_0 - \Sigma_{b_+,b_0}^{\top}\Sigma_{b_+}^{-1}\mu_+}_{\alpha_{0,+}} \; \underbrace{-\Sigma_{b_+,b_0}^{\top}\Sigma_{b_+}^{-1}\eta_+ + \eta_0}_{\eta_0}\big]. \tag{A16}$$

The first underbrace bracket comes from the fact that $\Sigma_{b_+,b_0}^{\top}\Sigma_{b_+}^{-1} = \phi$ in Equation (3), and the second underbrace bracket comes from the fact that $\eta_+ = 0$, i.e., the vector of Lagrange multipliers associated with factors that have a positive weight is zero. Thus, we have that

$$w_{b_0} = S^{-1}[\alpha_{0,+} + \eta_0] = 0, \tag{A17}$$

because w_{b_0} is the vector of weights for which the shortsale-constrained mean-variance portfolio finds optimal to assign a zero weight. Pre-multiplying w_{b_0} with S, we have that

$$[\alpha_{0,+} + \eta_0] = 0, \tag{A18}$$

which implies that $\alpha_{0,+} = -\eta_0$. Because $\eta_0 > 0$ is the vector of Lagrange multipliers associated with the non-negativity constraints of the factors for which the shortsale-constrained mean-variance portfolio assigns a zero weight, we have that the elements of the vector of intercepts $\alpha_{0,+}$ in Equation (3) are all negative.

In the second part of the proof, we show the mechanism behind the alpha decay experienced when we replace the benchmark model without shortsale constraints with a more parsimonious factor model that drops the factor for which the shortsale-constrained mean-variance portfolio assigns a zero weight. To do that, we plug into the equation for the traditional alpha, the expression for the factors $R_{b_0,t}$ in Equation (3). This yields:

$$\alpha_{\mathcal{T}} = R_{mf,t} - \beta_{\mathcal{T},+} R_{b_+,t} - \beta_{\mathcal{T},0} \left(\alpha_{0,+} + \beta_{0,+} R_{b_+,t} + \epsilon_{0,+,t} \right) - \epsilon_{b,t}. \tag{A19}$$

Rearranging terms, we have

$$\alpha_{\mathcal{T}} = \underbrace{R_{mf,t} - \overbrace{(\beta_{\mathcal{T},+} + \beta_{\mathcal{T},0}\beta_{0,+})}^{\tilde{\beta}_{\mathcal{A}}} R_{b_+,t}}_{\alpha_{\mathcal{A}} + \tilde{\epsilon}_{b,t}} - \beta_{\mathcal{T},0}\alpha_{0,+} - \beta_{\mathcal{T},0}\epsilon_{0,+,t} - \epsilon_{b,t}. \tag{A20}$$

Taking expectations, we obtain

$$\alpha_{\mathcal{T}} - \alpha_{\mathcal{A}} = -\beta_{\mathcal{T},0}\alpha_{0,+},$$

which is the desired result. □

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Internet Appendix to

Rethinking Mutual Fund Performance: From Traditional Alpha to Achievable Alpha

This Internet Appendix reports the following robustness checks and additional results: (i) relaxing the shortsale constraints, (ii) replicating the long-short factors using long-only portfolios of mutual funds, (iii) estimating value-added using the flexible and bias-adjusted econometric approach of Barras et al. (2022), (iv) studying the time variation in the traditional and achievable alphas, (v) evaluating mutual-fund performance in terms of traditional and achievable alphas *net* of fund fees, (vi) evaluating mutual-fund performance separately for retail and institutional share classes, (vii) evaluating mutual-fund performance separately for different fund styles, (viii) evaluating fund skill and scalability using log assets under management, (ix) evaluating mutual-fund performance across different subsample periods, (x) considering factor models that include both the long and the short leg of academic factors, (xi) considering an alternative approach for imputing missing observations in the Vanguard model, and (xii) studying the explanation for the decay of achievable alpha.

IA.1 Relaxing the Shortsale Constraints

In the previous sections, we evaluated the achievable alpha for an investor who cannot short the benchmark factors. While such shortsale constraints represent a realistic scenario for most retail and institutional investors, such as certain pension funds, we now evaluate the performance of mutual funds for investors that can engage in a *limited* amount of shortselling. Section IA.1.1 considers the case of an investor who can short *only* the market factor using, for instance, an inverse market ETF. Section IA.1.2 considers the case of an investor who can short the benchmark factors but faces a leverage constraint so the overall amount of shorting is restricted.

IA.1.1 Shorting the Market

Since 2006, investors can short the market by buying an inverse ETF. Although inverse ETFs represent a minuscule fraction of the ETF industry,[1] it is informative to evaluate the performance of mutual funds for an investor who can short the market.

It is straightforward to extend Proposition 2 to show that the marginal utility improvement for an investor (who can short only the market) when she has access to a mutual fund in addition to the benchmark factors is measured by the achievable alpha, defined as

[1]As of November 2024, the ETF database lists around 72 inverse ETFs with an aggregate AUM of only around 8.4 billion dollars; see https://etfdb.com/etfdb-category/inverse-equities/.

Table IA.1: Fund performance for investors who can short the market

This table reports cross-sectional statistics for the achievable fund alpha and value-added with respect to the long-only version of the seven factor models listed in Table 3 for investors who can short the market. For each fund, Panels A and B report the achievable alpha and value-added with respect to the market plus other benchmark factors with positive weight in the mean-variance portfolio of an investor who can short only the market. We report the average alpha and value-added across funds, their t-statistics, the time-weighted average achievable alpha and value-added, where the weight is proportional to the length of the sample period for which we have return data for the fund, and their t-statistics. We also report the percentiles of the cross-sectional distributions of achievable fund alpha and value-added, the percentage of funds with positive achievable alpha and value-added, and the percentage of funds with achievable alpha and value-added t-statistic greater than two. Alphas are annualized and reported in percentage. Like Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range (difference between the 90th and 10th percentiles) away from the median.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Achievable alpha with respect to long-only factors							
Average alpha	0.05	-0.79	-0.88	-1.12	-1.80	-1.80	-0.86
t-stat	1.06	-14.82	-16.87	-20.92	-26.56	-26.57	-15.15
Time-weighted average alpha	0.33	-0.42	-0.58	-0.82	-1.49	-1.50	-0.21
t-stat	4.16	-4.37	-4.63	-4.76	-4.84	-4.84	-3.36
10th percentile	-3.07	-4.02	-4.00	-4.36	-5.87	-5.87	-4.24
50th percentile	0.13	-0.34	-0.67	-0.77	-1.26	-1.26	-0.37
90th percentile	3.06	2.07	1.98	1.80	1.80	1.80	2.14
Percentage of funds with α >0	52.50	43.02	37.42	36.17	32.16	32.16	42.34
Percentage of funds with $t(\alpha)$ >2	4.26	4.53	2.45	3.00	3.03	3.00	4.08
Panel B: Achievable value-added with respect to long-only factors							
Average value-added	-3.32	-3.72	-5.07	-5.26	-8.51	-8.50	-5.01
t-stat	-12.57	-13.74	-17.03	-18.00	-20.66	-20.65	-17.74
Time-weighted average value-added	-3.60	-4.05	-6.40	-6.67	-10.70	-10.69	-5.02
t-stat	-4.60	-4.65	-4.80	-4.83	-4.86	-4.86	-4.74
10th percentile	-15.84	-15.85	-19.17	-20.23	-29.08	-29.07	-19.30
50th percentile	-0.73	-0.95	-1.42	-1.42	-2.14	-2.14	-1.35
90th percentile	4.22	3.37	2.15	2.25	1.90	1.90	2.75
Percentage of funds with value-added>0	31.59	28.47	23.39	23.97	21.53	21.50	23.62

the fund's alpha with respect to the return of the market factor plus the returns of other benchmark factors with positive weight in the investor's mean-variance portfolio. Similarly, the achievable value-added can be computed using the mutual fund's abnormal returns with respect to the market and other benchmark factors with positive weight in the investor's portfolio. For the VANG model, we allow the investor to assign a positive or negative weight to VFINX, which is the Vanguard fund tracking the S&P500 index.

Table IA.2: Difference in deciles based for investors who can short the market

This table reports the percentage of funds whose decile rank changes when, instead of sorting funds by their traditional alpha and value-added computed with respect to the long-short version of the seven factor models listed in Table 3, we sort the funds by their achievable alpha (Panel A) and achievable value-added (Panel B) with respect to the long-only version of the factor models, while allowing investors to short the market. For each factor model, we report the measure Diff defined in Equation (6) as a percentage.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Difference in deciles based on alpha							
Diff (%)	0.00	71.80	76.77	78.34	83.76	83.51	75.46
Panel B: Difference in deciles based on value-added							
Diff (%)	0.00	60.61	74.31	72.32	75.52	75.73	80.71

Panels A and B of Table IA.1 report the achievable alpha and value-added of an investor who has access to long-only benchmark factors and can short the market. Consistent with the results in Section 3.3, we find that (for every model except the CAPM) the achievable alpha and value-added of this investor are much smaller than the traditional alpha and value-added of an unconstrained investor who has access to long-short benchmark factors, which we report in Panel A of Tables 5 and 6. Of course, as one would expect, the percentage of funds with positive achievable alpha and value-added increases when the investor can short the market. For instance, when the investor cannot short the market, the percentage of mutual funds with positive achievable alpha with respect to the long-only version of the factor models is 10.25% for HXZ and 34.65% for VANG. In contrast, when the investor can short the market, the percentage of mutual funds with positive achievable alpha with respect to the long-only version of the models ranges between 32.16% for HXZ and 42.34% for VANG. Similarly, when the investor cannot short the market, the percentage of mutual funds with positive achievable value-added with respect to the long-only benchmark models is 6.23% for HXZ and 19.00% for VANG. In contrast, when the investor can short the market, the percentage of mutual funds with positive achievable value-added with respect to the long-only models is 21.53% for HXZ and 23.62% for VANG.

Table IA.2 reports the difference in decile ranks of mutual funds based on the traditional and achievable alphas and value-added with respect to the long-only version of the factor models for investors who can short only the market. The table shows that the decile rank of more than 60% of the funds changes by at least one decile across all factor models except the CAPM. Thus, while the ability of investors to short the market can help them benefit from investing in active mutual funds, the relative performance of mutual funds for such investors remains sensitive to the presence of shortsale constraints on the other benchmark factors.

There are two takeaways from the results in Tables IA.1 and IA.2. The first is that, even though inverse ETFs represent only a small fraction of the ETF market, they have the potential to improve the mean-variance efficiency gains offered by active mutual funds to shortsale-constrained investors. The second is that, despite being able to short the market, the achievable alpha and value-added of a shortsale-constrained investor are still much smaller than the traditional alpha and value-added of an unconstrained investor, and the relative rankings of funds are still substantially different under the traditional and achievable metrics.

IA.1.2 Leverage-Constrained Investors

We now consider the case of a mean-variance investor who can short the benchmark factors, but faces a constraint on overall leverage. Specifically, we consider an investor whose aggregate short position has to be smaller than a fraction δ of her aggregate long position. The portfolio selection problem of this investor can be formulated as:

$$\max_{w_b, w_{mf}} \quad \text{MVU}(w_b, w_{mf}) \tag{IA1}$$

$$\text{s.t.} \quad w_b + \psi_s - \psi_\ell = 0, \tag{IA2}$$

$$w_{mf} + \nu_s - \nu_\ell = 0, \tag{IA3}$$

$$e^\top \psi_s + \nu_s \leq \delta(e^\top \psi_\ell + \nu_\ell), \tag{IA4}$$

$$\psi_\ell,\ \psi_s,\ \nu_\ell,\ \nu_s \geq 0, \tag{IA5}$$

where w_b is the vector of benchmark factor weights, w_{mf} is the weight on the mutual fund, ψ_s and ψ_ℓ are vectors of slack variables that measure the negative and positive positions of the benchmark portfolio, ν_s and ν_ℓ are scalar slack variables that measure the negative and positive positions on the mutual fund, e is the vector of ones, the constraint $e^\top \psi_s + \nu_s \leq \delta(e^\top \psi_\ell + \nu_\ell)$ requires that the aggregate short position of the investor be smaller than a fraction δ of her aggregate long position, and the investor's mean-variance utility is

$$\text{MVU}(w_b, w_{mf}) = \begin{bmatrix} \mu_b^\top & \mu_{mf}^\top \end{bmatrix} \begin{bmatrix} w_b \\ w_{mf} \end{bmatrix} - \frac{\gamma}{2} \begin{bmatrix} w_b^\top & w_{mf}^\top \end{bmatrix} \begin{bmatrix} \Sigma_b & \Sigma_{b,mf} \\ \Sigma_{mf,b} & \Sigma_{mf} \end{bmatrix} \begin{bmatrix} w_b \\ w_{mf} \end{bmatrix}. \tag{IA6}$$

For a given w_{mf}, the optimal portfolio of the benchmark factors for the leverage-constrained investor is given by the following portfolio selection problem:

$$\text{MVU}^*(w_{mf}) = \max_{w_b} \quad \text{MVU}(w_b, w_{mf}) \tag{IA7}$$

$$\text{s.t.} \quad w + \psi_s - \psi_\ell = 0, \tag{IA8}$$

$$w_{mf} + \nu_s - \nu_\ell = 0, \tag{IA9}$$

$$e^\top \psi_s + \nu_s \leq \delta(e^\top \psi_\ell + \nu_\ell), \tag{IA10}$$

$$\psi_\ell,\ \psi_s,\ \nu_\ell,\ \nu_s \geq 0, \tag{IA11}$$

where $\text{MVU}^*(w_{mf})$ is the optimal mean-variance utility as a function of the weight on the mutual fund w_{mf}.

In the following proposition, we characterize the marginal mean-variance utility improvement that a leverage-constrained investor can achieve by investing in the fund in addition to the benchmark factors.

Proposition IA.1 *Let the leverage-constrained mean-variance portfolio of the benchmark factors be w_b^*, i.e., let w_b^* be the solution to Problem (IA7) for $w_{mf} = 0$. Then, the marginal mean-variance utility improvement that a leverage-constrained investor can achieve by investing in the fund in addition to the benchmark factors is the achievable alpha,*

$$\alpha_{\mathcal{A}} = \mu_{mf} - \gamma \Sigma_{mf,b}\, w_b^* - \lambda, \tag{IA12}$$

where μ_{mf} is the mean gross return of the fund, γ is the investor's relative risk aversion, $\Sigma_{mf,b}$ is the covariance between the mutual fund return and the benchmark factor returns, and λ is the Lagrange multiplier for the constraint $w_{mf} + \nu_s - \nu_\ell = 0$ for problem (IA7) at the maximizer w_b^* for the value of $w_{mf} = 0$.

Proof. Using the envelope theorem (Mas-Colell, Whinston, and Green, 1995, p. 965)

$$\frac{d\text{MVU}^*(w_{mf})}{dw_{mf}} = \left.\frac{\partial \text{MVU}(w_b, w_{mf})}{\partial w_{mf}}\right|_{w_b(w_{mf})} - \lambda,$$

where $w_b(w_{mf})$ is the optimal leverage-constrained mean-variance portfolio of the benchmark factors for a given weight on the mutual fund factor w_{mf}, and λ is the Lagrange multiplier for the constraint $w_{mf} + \nu_s - \nu_\ell = 0$ for the problem in (IA7) at the maximizer $w_b(w_{mf})$. Moreover,

$$\left.\frac{d\text{MVU}^*(w_{mf})}{dw_{mf}}\right|_{w_{mf}=0} = \left.\frac{\partial \text{MVU}(w_b, w_{mf})}{\partial w_{mf}}\right|_{w_b^*, w_{mf}=0} - \lambda = \mu_{mf} - \gamma \Sigma_{mf,b} w_b^* - \lambda,$$

Table IA.3: Achievable alpha for leverage-constrained investors

This table reports the average traditional and achievable alphas for unconstrained and leverage-constrained investors, respectively. We consider 11 different levels of leverage, ranging from $\delta = 0$, where the investor is not allowed to short, to $\delta = 1$, where the investor is allowed to short 100% of her long position.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Traditional alpha	0.05	0.01	0.25	0.15	-0.06	-0.00	0.47
Achievable alpha with δ =0	-0.02	-2.04	-2.32	-2.58	-3.60	-3.59	-1.33
Achievable alpha with δ =0.1	-0.02	-2.32	-2.65	-2.96	-4.06	-4.05	-1.63
Achievable alpha with δ =0.2	-0.02	-2.58	-2.97	-3.33	-4.56	-4.58	-1.84
Achievable alpha with δ =0.3	-0.02	-2.79	-3.28	-3.72	-5.10	-5.12	-1.96
Achievable alpha with δ =0.4	-0.02	-2.86	-3.59	-4.10	-5.64	-5.68	-2.11
Achievable alpha with δ =0.5	-0.02	-2.72	-3.85	-4.47	-6.07	-6.12	-2.05
Achievable alpha with δ =0.6	-0.02	-2.35	-3.98	-4.79	-6.15	-6.31	-0.71
Achievable alpha with δ =0.7	-0.02	-1.75	-3.88	-4.76	-6.05	-6.32	0.23
Achievable alpha with δ =0.8	-0.02	-0.81	-3.08	-4.27	-4.50	-4.97	0.29
Achievable alpha with δ =0.9	-0.02	-0.30	-0.73	-1.27	-1.09	-1.28	0.26
Achievable alpha with δ =1	-0.02	-0.16	0.10	-0.15	-0.51	-0.54	0.39

where the second equality follows by taking the partial derivative of the right-hand side of Equation (IA6) with respect to w_{mf}. □

Using Proposition IA.1, Table IA.3 depicts, for different values of the leverage parameter δ, the cross-sectional average achievable alpha for leverage-constrained investors. Table IA.3 shows that the average achievable alpha of a leverage-constrained investor is substantially smaller than the traditional alpha of an unconstrained investor.

For instance, for the case of $\delta = 0$, which corresponds to no shorting, we get the result reported in the first row of Panel B of Table 5, where, other than for the CAPM, the average achievable alpha with respect to the other six factor models are negative, ranging from -1.33 for VANG to -3.60 for HXZ. For the case with a moderate leverage of $\delta = 0.4$, the average achievable alpha remains negative for all factor models.[2] For the case with $\delta = 1$, for which the investor can hold aggregate negative positions as large as her aggregate positive position, the average achievable alpha remains negative for the CAPM, FFC, FF6, HXZ, and HXZM models but is positive for the FF5 and VANG models—though still smaller than the average traditional alpha.[3]

[2]Note that achievable alpha measures the utility difference between the cases with and without access to the mutual fund. Allowing for more leverage increases the utility both for the case with and without access to the mutual fund, so it is possible that the achievable alpha decreases when the amount of leverage allowed increases, if the portfolio without access to the mutual fund benefits more compared to the portfolio with access to the mutual fund.

[3]For the CAPM case, increasing δ does not increase achievable alpha. Achievable alpha is computed under the constraint that the fund weight is fixed at $w_{mf} = 0$. With only one benchmark factor, shorting

IA.2 Replicating Factors with Mutual Funds

It is challenging for shortsale-constrained investors to gain exposure to long-short factors, such as value and momentum, because they require taking short positions. In this section, we replicate the long-short factors in prominent models by using long-only portfolios of mutual funds, which do not require the investor to take any short positions. We then show that our findings are robust to considering the resulting long-only factors of mutual funds, instead of the long-only version of the original factors as in the main body of the manuscript.

Johansson et al. (2025) construct long-short factors whose long leg is a long-only portfolio of mutual funds or ETFs and the short leg is a short-only portfolio of ETFs. They show that transaction and shortselling costs lead to an implementation shortfall for the tradable factors of 2–4 percent annually, relative to the academic (on paper) factors. However, their long-short factors require shorting ETFs, and thus, do not represent the alternative investment opportunity set of shortsale-constrained investors. Motivated by Johansson et al. (2025), we construct factors that do not require shorting by using the long-only version of the original factor to replicate the long leg and a long-only portfolio of mutual funds with negative exposure to the original factor to replicate the short leg. Specifically, we replicate the short leg of the original factors by forming an equal-weighted portfolio of funds whose beta with respect to the long-short factor has a t-statistic smaller than minus two. For example, in the context of the FFC model, we approximate the short leg of the HML factor by aggregating the returns of funds whose estimated loading on the traditional long-short HML factor is both negative and statistically significant.

Table IA.4 reports the time-series correlations between the replicated factors and the original long-short factors, along with the annualized Sharpe ratio of the replicated and original factors. With the exception of SMB, our replicated factors successfully achieve the intended negative exposures. However, the correlations between the replicated and original factors are generally low, which is consistent with the findings of Johansson et al. (2025), who highlight the difficulty of replicating academic factor returns using only tradable funds.

We now evaluate mutual-fund performance using augmented factor models that incorporate both the long-only versions of academic factors and the replicated factors. Table IA.5

the benchmark requires a positive short-slack variable, $\psi_s > 0$. However, when $w_{mf} = 0$, the leverage constraint (IA10) reduces to $\psi_s \leq \delta\,\psi_\ell$ because $\nu_s = \nu_\ell = 0$ under $w_{mf} = 0$ for $\delta \in \{0, 1\}$. When the investor shorts the benchmark in the CAPM, the long-slack variable is zero, $\psi_\ell = 0$, which forces $\psi_s = 0$. Accordingly, the CAPM benchmark cannot be shorted for any value of $\delta \in \{0, 1\}$.

Table IA.4: Correlations and Sharpe ratios of replicated factors

This table reports the time-series correlations between the replicated factors and the original factors, the annualized Sharpe ratios of the replicated factors, and the annualized Sharpe ratios of the original factors.

	SMB	HML	CMA	RMW	UMD	ME	IA	ROE
Correlation with the original factor	0.40	-0.37	-0.34	-0.31	-0.24	-0.23	-0.46	-0.26
Sharpe ratio of replicated factor	0.61	0.58	0.60	0.57	0.59	-0.48	0.63	0.62
Sharpe ratio of original factor	0.60	0.47	0.48	0.36	0.27	0.56	0.43	0.35

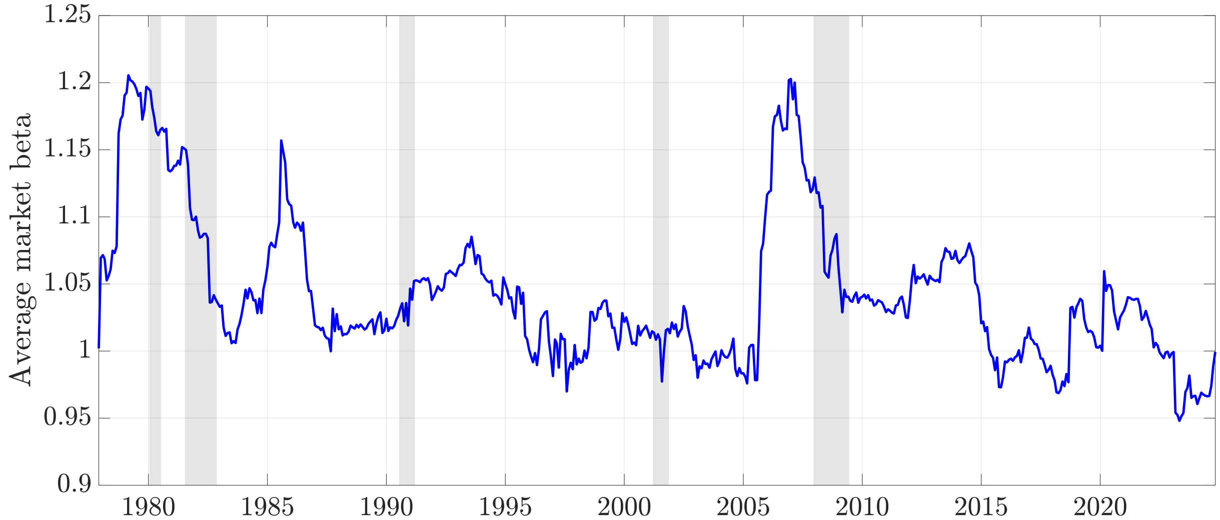
Table IA.5: Mutual-fund alphas with replicated factors

This table reports cross-sectional statistics for the traditional and achievable fund gross alphas using augmented factor models that incorporate both the long-only versions of academic factors and the replicated factors for the five factor models listed in Table 3 that require long-short factors. Panel A reports cross-sectional statistics for the traditional alpha, and Panel B for the achievable alpha, obtained by regressing fund returns on just those replicated factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). We report the average alpha across funds, its t-statistic, the time-weighted average alpha (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of fund alpha and the percentage of funds with positive alpha and t-statistic greater than two. Alphas are annualized and reported in percentage. Like Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range (difference between the 90th and 10th percentiles) away from the median.

	FFC	FF5	FF6	HXZ	HXZM
Panel A: Traditional alpha with respect to fund-based factors					
Average alpha	-0.14	-0.23	-0.23	-0.24	-0.23
t-stat	-3.22	-5.38	-5.35	-5.07	-5.18
Time-weighted average alpha	0.11	0.01	0.02	0.02	-0.01
t-stat	2.57	0.29	0.52	0.44	-0.23
10th percentile	-2.64	-2.81	-2.73	-3.08	-2.87
50th percentile	0.02	-0.17	-0.14	-0.15	-0.16
90th percentile	2.27	2.24	2.16	2.36	2.31
Percentage of funds with α >0	50.51	45.67	47.27	46.85	46.22
Percentage of funds with $t(\alpha)$ >2	7.56	6.38	6.35	6.40	6.67
Panel B: Achievable alpha with respect to fund-based factors					
Average alpha	-2.08	-2.35	-2.62	-3.52	-3.52
t-stat	-30.22	-38.35	-40.43	-51.37	-51.16
Time-weighted average alpha	-1.35	-1.72	-1.98	-3.06	-3.07
t-stat	-4.83	-4.88	-4.89	-4.91	-4.91
10th percentile	-6.40	-6.02	-6.61	-7.68	-7.68
50th percentile	-1.38	-1.76	-1.95	-2.89	-2.90
90th percentile	1.41	0.87	0.75	0.23	0.17
Percentage of funds with α >0	28.39	19.83	17.98	11.51	11.13
Percentage of funds with $t(\alpha)$ >2	2.55	0.89	0.99	0.61	0.51

Figure IA.1: Cross-sectional average of fund market betas

This figure depicts the cross-sectional average of fund market betas from 36-month rolling windows.



reports cross-sectional statistics for both traditional and achievable fund gross alphas, based on the five factor models described in Table 3 that rely on long-short factors. Consistent with the analysis in the main body of the manuscript, average achievable alphas are substantially lower than average traditional alphas across all models. Furthermore, the proportion of funds generating a positive achievable alpha ranges from 11.13% for HXZM to 28.39% for FFC—considerably lower than the fraction of funds with a positive traditional alpha, which ranges from 45.67% for FF5 to 50.51% for FFC.

IA.3 Time Variation in Alphas

In the main body of the manuscript, we follow Berk and van Binsbergen (2015) and compute fund alphas using each fund's entire return history. However, funds are expected to adjust their risk exposure over time. To account for this time variation, we estimate fund alphas using 36-month rolling windows. To compute a fund's alpha, we require a minimum of 30 months within the estimation window. Then, for each fund mf, we compute the average alpha $\bar{\alpha}_{mf}$ using all estimated alphas from all the corresponding windows. We report cross-sectional statistics of funds' average traditional alpha and achievable alpha, where we retain only those benchmark factors in the time-series regression for which the shortsale-constrained mean-variance portfolio assigns a positive weight.

Table IA.6: Traditional and achievable mutual-fund alphas using rolling windows

This table reports cross-sectional statistics for the traditional and achievable average alphas with respect to the seven factor models listed in Table 3. We estimate funds' average alphas using 36-month rolling windows. To compute a fund's alpha, we require a minimum of 30 months within the estimation window. Then, for each fund mf, we compute the average alpha $\bar{\alpha}_{mf}$ using all estimated alphas from all the corresponding windows. We compute the traditional alpha by regressing the fund returns on all factors for each model and the achievable alpha on only those factors with strictly positive weights in the shortsale-constrained mean-variance portfolio. We report the average alpha across funds, its t-statistic, percentiles of the cross-sectional distribution of fund alpha, and the percentage of funds with positive alpha. Alphas are annualized and reported as a percentage.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditinal alpha with respect to long-short factors							
Average alpha	0.16	-0.05	0.36	0.31	0.05	0.20	0.35
t-stat	2.00	-1.02	5.43	4.83	1.00	3.98	7.24
10th percentile	-3.11	-2.27	-2.31	-2.19	-2.57	-2.35	-2.11
50th percentile	0.13	-0.05	0.13	0.12	-0.01	0.13	0.32
90th percentile	3.03	2.26	3.44	3.14	2.85	2.89	2.92
Percentage of funds with α >0	53.06	49.12	53.10	52.48	49.80	52.79	58.44
Panel B: Achievable alpha with respect to long-only factors							
Average alpha	-0.91	-3.15	-3.45	-3.58	-3.47	-3.56	-3.38
t-stat	-11.00	-32.42	-36.20	-37.48	-36.85	-37.44	-38.10
10th percentile	-4.20	-7.84	-7.78	-8.10	-8.04	-8.22	-7.43
50th percentile	-0.80	-2.41	-2.84	-2.94	-2.84	-2.91	-2.93
90th percentile	1.95	0.51	0.14	0.04	0.16	0.09	0.09
Percentage of funds with α >0	35.09	14.98	10.65	10.21	11.20	10.93	10.52

Figure IA.1 shows that fund exposure to systematic risk fluctuates significantly over time. From 1980 to 2005, the average market beta trended downward, with temporary peaks around August 1985 and August 1993. By March 2005, the average beta had dropped below one. However, it surged rapidly thereafter, reaching a peak of approximately 1.2 by December 2006. Following this spike, the average market beta gradually declined and stabilized around 1 in the subsequent years.

Tables IA.6 and IA.7 present cross-sectional statistics of funds' average alphas and value added for the seven factor models listed in Table 3. The results are consistent with those in Tables 5 and 6 from the main body of the manuscript. Across all factor models, the average achievable alpha and value-added are significantly lower than those obtained under the traditional approach. Accounting for time-varying fund exposure to benchmark factors via rolling windows further reduces the achievable alpha and value-added for the CAPM, FFC, FF5, FF6, and VANG models. This finding is particularly relevant given that financial

Table IA.7: Traditional and achievable value-added using rolling windows

This table reports cross-sectional statistics for the traditional and achievable average value-added with respect to the seven factor models listed in Table 3. We compute the average value added for funds using 36-month rolling windows. To compute a fund's value-added, we require at least 30 months of data within the estimation window. Then, for each fund mf, we compute the average value-added using all the estimated value-added from all the corresponding windows. We compute the traditional value-added as the average of the product of assets under management and abnormal returns, obtained by regressing fund returns on all long-short factors in each model, and the achievable alpha on only those factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio. We report the average value-added, its t-statistic, percentiles of the cross-sectional distribution of fund value-added, and the percentage of funds with positive value-added. Value added is annualized and expressed in January 2000 million dollars. Like Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range away from the median.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditinal value-added with respect to long-short factors							
Average alpha	-1.75	0.36	3.18	2.79	0.85	1.69	3.18
t-stat	-2.34	0.72	4.04	3.80	1.25	2.48	5.75
10th percentile	-15.93	-9.61	-8.22	-7.95	-10.78	-8.96	-6.27
50th percentile	-0.68	-0.39	-0.21	-0.21	-0.46	-0.28	-0.06
90th percentile	5.35	4.77	10.21	9.08	6.80	7.44	10.63
Percentage of funds with α >0	32.33	35.43	41.18	40.88	36.18	38.80	46.97
Panel B: Achievable value-added with respect to long-only factors							
Average alpha	-12.80	-18.06	-20.34	-20.49	-21.37	-21.83	-22.80
t-stat	-14.27	-15.95	-17.34	-17.41	-17.68	-17.68	-18.73
10th percentile	-36.44	-45.10	-50.16	-50.11	-51.27	-52.37	-52.98
50th percentile	-3.30	-4.62	-5.40	-5.51	-5.43	-5.52	-6.20
90th percentile	0.57	0.01	-0.10	-0.12	-0.12	-0.11	-0.21
Percentage of funds with α >0	14.94	10.28	7.56	7.28	7.18	7.25	5.85

services firms, such as Morningstar, typically report alphas based on short rolling windows of 36 or 72 months rather than using a fund's entire return history. In shorter rolling windows, periods of market underperformance may lead to optimal strategies that involve shorting the market, which explains why even for the CAPM the achievable alpha and value-added are now much smaller than the traditional ones.

IA.4 Alternative Estimator of Value-Added

In this section, we study the robustness of our findings to estimating value-added using the flexible and bias-adjusted econometric approach of Barras et al. (2022). Table IA.8 reports

Table IA.8: Value-added: alternative estimator of Barras et al. (2022)

This table reports cross-sectional statistics for the traditional and achievable fund value-added estimated using the flexible and bias-adjusted econometric approach of Barras et al. (2022), with respect to the seven factor models listed in Table 3. Panel A reports cross-sectional statistics for the traditional value-added computed using fund abnormal returns obtained by regressing the fund returns on all long-short factors in each model, and Panel B the achievable value-added computed using fund abnormal returns with respect to just those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). We report the average value-added, its t-statistic, the time-weighted average value-added (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of value-added and the percentage of funds with positive average value-added. Value added is annualized and expressed in January 2000 million dollars. Like Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range away from the median.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional value-added with respect to long-short factors							
Average value-added	-3.85	-1.73	-1.28	-1.52	-3.00	-2.49	0.41
t-stat	-13.43	-8.26	-4.91	-6.78	-11.68	-10.63	1.88
Time-weighted average value-added	-4.06	-1.41	-1.27	-1.46	-3.09	-2.58	1.12
t-stat	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	0.00
10th percentile	-17.62	-10.49	-10.90	-10.58	-13.66	-12.30	-7.03
50th percentile	-0.98	-0.61	-0.63	-0.68	-0.97	-0.82	-0.14
90th percentile	4.64	4.60	6.51	5.23	4.04	3.98	8.51
% of funds with average value-added >0	30.85	32.42	33.07	31.32	28.41	29.42	44.07
Panel B: Achievable value-added with respect to long-only factors							
Average value-added	-3.88	-7.57	-11.14	-10.81	-17.72	-17.64	-6.33
t-stat	-13.49	-18.20	-24.70	-24.88	-28.88	-28.82	-18.24
Time-weighted average value-added	-4.07	-7.52	-12.71	-12.25	-21.40	-21.34	-5.63
t-stat	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
10th percentile	-17.66	-27.26	-32.63	-32.44	-48.86	-48.74	-23.33
50th percentile	-1.02	-2.69	-3.81	-3.99	-6.13	-6.06	-2.30
90th percentile	4.63	1.76	0.17	0.18	-0.33	-0.31	1.96
% of funds with average value-added >0	30.48	18.02	11.64	11.64	5.90	6.25	18.41

cross-sectional statistics for the traditional and achievable fund value-added estimated using the approach of Barras et al. (2022), with respect to the seven factor models listed in Table 3.

Comparing the average traditional and achievable value-added in Tables 6 and IA.8, we find that the approach of Barras et al. (2022) leads to lower estimates of average value-added (both traditional and achievable). Nevertheless, our findings are robust to estimating value-added using the approach of Barras et al. (2022). In particular, we find that the the average achievable value-added in Panel B of Table IA.8 is substantially smaller than the average traditional value-added in Panel A. Similarly, the proportion of funds with positive achievable value-added in Panel B of Table IA.8 is substantially smaller than the proportion of funds with positive traditional value-added in Panel A.

IA.5 Empirical Results for Net-of-Fees Returns

To facilitate the comparison with the closely related literature on mutual-fund manager skill (Berk and van Binsbergen, 2015; Barras et al., 2022), in the main body of the manuscript we study fund performance in terms of alpha and value-added based on *gross-of-fees* returns. However, it is also important to evaluate mutual-fund performance in terms of net-of-fees returns because this is the relevant economic criterion from an investor's perspective. In this section, we replicate our entire empirical analysis for the case with net-of-fees returns and demonstrate that all our findings are robust. In particular, our key result continues to hold: the proportion of funds with positive achievable *net* alpha and value-added is substantially smaller than the proportion of funds with positive traditional *net* alpha and value-added.

IA.5.1 Achievable Net Alpha

Table 5 in the main body of the manuscript shows that the proportion of funds with positive achievable gross alpha is substantially smaller than that with positive traditional gross alpha. In this section, we show that this finding is robust to considering the achievable and traditional net-of-fees alphas.

Table IA.9 replicates Table 5 in the main body of the manuscript for the case with net alphas. As one would expect, accounting for mutual-fund fees reduces both the average traditional and achievable alphas, with the average traditional *net* alphas in Panel A of Table IA.9 now being significantly negative for every factor model, whereas the average traditional *gross* alphas were positive for the CAPM, FFC, FF5, FF6, and VANG models, and statistically significant for the FF5, FF6, and VANG models in Panel A of Table 5. Importantly, our main finding is robust to evaluating mutual-fund performance in terms of net alphas: while the proportion of funds with positive traditional net alpha ranges from 26.60% for the HXZM model to 35.38% for the VANG model, the proportion of funds with positive achievable net alpha drops to only 4.39% for HXZM and 17.29% for VANG. Thus, the proportion of funds with positive achievable net alpha is much smaller than that with positive traditional net alpha for every model except CAPM.

Table IA.9: Traditional and achievable mutual-fund net alphas

This table reports cross-sectional statistics for the traditional and achievable fund net alphas with respect to the seven factor models listed in Table 3. The net alpha is obtained by regressing mutual-fund net-of-fees returns on factor returns. Panel A reports cross-sectional statistics for the traditional net alpha with respect to the long-short factors, obtained by regressing fund net returns on all long-short factors for each model, and Panel B for the achievable net alpha with respect to the long-only factors, obtained by regressing fund net returns on just those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for each fund). We report the average net alpha across funds, its t-statistic, the time-weighted average net alpha (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of fund net alpha and the percentage of funds with positive net alpha and t-statistic greater than two. Net alphas are annualized and reported in percentage. Like Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range (difference between the 90th and 10th percentiles) away from the median.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional net alpha with respect to long-short factors							
Average alpha	-1.13	-1.18	-0.93	-1.04	-1.25	-1.20	-0.71
t-stat	-21.52	-28.07	-17.29	-21.48	-23.85	-25.09	-15.82
Time-weighted average alpha	-0.83	-0.86	-0.73	-0.84	-0.99	-0.96	-0.34
t-stat	-4.78	-4.83	-4.69	-4.78	-4.80	-4.81	-4.32
10th percentile	-4.33	-3.60	-3.76	-3.70	-4.07	-3.82	-3.32
50th percentile	-0.99	-1.05	-1.09	-1.12	-1.26	-1.20	-0.62
90th percentile	1.80	1.20	2.15	1.78	1.75	1.61	1.75
Percentage of funds with α >0	31.71	26.78	30.20	27.78	27.31	26.60	35.38
Percentage of funds with $t(\alpha)$ >2	0.95	1.16	3.27	2.11	1.53	1.53	2.66
Panel B: Achievable net alpha with respect to long-only factors							
Average alpha	-1.17	-3.23	-3.48	-3.78	-4.78	-4.78	-2.53
t-stat	-22.30	-44.48	-53.44	-54.08	-65.46	-65.82	-40.13
Time-weighted average alpha	-0.85	-2.50	-2.87	-3.14	-4.30	-4.30	-1.69
t-stat	-4.78	-4.90	-4.91	-4.91	-4.92	-4.92	-4.87
10th percentile	-4.36	-7.73	-7.26	-7.95	-9.00	-9.01	-6.26
50th percentile	-1.02	-2.47	-2.91	-3.08	-4.10	-4.10	-2.01
90th percentile	1.78	0.39	-0.19	-0.25	-1.07	-1.05	0.71
Percentage of funds with α >0	31.30	14.33	8.38	7.90	4.25	4.39	17.29
Percentage of funds with $t(\alpha)$ >2	0.89	0.20	0.17	0.17	0.03	0.03	0.68

Just as in the case of gross alphas, the finding that achievable alpha is smaller than the traditional alpha, is robust to evaluating mutual-fund performance in terms of the alpha t-statistic. For instance, comparing the last rows in Panels A and B of Table IA.9, we find that while the proportion of mutual funds with significant ($t(\alpha) > 2$) traditional alpha with respect to the long-short factor models is 1.53% for HXZM and 2.66% for VANG, the proportion of mutual funds with significant achievable alpha with respect to the long-only models is only 0.03% for HXZM and 0.68% for VANG.

IA.5.2 Achievable Net Value-Added

Table 6 in the main body of the manuscript shows that the proportion of funds with positive achievable gross value-added is substantially smaller than that with positive traditional gross value-added. In this section, we show that this finding is robust to considering the achievable and traditional net-of-fees value-added.

Table IA.10 replicates Table 6 in the main body of the manuscript for the case with net value-added. Table IA.10 contains two panels: Panel A reports the average traditional net value-added for the long-short factor models, and Panel B the average achievable net value-added for the long-only factor models. Consistent with the findings of Berk and van Binsbergen (2015), and just as in the case of gross returns considered in the main text, Panel A of Table IA.10 shows that the average traditional net value-added in the cross-section of mutual funds is generally negative when computed with respect to conventional factor models, ranging from −4.75 million dollars for the FF5 model to −7.50 million dollars for the CAPM model. We also find that the average traditional net value-added with respect to the VANG model is −3.12 million dollars, with a significant t-stat of −15.65; the time-weighted average net value-added is also negative at −3.59 million dollars, with a significant t-statistic of −4.77.

However, the main takeaway from Table IA.10 is that, consistent with the results based on achievable and traditional net alphas, the performance of mutual funds based on achievable net value-added is substantially worse than that in terms of traditional net value-added. For instance, comparing Panels A and B in Table IA.10, we find that while the *proportion* of mutual funds with positive traditional net value-added with respect to the long-short factor models ranges from 14.47% for HXZ to 21.80% for VANG, the proportion of mutual funds with positive achievable net value-added with respect to the long-only models is only 2.75 for HXZ and 8.86 for VANG.

IA.5.3 Relative Performance of Funds Based on Net Returns

Table 7 in the main body of the manuscript shows that the *relative* performance of mutual funds changes substantially when we evaluate performance in terms of achievable rather than

Table IA.10: Traditional and achievable mutual-fund net value-added

This table reports cross-sectional statistics for the traditional and achievable net value-added with respect to the seven factor models listed in Table 3. Panel A reports cross-sectional statistics for the traditional net value-added computed as the average of the product of assets under management and abnormal returns, obtained by regressing the fund (net-of-fees) returns on all long-short factors in each model, and Panel B the achievable net value-added computed using the fund net-of-fees abnormal returns with respect to just those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). We report the average net value-added, its t-statistic, the time-weighted average net value-added (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of net value-added and the percentage of funds with positive average net value-added. Net value added is annualized and expressed in January 2000 million dollars. Like Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range away from the median.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional net value-added with respect to long-short factors							
Average value-added	-7.50	-5.40	-4.75	-5.12	-6.46	-6.09	-3.12
t-stat	-23.51	-22.73	-17.28	-19.57	-22.89	-23.41	-15.65
Time-weighted average value-added	-9.49	-6.63	-5.98	-6.49	-8.15	-7.76	-3.59
t-stat	-4.89	-4.88	-4.84	-4.86	-4.89	-4.90	-4.77
10th percentile	-25.11	-17.58	-17.99	-17.68	-20.65	-19.72	-12.16
50th percentile	-2.17	-1.87	-1.68	-1.78	-2.18	-2.03	-1.13
90th percentile	0.85	0.38	2.24	1.09	0.38	0.38	2.08
% of funds with average value-added >0	16.35	14.46	18.47	16.56	14.47	14.48	21.80
Panel B: Achievable net value-added with respect to long-only factors							
Average value-added	-7.53	-10.86	-15.03	-15.11	-21.53	-21.26	-10.07
t-stat	-23.61	-24.20	-28.50	-28.84	-30.09	-30.35	-26.63
Time-weighted average value-added	-9.50	-12.32	-18.89	-19.09	-28.13	-27.81	-11.46
t-stat	-4.89	-4.89	-4.93	-4.92	-4.93	-4.93	-4.89
10th percentile	-25.12	-33.77	-41.48	-41.46	-57.07	-56.91	-31.54
50th percentile	-2.22	-3.98	-5.27	-5.32	-7.28	-7.26	-3.75
90th percentile	0.85	-0.04	-0.22	-0.22	-0.47	-0.46	-0.05
% of funds with average value-added >0	15.98	9.11	5.61	5.53	2.75	2.75	8.86

traditional gross alpha. In this section, we show that this finding is robust to evaluating performance in terms of net-of-fees alphas.

Table IA.11 replicates Table 7 in the main body of the manuscript for the case with net fund returns. The table shows that there is a change in the decile rank for more than two-thirds of the funds (instead of more than 70% of the funds when using gross-of-fees returns) across every factor model except CAPM. This demonstrates that relative mutual-

Table IA.11: Difference in deciles for traditional and achievable net metrics

This table reports the difference between the deciles of funds sorted by the traditional and achievable net-of-fees alpha and value-added with respect to the long-only version of the seven factor models listed in Table 3. Panel A reports the difference in terms of traditional and achievable net alphas, and Panel B in terms of traditional and achievable net value-added. For each factor model, we report the measure Diff defined in Equation (6) in percentage.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Difference in deciles based on alpha							
Diff (%)	4.90	76.97	82.45	81.44	82.97	82.12	73.07
Panel B: Difference in deciles based on value-added							
Diff (%)	3.20	67.34	79.49	75.63	77.74	76.93	74.93

Table IA.12: Difference in net alphas during periods of financial turmoil

This table reports the slope coefficient for the market-risk variable in (7), along with its standard error and the regression R-squared. The independent variable is standardized, allowing the coefficients to be interpreted as the change in the difference between the traditional and achievable net alphas (in basis points) resulting from a one-standard-deviation increase in market volatility. The first seven columns report the results for pooled regressions for each model, and the eighth column reports the results across all models. Model fixed effects are included only for the pooled regression across all models. Standard errors are clustered by fund.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG	ALL
Slope (bps)	11.639	5.139	10.333	9.868	11.498	12.609	8.583	9.953
Standard errors (bps)	0.116	0.230	0.234	0.232	0.253	0.247	0.217	0.186
Model FE	No	No	No	No	No	No	No	Yes
Fund FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared (%)	12.287	1.692	4.672	4.261	8.272	9.567	4.589	5.226

fund performance is very different from the perspective of a shortsale-constrained investor even when measured in terms of net returns.

IA.5.4 Time Series of Traditional and Achievable Net Alphas

Table 8 in the main body of the manuscript shows that the difference between the traditional and achievable gross alphas increases with market volatility. We now show that these findings are robust to evaluating performance in terms of net alphas. Table IA.12 replicates Table 8 in the main body of the manuscript for the case with net alphas. The figure shows that the effect of a one-standard-deviation increase in market volatility on the difference between the traditional and achievable net alphas is significantly positive for every model, ranging between 5.139 basis points for the FFC model and 12.609 basis points for the HXZM model.

Table 9 in the main body of the manuscript shows that traditional and achievable gross alphas are jointly significant in explaining future fund flows, and that the predictive

Table IA.13: Achievable and Traditional Net Alphas and Fund Flows

This table reports slope coefficients and their t-statistics for several versions of panel regression (9). Panel A considers the regression of fund flows on traditional net-of-fees alpha, Panel B the regression of fund flows on net-of-fees achievable alpha, Panel C the regression of fund flows jointly on net-of-fees traditional and achievable alphas, and Panel D the regression of fund flows jointly on net-of-fees traditional and achievable alphas and their interactions with a "Risk" indicator variable that takes a value of one for months in the top decile of months sorted by realized market volatility in the prior 36 months, and zero otherwise. For all regressions, we include time and fund fixed effects, control for lagged fund flows up to 12 months, and double-cluster standard errors by time and fund.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional alpha							
Slope	0.128	0.134	0.117	0.112	0.125	0.127	0.113
	[26.339]	[33.949]	[23.804]	[23.607]	[22.526]	[32.117]	[24.708]
R2 (%)	1.638	1.805	1.364	1.256	1.563	1.609	1.276
Panel B: Achievable alpha							
Slope	0.123	0.114	0.118	0.116	0.121	0.119	0.117
	[13.136]	[12.620]	[12.673]	[12.613]	[12.624]	[12.529]	[13.687]
R2 (%)	1.516	1.295	1.391	1.343	1.467	1.409	1.362
Panel C: Traditional and achievable alpha							
Slope $\alpha_{\mathcal{T}}$	0.126	0.107	0.076	0.072	0.079	0.086	0.062
	[6.449]	[16.388]	[13.521]	[12.748]	[10.068]	[14.799]	[9.647]
Slope $\alpha_{\mathcal{A}}$	0.002	0.039	0.078	0.080	0.067	0.063	0.074
	[0.116]	[5.030]	[15.291]	[15.715]	[8.180]	[9.639]	[8.991]
R2 (%)	1.639	1.883	1.805	1.737	1.802	1.838	1.571
Panel D: Traditional and achievable alpha with risk-interaction terms							
Slope $\alpha_{\mathcal{T}}$	0.130	0.108	0.077	0.074	0.082	0.089	0.065
	[6.423]	[15.926]	[12.906]	[12.313]	[10.473]	[15.295]	[9.431]
Slope $\alpha_{\mathcal{A}}$	-0.006	0.036	0.075	0.077	0.062	0.058	0.070
	[-0.286]	[4.658]	[14.509]	[15.073]	[8.001]	[9.318]	[8.529]
Slope $\alpha_{\mathcal{T}}\times$Risk	-0.038	-0.016	-0.023	-0.021	-0.021	-0.025	-0.019
	[-2.150]	[-1.862]	[-3.534]	[-3.340]	[-2.990]	[-4.404]	[-2.422]
Slope $\alpha_{\mathcal{A}}\times$Risk	0.054	0.023	0.030	0.027	0.035	0.034	0.027
	[3.000]	[2.968]	[5.056]	[4.513]	[5.678]	[6.158]	[3.847]
R2 (%)	1.668	1.898	1.840	1.767	1.857	1.887	1.597

power of achievable gross alpha increases during periods of high market volatility. We now show that these findings are robust to considering net-of-fees alphas.

Table IA.13 replicates Table 9 of the main body of the manuscript for the case with net alphas. The results in Table IA.13 are nearly identical to those in Table 9, which demonstrates that our findings are robust to considering net-of-fees fund returns instead of gross returns. In particular, traditional and achievable net alphas are jointly significant for explaining fund flows for every model except CAPM, and the explanatory power of the achievable net alpha strengthens during periods of high market volatility. These findings suggest that investors believe that achievable net alpha is a more informative measure of future performance during periods of financial turmoil, and thus, they allocate more capital to funds with high achievable net alpha during periods of high market volatility.

IA.6 Results for Retail and Institutional Share Classes

In the main body of the manuscript, we evaluate fund performance by aggregating institutional and retail shares at the fund level. We now study performance separately for retail and institutional share classes, after aggregating only retail or institutional shares offered by funds. Our findings are robust to considering retail or institutional share classes separately. In particular, mutual-fund performance in terms of achievable alpha and value-added is substantially worse than in terms of traditional alpha and value-added for both retail and institutional share classes. Section IA.6.1 describes how we identify retail and institutional share classes, Section IA.6.2 gives the results for retail classes, and Section IA.6.3 for institutional share classes.

IA.6.1 Identifying retail and institutional share classes

We classify mutual fund share classes using fund labels rather than relying on CRSP's retail_fund/inst_fund indicators, which are available only from December 1999 and are not always consistent. For each CRSP share class, we extract from its name the share-class tag that typically follows the fund's name after a slash or semicolon (e.g., "... / Class A"). We standardize this tag by converting it to uppercase, removing the word "Class," deleting spaces, periods, and hyphens, and keeping only the first token (so "Class A," "A-share," and "A," all map to "A"). We classify a share class as institutional if either (i) its standardized tag is I, Y, X, INS, INST, NAV, or TRUST, or (ii) the full fund name contains the word "Institutional" (case-insensitive), capturing institutional classes without an explicit tag. We define restricted classes—sold through advisors, retirement platforms, or to employees—as tags ADMIN, ADVISORY, AGENCY, FIDUCIARY, F, RET, R, RETIREMENT, Z, W, Q, or S. Our retail universe comprises all unrestricted classes (i.e., tags not in the restricted set) that are neither institutional nor restricted and are not flagged by CRSP as institutional (inst_fund="Y"). For the institutional-only universe, we keep only the "true institutional" classes.

IA.6.2 Retail shares

Below, we reproduce the results in Tables 5, 6, 7, 8, and 9 in the main body of the manuscript for retail share classes. All our findings are robust to considering only retail share classes. Tables IA.14 and IA.15 show that achievable alpha and value added are, on average, much smaller than traditional alpha and value added for all models except CAPM, and Table IA.16 shows that the relative rankings change dramatically when computing performance with achievable alpha and value added. Table IA.17 shows that the difference between traditional and achievable alpha increases during periods of financial turmoil. Table IA.18 shows that fund flows react to past performance, and the relation between achievable alpha and fund flows strengthens during periods of financial turmoil, while the relation between traditional alpha and fund flows weakens during periods of financial turmoil.

Table IA.14: Traditional and achievable alphas: Retail fund classes

This table reports cross-sectional statistics for the traditional and achievable fund gross alphas with respect to the seven factor models listed in Table 3 for retail fund classes. Panel A reports cross-sectional statistics for the traditional alpha with respect to the long-short factors, obtained by regressing the fund returns on all long-short factors for each model, and Panel B for the achievable alpha with respect to the long-only factors, obtained by regressing fund returns on just those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). We report the average alpha across funds, its t-statistic, the time-weighted average alpha (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of fund alpha and the percentage of funds with positive alpha and t-statistic greater than two. Alphas are annualized and reported in percentage. As in Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range (difference between the 90th and 10th percentiles) away from the median.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional alpha with respect to long-short factors							
Average alpha	0.07	0.01	0.25	0.14	-0.06	-0.01	0.48
t-stat	1.36	0.28	4.42	2.79	-1.13	-0.27	10.63
Time-weighted average alpha	0.35	0.31	0.46	0.34	0.19	0.22	0.84
t-stat	4.07	4.16	4.24	4.08	3.14	3.52	4.64
10th percentile	-3.00	-2.39	-2.70	-2.47	-2.90	-2.66	-2.04
50th percentile	0.15	0.09	0.01	-0.03	-0.12	-0.06	0.49
90th percentile	3.01	2.39	3.45	3.00	3.05	2.82	2.96
Percentage of funds with $\alpha > 0$	52.55	51.91	50.26	49.61	47.38	48.83	61.59
Percentage of funds with $t(\alpha) > 2$	4.29	4.85	8.88	7.01	5.03	5.62	11.81
Panel B: Achievable alpha with respect to long-only factors							
Average alpha	0.03	-2.08	-2.35	-2.63	-3.66	-3.64	-1.30
t-stat	0.52	-29.03	-37.00	-38.26	-52.04	-51.03	-20.86
Time-weighted average alpha	0.33	-1.33	-1.71	-1.97	-3.15	-3.15	-0.46
t-stat	4.00	-4.65	-4.70	-4.71	-4.73	-4.73	-4.22
10th percentile	-3.07	-6.43	-5.94	-6.54	-7.72	-7.71	-5.10
50th percentile	0.13	-1.39	-1.77	-1.99	-3.06	-3.06	-0.81
90th percentile	3.00	1.49	0.94	0.84	-0.03	-0.01	1.89
Percentage of funds with $\alpha > 0$	52.04	28.36	19.74	18.01	9.76	9.90	35.29
Percentage of funds with $t(\alpha) > 2$	4.22	2.16	0.84	0.84	0.37	0.33	2.93

Table IA.15: Traditional and achievable value-added: Retail fund classes

This table reports cross-sectional statistics for the traditional and achievable fund value-added with respect to the seven factor models listed in Table 3 for retail fund classes. Panel A reports cross-sectional statistics for the traditional value-added computed as the average of the product of assets under management and abnormal returns, obtained by regressing the fund returns on all long-short factors in each model, and Panel B the achievable value-added computed using the fund abnormal returns with respect to just those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). We report the average value-added, its t-statistic, the time-weighted average value-added (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of value-added and the percentage of funds with positive average value-added. Value added is annualized and expressed in January 2000 million dollars. Like Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range away from the median.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional value-added with respect to long-short factors							
Average value-added	-1.91	-0.55	-0.14	-0.36	-1.63	-1.27	0.67
t-stat	-8.60	-2.97	-0.63	-1.82	-7.83	-6.56	3.60
Time-weighted average value-added	-1.88	-0.06	0.05	-0.15	-1.68	-1.21	1.58
t-stat	-4.00	-0.27	0.18	-0.65	-3.95	-3.58	4.03
10th percentile	-10.86	-7.62	-7.24	-7.24	-9.40	-8.65	-5.24
50th percentile	-0.35	-0.22	-0.22	-0.25	-0.39	-0.33	-0.03
90th percentile	4.72	4.47	6.61	5.15	3.76	3.87	7.22
% of funds with average value-added >0	34.14	35.52	37.07	35.01	31.84	32.39	45.60
Panel B: Achievable value-added with respect to long-only factors							
Average value-added	-1.94	-6.17	-8.60	-8.49	-13.42	-13.27	-4.30
t-stat	-8.57	-16.83	-22.46	-21.92	-25.90	-25.97	-15.41
Time-weighted average value-added	-1.90	-6.36	-10.01	-9.79	-17.20	-17.07	-3.81
t-stat	-3.98	-4.61	-4.73	-4.72	-4.76	-4.77	-4.47
10th percentile	-10.91	-23.35	-27.07	-26.67	-39.52	-39.15	-16.66
50th percentile	-0.37	-1.45	-2.20	-2.26	-3.44	-3.40	-1.13
90th percentile	4.75	1.23	0.12	0.16	-0.04	-0.04	1.70
% of funds with average value-added >0	33.72	18.90	12.68	12.86	7.23	7.75	20.41

Table IA.16: Decile difference for tradit. and achievable metrics: Retail funds

This table reports the percentage of retail fund classes whose decile rank changes when, instead of sorting funds by their traditional alpha and value-added computed with respect to the long-short version of the seven factor models listed in Table 3, we sort the funds by their achievable alpha (Panel A) and achievable value-added (Panel B) with respect to the long-only version of the seven factor models. For each factor model, we report the measure Diff defined in Equation (6) as a percentage.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Difference in deciles based on alpha							
Diff (%)	4.88	78.27	81.79	82.20	84.43	83.11	72.89
Panel B: Difference in deciles based on value-added							
Diff (%)	3.28	77.06	86.36	84.71	84.42	83.71	78.31

Table IA.17: Alpha difference during periods of turmoil: Retail funds

This table reports the slope coefficient for the market-risk variable in (7), along with its standard error and the regression R-squared, for retail fund classes. The independent variable is standardized, allowing the coefficients to be interpreted as the change in the difference between the traditional and achievable alphas (in basis points) resulting from a one-standard-deviation increase in market volatility. The first seven columns report the results for pooled regressions for each model, and the eighth column across all models. Model fixed effects are included only for the pooled regression across all models. Standard errors are clustered by fund.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG	ALL
Slope (bps)	11.790	5.076	10.259	9.774	11.494	12.601	8.589	9.940
Standard errors (bps)	0.118	0.235	0.240	0.237	0.260	0.253	0.222	0.190
Model FE	No	No	No	No	No	No	No	Yes
Fund FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared (%)	12.441	1.658	4.745	4.313	8.366	9.731	4.634	5.248

Table IA.18: Alphas and Fund Flows: Retail funds

This table reports slope coefficients and their t-statistics for several versions of panel regression (9) for retail fund classes. Panel A considers the regression of fund flows on traditional alpha, Panel B the regression of fund flows on achievable alpha, Panel C the regression of fund flows jointly on traditional and achievable alphas, and Panel D the regression of fund flows jointly on traditional and achievable alphas and their interactions with a "Risk" indicator variable that takes a value of one for months in the top decile of months sorted by realized market volatility in the prior 36 months, and zero otherwise. For all regressions, we consider time and fund fixed effects, control for lagged values of fund flows up to 12 months, and double-cluster standard errors by time and fund.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional alpha							
Slope	0.113	0.116	0.101	0.097	0.107	0.109	0.097
	[25.541]	[32.845]	[23.484]	[23.012]	[21.645]	[30.136]	[24.085]
R2 (%)	1.270	1.343	1.013	0.940	1.155	1.189	0.939
Panel B: Achievable alpha							
Slope	0.109	0.101	0.105	0.103	0.107	0.105	0.103
	[16.526]	[16.012]	[16.069]	[16.099]	[15.282]	[15.220]	[16.675]
R2 (%)	1.179	1.013	1.095	1.055	1.148	1.101	1.063
Panel C: Traditional and achievable alpha							
Slope $\alpha_{\mathcal{T}}$	0.108	0.089	0.062	0.060	0.064	0.070	0.049
	[6.389]	[16.301]	[12.449]	[12.132]	[9.398]	[13.687]	[8.501]
Slope $\alpha_{\mathcal{A}}$	0.005	0.038	0.071	0.072	0.063	0.058	0.069
	[0.293]	[6.600]	[14.698]	[15.215]	[9.547]	[10.474]	[10.442]
R2 (%)	1.270	1.416	1.361	1.313	1.362	1.381	1.192
Panel D: Traditional and achievable alpha with risk-interaction terms							
Slope $\alpha_{\mathcal{T}}$	0.112	0.091	0.064	0.062	0.067	0.074	0.052
	[6.307]	[15.827]	[11.931]	[11.674]	[9.786]	[13.962]	[8.379]
Slope $\alpha_{\mathcal{A}}$	-0.001	0.035	0.068	0.069	0.058	0.054	0.065
	[-0.082]	[6.082]	[13.673]	[14.253]	[9.234]	[9.885]	[9.755]
Slope $\alpha_{\mathcal{T}}\times$Risk	-0.034	-0.016	-0.024	-0.020	-0.021	-0.024	-0.020
	[-2.077]	[-2.212]	[-4.366]	[-3.690]	[-3.470]	[-4.759]	[-2.884]
Slope $\alpha_{\mathcal{A}}\times$Risk	0.044	0.020	0.028	0.024	0.031	0.030	0.024
	[2.766]	[2.924]	[5.330]	[4.327]	[5.484]	[5.599]	[3.882]
R2 (%)	1.286	1.426	1.392	1.337	1.403	1.419	1.212

IA.6.3 Institutional shares

Below, we reproduce the results in Tables 5, 6, 7, 8, and 9 in the main body of the manuscript for institutional share classes. Our results are generally robust to considering only institutional share classes. Tables IA.19 and IA.20 show that achievable alpha and value added are, on average, much smaller than traditional alpha and value added for all models except the CAPM, and Table IA.21 shows that the relative rankings change dramatically when computing performance with achievable alpha and value added. Table IA.22 shows that the difference between traditional and achievable alpha increases during periods of financial turmoil. Table IA.23 shows that fund flows react to past performance, measured by both achievable and traditional alpha. The only difference is that, when considering only institutional fund classes, the relation between achievable alpha and fund flows does not strengthen during periods of financial turmoil. This suggests that, in contrast to retail investors, institutional investors do not consider achievable alpha as a more credible signal of future performance during periods of financial turmoil.

Table IA.19: Traditional and achievable alphas: Institutional classes

This table reports cross-sectional statistics for the traditional and achievable fund gross alphas with respect to the seven factor models listed in Table 3 for institutional fund classes. Panel A reports cross-sectional statistics for the traditional alpha with respect to the long-short factors, obtained by regressing the fund returns on all long-short factors for each model, and Panel B for the achievable alpha with respect to the long-only factors, obtained by regressing fund returns on just those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). We report the average alpha across funds, its t-statistic, the time-weighted average alpha (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of fund alpha and the percentage of funds with positive alpha and t-statistic greater than two. Alphas are annualized and reported in percentage. As in Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range (difference between the 90th and 10th percentiles) away from the median.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional alpha with respect to long-short factors							
Average alpha	-0.32	-0.21	-0.03	-0.10	-0.27	-0.20	0.33
t-stat	-4.29	-3.52	-0.42	-1.54	-3.65	-3.03	5.46
Time-weighted average alpha	0.01	0.07	0.19	0.11	-0.03	0.02	0.59
t-stat	0.16	1.30	2.20	1.67	-0.42	0.36	3.15
10th percentile	-3.57	-2.53	-2.59	-2.49	-2.81	-2.59	-2.08
50th percentile	-0.18	-0.15	-0.15	-0.22	-0.35	-0.27	0.35
90th percentile	2.68	2.06	2.84	2.55	2.54	2.41	2.61
Percentage of funds with α >0	46.38	46.23	45.73	45.04	42.43	45.00	60.00
Percentage of funds with $t(\alpha)$ >2	2.54	2.77	6.00	4.84	3.92	3.77	9.85
Panel B: Achievable alpha with respect to long-only factors							
Average alpha	-0.35	-1.94	-2.33	-2.50	-3.52	-3.52	-1.68
t-stat	-4.74	-20.90	-27.45	-27.96	-37.59	-37.53	-20.58
Time-weighted average alpha	-0.01	-1.25	-1.80	-1.94	-3.10	-3.09	-1.02
t-stat	-0.10	-3.21	-3.25	-3.25	-3.27	-3.27	-3.20
10th percentile	-3.58	-5.85	-5.93	-6.18	-7.34	-7.34	-5.24
50th percentile	-0.20	-1.33	-1.87	-1.97	-3.03	-3.02	-1.26
90th percentile	2.65	1.33	0.81	0.67	-0.02	-0.01	1.36
Percentage of funds with α >0	46.00	28.46	18.54	17.00	9.69	9.92	28.31
Percentage of funds with $t(\alpha)$ >2	2.38	1.92	0.92	1.08	0.23	0.23	1.38

Table IA.20: Traditional and achievable value-added: Institutional classes

This table reports cross-sectional statistics for the traditional and achievable fund value-added with respect to the seven factor models listed in Table 3 for institutional fund classes. Panel A reports cross-sectional statistics for the traditional value-added computed as the average of the product of assets under management and abnormal returns, obtained by regressing the fund returns on all long-short factors in each model, and Panel B the achievable value-added computed using the fund abnormal returns with respect to just those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). We report the average value-added, its t-statistic, the time-weighted average value-added (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of value-added and the percentage of funds with positive average value-added. Value added is annualized and expressed in January 2000 million dollars. Like Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range away from the median.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional value-added with respect to long-short factors							
Average value-added	-3.05	-1.36	-1.29	-1.50	-1.81	-1.66	0.24
t-stat	-10.18	-7.47	-5.98	-8.16	-8.38	-8.29	1.44
Time-weighted average value-added	-3.18	-1.36	-1.38	-1.63	-2.10	-1.87	0.38
t-stat	-3.12	-2.98	-2.84	-3.04	-3.07	-3.06	1.72
10th percentile	-11.93	-6.54	-6.64	-6.58	-7.80	-7.27	-3.60
50th percentile	-0.64	-0.46	-0.38	-0.44	-0.49	-0.44	-0.09
90th percentile	2.08	2.24	3.39	2.24	2.04	1.88	4.66
% of funds with average value-added >0	28.67	28.95	32.82	30.80	28.72	29.41	42.74
Panel B: Achievable value-added with respect to long-only factors							
Average value-added	-3.06	-4.30	-5.81	-5.81	-9.13	-9.10	-4.42
t-stat	-10.20	-12.17	-16.24	-16.56	-19.57	-19.49	-13.86
Time-weighted average value-added	-3.18	-3.80	-6.33	-6.26	-10.71	-10.68	-4.14
t-stat	-3.12	-3.14	-3.23	-3.24	-3.25	-3.25	-3.19
10th percentile	-11.93	-16.10	-18.18	-17.68	-26.37	-26.38	-14.55
50th percentile	-0.67	-1.39	-2.09	-2.06	-3.18	-3.14	-1.47
90th percentile	2.05	1.17	0.23	0.21	-0.03	-0.03	0.80
% of funds with average value-added >0	28.36	18.39	12.95	12.95	7.81	7.81	17.61

Table IA.21: Deciles for tradit. and achievable metrics: Institutional funds

This table reports the percentage of institutional fund classes whose decile rank changes when, instead of sorting funds by their traditional alpha and value-added computed with respect to the long-short version of the seven factor models listed in Table 3, we sort the funds by their achievable alpha (Panel A) and achievable value-added (Panel B) with respect to the long-only version of the seven factor models. For each factor model, we report the measure Diff defined in Equation (6) as a percentage.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Difference in deciles based on alpha							
Diff (%)	3.77	74.00	81.38	82.85	83.08	82.54	73.62
Panel B: Difference in deciles based on value-added							
Diff (%)	2.55	72.20	79.69	78.60	81.09	81.40	80.48

Table IA.22: Alpha difference during periods of turmoil: Institutional funds

This table reports the slope coefficient for the market-risk variable in (7), along with its standard error and the regression R-squared, for institutional fund classes. The independent variable is standardized, allowing the coefficients to be interpreted as the change in the difference between the traditional and achievable alphas (in basis points) resulting from a one-standard-deviation increase in market volatility. The first seven columns report the results for pooled regressions for each model, and the eighth column across all models. Model fixed effects are included only for the pooled regression across all models. Standard errors are clustered by fund.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG	ALL
Slope (bps)	11.104	3.974	10.205	9.616	10.788	12.235	7.308	9.318
Standard errors (bps)	0.175	0.375	0.364	0.358	0.370	0.364	0.332	0.280
Model FE	No	No	No	No	No	No	No	Yes
Fund FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared (%)	11.858	1.024	3.941	3.443	7.019	8.365	3.084	4.074

Table IA.23: Alphas and Fund Flows: Institutional funds

This table reports slope coefficients and their t-statistics for several versions of panel regression (9) for institutional fund classes. Panel A considers the regression of fund flows on traditional alpha, Panel B the regression of fund flows on achievable alpha, Panel C the regression of fund flows jointly on traditional and achievable alphas, and Panel D the regression of fund flows jointly on traditional and achievable alphas and their interactions with a "Risk" indicator variable that takes a value of one for months in the top decile of months sorted by realized market volatility in the prior 36 months, and zero otherwise. For all regressions, we consider time and fund fixed effects, control for lagged values of fund flows up to 12 months, and double-cluster standard errors by time and fund.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional alpha							
Slope	0.092	0.114	0.092	0.091	0.098	0.101	0.085
	[19.665]	[27.196]	[17.632]	[16.826]	[21.580]	[25.083]	[18.638]
R2 (%)	0.842	1.293	0.851	0.830	0.962	1.016	0.730
Panel B: Achievable alpha							
Slope	0.088	0.083	0.085	0.084	0.086	0.085	0.086
	[6.284]	[5.999]	[6.002]	[5.963]	[5.957]	[5.903]	[6.733]
R2 (%)	0.771	0.692	0.721	0.709	0.737	0.727	0.744
Panel C: Traditional and achievable alpha							
Slope $\alpha_{\mathcal{T}}$	0.103	0.106	0.070	0.071	0.073	0.077	0.053
	[4.862]	[13.883]	[10.050]	[9.831]	[11.790]	[14.514]	[8.121]
Slope $\alpha_{\mathcal{A}}$	-0.012	0.011	0.058	0.060	0.039	0.039	0.055
	[-0.485]	[1.278]	[11.426]	[11.274]	[5.543]	[8.263]	[6.179]
R2 (%)	0.842	1.299	1.143	1.151	1.052	1.116	0.928
Panel D: Traditional and achievable alpha with risk-interaction terms							
Slope $\alpha_{\mathcal{T}}$	0.096	0.106	0.070	0.070	0.073	0.078	0.053
	[4.635]	[13.290]	[9.616]	[9.491]	[11.779]	[13.963]	[7.698]
Slope $\alpha_{\mathcal{A}}$	-0.008	0.010	0.058	0.060	0.037	0.038	0.054
	[-0.335]	[1.210]	[11.167]	[11.201]	[5.487]	[7.910]	[6.022]
Slope $\alpha_{\mathcal{T}}\times$Risk	0.030	0.000	0.000	0.002	-0.005	-0.007	-0.002
	[1.504]	[0.036]	[0.009]	[0.319]	[-0.647]	[-1.014]	[-0.288]
Slope $\alpha_{\mathcal{A}}\times$Risk	-0.016	0.004	0.004	0.000	0.015	0.012	0.009
	[-0.766]	[0.478]	[0.596]	[0.023]	[2.113]	[2.034]	[1.416]
R2 (%)	0.863	1.301	1.145	1.151	1.064	1.123	0.934

IA.7 Fund Performance Across Styles

In this section, we study performance separately across mutual-fund styles: growth funds, large-cap funds, small-cap funds, aggressive-growth funds, large-cap value funds, and small-cap growth funds. We assign funds to growth, large-cap, or small-cap categories using two complementary sources of style information. First, we use the most recent style classifications available from Lipper, Strategic Insight, or Wiesenberger (e.g., LCGE for large-cap growth, SCGE for small-cap growth, LTG for large-cap growth). Second, we apply CRSP's unified objective code (CRSP_OBJ_CD), which encodes asset class, geography, and style in a four-character string; we restrict our analysis to domestic equity funds and then require the fourth character to equal the relevant style (G for growth, L for large-cap, and S for small-cap). A fund is included in a style category if it meets the criteria under either system. This approach ensures comprehensive coverage across time, since not all classification providers report consistently for all funds and periods.

IA.7.1 Growth funds

Below, we reproduce the results in Tables 5, 6, 7, 8, and 9 in the main body of the manuscript for growth funds. Our results are generally robust to considering only growth funds. Tables IA.24 and IA.25 show that achievable alpha and value added are, on average, much smaller than traditional alpha and value added for all models except CAPM, and Table IA.26 shows that the relative rankings change dramatically when computing performance with achievable alpha and value added. Table IA.27 shows that the difference between traditional and achievable alpha increases during periods of financial turmoil. Table IA.28 shows that fund flows react to past performance, and the relation between achievable alpha and fund flows strengthens during periods of financial turmoil, while the relation between traditional alpha and fund flows weakens during periods of financial turmoil.

Table IA.24: Traditional and achievable alphas: Growth funds

This table reports cross-sectional statistics for the traditional and achievable fund gross alphas with respect to the seven factor models listed in Table 3 for growth funds. Panel A reports cross-sectional statistics for the traditional alpha with respect to the long-short factors, obtained by regressing the fund returns on all long-short factors for each model, and Panel B for the achievable alpha with respect to the long-only factors, obtained by regressing fund returns on just those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). We report the average alpha across funds, its t-statistic, the time-weighted average alpha (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of fund alpha and the percentage of funds with positive alpha and t-statistic greater than two. Alphas are annualized and reported in percentage. As in Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range (difference between the 90th and 10th percentiles) away from the median.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional alpha with respect to long-short factors							
Average alpha	0.05	-0.02	0.53	0.35	0.09	0.13	0.54
t-stat	0.84	-0.38	8.02	6.07	1.51	2.30	10.27
Time-weighted average alpha	0.33	0.29	0.70	0.51	0.36	0.37	0.91
t-stat	3.68	3.69	4.09	4.00	3.65	3.75	4.23
10th percentile	-2.98	-2.49	-2.53	-2.40	-2.83	-2.61	-2.13
50th percentile	0.15	0.07	0.25	0.15	0.03	0.09	0.52
90th percentile	2.94	2.49	3.96	3.37	3.40	3.12	3.14
Percentage of funds with α >0	52.46	51.46	55.00	52.79	50.49	51.64	61.51
Percentage of funds with $t(\alpha)$ >2	3.68	4.61	10.63	8.38	5.90	6.69	12.05
Panel B: Achievable alpha with respect to long-only factors							
Average alpha	0.01	-2.26	-2.42	-2.75	-3.86	-3.86	-1.30
t-stat	0.12	-27.10	-32.57	-34.30	-46.02	-46.36	-18.23
Time-weighted average alpha	0.32	-1.48	-1.74	-2.06	-3.31	-3.31	-0.43
t-stat	3.62	-4.24	-4.27	-4.28	-4.30	-4.30	-3.73
10th percentile	-3.04	-7.07	-6.40	-7.20	-8.37	-8.37	-5.27
50th percentile	0.12	-1.49	-1.77	-2.04	-3.15	-3.15	-0.77
90th percentile	2.91	1.45	1.05	0.92	-0.03	-0.01	1.98
Percentage of funds with α >0	51.93	27.81	21.05	18.64	9.74	9.96	36.58
Percentage of funds with $t(\alpha)$ >2	3.68	1.59	0.66	0.71	0.27	0.27	2.83

Table IA.25: Traditional and achievable value-added: Growth funds

This table reports cross-sectional statistics for the traditional and achievable fund value-added with respect to the seven factor models listed in Table 3 for growth funds. Panel A reports cross-sectional statistics for the traditional value-added computed as the average of the product of assets under management and abnormal returns, obtained by regressing the fund returns on all long-short factors in each model, and Panel B the achievable value-added computed using the fund abnormal returns with respect to just those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). We report the average value-added, its t-statistic, the time-weighted average value-added (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of value-added and the percentage of funds with positive average value-added. Value added is annualized and expressed in January 2000 million dollars. Like Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range away from the median.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional value-added with respect to long-short factors							
Average value-added	-3.39	-1.47	0.10	-0.52	-1.81	-1.58	1.03
t-stat	-10.62	-6.03	0.35	-1.97	-6.54	-6.12	4.10
Time-weighted average value-added	-3.75	-1.05	0.32	-0.45	-1.81	-1.57	1.98
t-stat	-4.02	-2.80	0.92	-1.41	-3.49	-3.36	3.69
10th percentile	-16.18	-10.03	-8.60	-9.14	-11.26	-10.71	-6.43
50th percentile	-0.69	-0.50	-0.26	-0.39	-0.60	-0.55	-0.06
90th percentile	4.65	4.69	9.32	7.07	4.99	5.04	9.59
% of funds with average value-added >0	31.57	32.69	40.04	35.88	32.52	32.66	46.83
Panel B: Achievable value-added with respect to long-only factors							
Average value-added	-3.41	-8.02	-11.49	-11.05	-18.45	-18.36	-6.09
t-stat	-10.69	-16.25	-20.35	-20.60	-24.48	-24.41	-16.09
Time-weighted average value-added	-3.76	-8.52	-13.59	-13.32	-23.79	-23.71	-5.58
t-stat	-4.03	-4.22	-4.29	-4.29	-4.32	-4.32	-4.16
10th percentile	-16.19	-27.68	-33.87	-33.32	-50.76	-50.65	-21.77
50th percentile	-0.72	-2.55	-3.60	-3.77	-5.84	-5.79	-1.85
90th percentile	4.62	1.24	0.15	0.18	-0.18	-0.17	1.90
% of funds with average value-added >0	30.95	17.75	12.07	12.18	5.87	6.36	19.01

Table IA.26: Deciles for tradit. and achievable metrics: Growth funds

This table reports the percentage of growth funds whose decile rank changes when, instead of sorting funds by their traditional alpha and value-added computed with respect to the long-short version of the seven factor models listed in Table 3, we sort the funds by their achievable alpha (Panel A) and achievable value-added (Panel B) with respect to the long-only version of the seven factor models. For each factor model, we report the measure Diff defined in Equation (6) as a percentage.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Difference in rankings based on alpha							
Diff (%)	4.92	78.24	82.90	83.02	83.55	83.29	71.70
Panel B: Difference in ranking based on value-added							
Diff (%)	3.50	76.13	87.29	84.84	86.60	86.42	80.81

Table IA.27: Alpha difference during periods of turmoil: Growth funds

This table reports the slope coefficient for the market-risk variable in (7), along with its standard error and the regression R-squared, for growth funds. The independent variable is standardized, allowing the coefficients to be interpreted as the change in the difference between the traditional and achievable alphas (in basis points) resulting from a one-standard-deviation increase in market volatility. The first seven columns report the results for pooled regressions for each model, and the eighth column across all models. Model fixed effects are included only for the pooled regression across all models. Standard errors are clustered by fund.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG	ALL
Slope (bps)	12.064	4.733	10.184	9.926	12.794	13.954	8.636	10.327
Standard errors (bps)	0.133	0.256	0.270	0.264	0.294	0.284	0.251	0.215
Model FE	No	No	No	No	No	No	No	Yes
Fund FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared (%)	12.276	1.390	4.975	4.714	10.398	12.091	4.627	5.991

Table IA.28: Alphas and Fund Flows: Growth funds

This table reports slope coefficients and their t-statistics for several versions of panel regression (9) for growth funds. Panel A considers the regression of fund flows on traditional alpha, Panel B the regression of fund flows on achievable alpha, Panel C the regression of fund flows jointly on traditional and achievable alphas, and Panel D the regression of fund flows jointly on traditional and achievable alphas and their interactions with a "Risk" indicator variable that takes a value of one for months in the top decile of months sorted by realized market volatility in the prior 36 months, and zero otherwise. For all regressions, we consider time and fund fixed effects, control for lagged values of fund flows up to 12 months, and double-cluster standard errors by time and fund.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional alpha							
Slope	0.137	0.140	0.125	0.121	0.130	0.133	0.118
	[28.163]	[34.995]	[26.935]	[27.267]	[22.197]	[31.847]	[24.372]
R2 (%)	1.882	1.964	1.568	1.468	1.697	1.778	1.382
Panel B: Achievable alpha							
Slope	0.131	0.121	0.125	0.123	0.128	0.125	0.122
	[21.438]	[20.644]	[20.866]	[21.144]	[20.979]	[21.019]	[19.428]
R2 (%)	1.710	1.457	1.559	1.511	1.630	1.572	1.484
Panel C: Traditional and achievable alpha							
Slope $\alpha_{\mathcal{T}}$	0.149	0.110	0.078	0.074	0.080	0.089	0.062
	[7.254]	[16.647]	[12.333]	[11.932]	[9.747]	[13.698]	[8.007]
Slope $\alpha_{\mathcal{A}}$	-0.012	0.042	0.077	0.079	0.070	0.063	0.078
	[-0.610]	[6.818]	[12.953]	[13.699]	[10.120]	[9.725]	[9.594]
R2 (%)	1.883	2.051	1.929	1.867	1.936	1.982	1.673
Panel D: Traditional and achievable alpha with risk-interaction terms							
Slope $\alpha_{\mathcal{T}}$	0.153	0.113	0.081	0.078	0.084	0.095	0.067
	[7.145]	[16.301]	[12.193]	[11.777]	[10.000]	[14.061]	[8.044]
Slope $\alpha_{\mathcal{A}}$	-0.019	0.038	0.073	0.075	0.064	0.057	0.073
	[-0.954]	[6.115]	[12.099]	[12.819]	[9.254]	[8.760]	[8.753]
Slope $\alpha_{\mathcal{T}}\times$Risk	-0.048	-0.024	-0.029	-0.026	-0.025	-0.030	-0.024
	[-2.170]	[-2.714]	[-4.319]	[-4.131]	[-3.174]	[-4.574]	[-2.866]
Slope $\alpha_{\mathcal{A}}\times$Risk	0.058	0.026	0.033	0.029	0.035	0.035	0.027
	[2.667]	[3.088]	[5.011]	[4.481]	[4.911]	[5.364]	[3.720]
R2 (%)	1.902	2.067	1.969	1.901	1.989	2.034	1.698

IA.7.2 Large-cap funds

Below, we reproduce the results in Tables 5, 6, 7, 8, and 9 in the main body of the manuscript for large-cap funds. Our results are generally robust to considering only large-cap funds. Tables IA.29 and IA.30 show that achievable alpha and value added are, on average, much smaller than traditional alpha and value added for all models except CAPM, and Table IA.31 shows that the relative rankings change dramatically when computing performance with achievable alpha and value added. Table IA.32 shows that the difference between traditional and achievable alpha increases during periods of financial turmoil. Table IA.33 shows that fund flows react to past performance, and the relation between achievable alpha and fund flows strengthens during periods of financial turmoil, while the relation between traditional alpha and fund flows weakens during periods of financial turmoil.

Table IA.29: Traditional and achievable alphas: Large-cap funds

This table reports cross-sectional statistics for the traditional and achievable fund gross alphas with respect to the seven factor models listed in Table 3 for large-cap funds. Panel A reports cross-sectional statistics for the traditional alpha with respect to the long-short factors, obtained by regressing the fund returns on all long-short factors for each model, and Panel B for the achievable alpha with respect to the long-only factors, obtained by regressing fund returns on just those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). We report the average alpha across funds, its t-statistic, the time-weighted average alpha (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of fund alpha and the percentage of funds with positive alpha and t-statistic greater than two. Alphas are annualized and reported in percentage. As in Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range (difference between the 90th and 10th percentiles) away from the median.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional alpha with respect to long-short factors							
Average alpha	0.06	0.17	0.14	0.13	-0.06	-0.04	0.26
t-stat	0.95	3.39	1.95	2.07	-0.80	-0.67	4.69
Time-weighted average alpha	0.35	0.39	0.34	0.30	0.13	0.14	0.62
t-stat	2.81	2.93	2.68	2.68	1.71	1.97	3.01
10th percentile	-2.33	-1.73	-2.21	-1.86	-2.43	-2.25	-1.81
50th percentile	0.20	0.16	-0.11	-0.07	-0.17	-0.18	0.26
90th percentile	2.30	2.08	2.79	2.56	2.59	2.43	2.36
Percentage of funds with $\alpha > 0$	54.93	54.84	47.95	47.95	45.46	46.53	57.24
Percentage of funds with $t(\alpha) > 2$	3.51	5.06	8.82	7.11	4.54	4.97	9.85
Panel B: Achievable alpha with respect to long-only factors							
Average alpha	0.02	-1.78	-2.15	-2.35	-3.26	-3.25	-1.36
t-stat	0.36	-17.14	-22.26	-23.35	-31.79	-31.69	-14.74
Time-weighted average alpha	0.33	-0.99	-1.46	-1.65	-2.71	-2.71	-0.45
t-stat	2.78	-3.01	-3.07	-3.07	-3.09	-3.09	-2.75
10th percentile	-2.43	-6.26	-6.01	-6.50	-7.49	-7.48	-5.14
50th percentile	0.19	-1.00	-1.58	-1.67	-2.67	-2.66	-0.76
90th percentile	2.30	1.57	1.16	1.07	0.30	0.35	1.63
Percentage of funds with $\alpha > 0$	54.67	33.68	23.91	22.11	12.43	12.77	34.53
Percentage of funds with $t(\alpha) > 2$	3.51	2.57	1.11	1.11	0.26	0.26	3.43

Table IA.30: Traditional and achievable value-added: Large-cap funds

This table reports cross-sectional statistics for the traditional and achievable fund value-added with respect to the seven factor models listed in Table 3 for large-cap funds. Panel A reports cross-sectional statistics for the traditional value-added computed as the average of the product of assets under management and abnormal returns, obtained by regressing the fund returns on all long-short factors in each model, and Panel B the achievable value-added computed using the fund abnormal returns with respect to just those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). We report the average value-added, its t-statistic, the time-weighted average value-added (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of value-added and the percentage of funds with positive average value-added. Value added is annualized and expressed in January 2000 million dollars. Like Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range away from the median.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional value-added with respect to long-short factors							
Average value-added	-2.42	-0.88	-1.49	-1.53	-2.45	-2.00	-0.04
t-stat	-6.11	-2.64	-3.09	-3.77	-5.23	-4.96	-0.10
Time-weighted average value-added	-2.55	-0.53	-1.79	-1.90	-3.26	-2.63	0.55
t-stat	-2.77	-1.25	-2.24	-2.52	-2.80	-2.79	1.23
10th percentile	-12.71	-9.03	-11.91	-10.86	-13.53	-11.74	-7.83
50th percentile	-0.39	-0.29	-0.43	-0.43	-0.64	-0.59	-0.18
90th percentile	4.31	4.73	7.00	6.11	4.53	4.32	6.46
% of funds with average value-added >0	35.55	36.75	34.76	34.44	31.29	31.69	40.96
Panel B: Achievable value-added with respect to long-only factors							
Average value-added	-2.40	-6.77	-10.50	-10.89	-18.26	-18.24	-5.25
t-stat	-6.10	-7.76	-11.72	-11.33	-15.83	-15.80	-9.34
Time-weighted average value-added	-2.55	-6.57	-12.29	-13.01	-23.50	-23.49	-4.05
t-stat	-2.77	-2.87	-3.07	-3.06	-3.12	-3.12	-2.84
10th percentile	-12.71	-29.07	-34.12	-36.77	-51.16	-51.16	-20.36
50th percentile	-0.40	-1.67	-2.82	-2.95	-5.21	-5.21	-1.61
90th percentile	4.31	4.24	1.32	1.38	-0.06	-0.03	2.54
% of funds with average value-added >0	35.23	24.74	17.31	17.26	8.90	9.69	20.19

Table IA.31: Deciles for tradit. and achievable metrics: Large-cap funds

This table reports the percentage of large-cap funds whose decile rank changes when, instead of sorting funds by their traditional alpha and value-added computed with respect to the long-short version of the seven factor models listed in Table 3, we sort the funds by their achievable alpha (Panel A) and achievable value-added (Panel B) with respect to the long-only version of the seven factor models. For each factor model, we report the measure Diff defined in Equation (6) as a percentage.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Difference in rankings based on alpha							
Diff (%)	3.86	81.66	83.89	83.03	86.46	86.20	73.01
Panel B: Difference in ranking based on value-added							
Diff (%)	2.19	79.43	82.11	82.69	82.85	82.82	75.09

Table IA.32: Alpha difference during periods of turmoil: Large-cap funds

This table reports the slope coefficient for the market-risk variable in (7), along with its standard error and the regression R-squared, for large-cap funds. The independent variable is standardized, allowing the coefficients to be interpreted as the change in the difference between the traditional and achievable alphas (in basis points) resulting from a one-standard-deviation increase in market volatility. The first seven columns report the results for pooled regressions for each model, and the eighth column across all models. Model fixed effects are included only for the pooled regression across all models. Standard errors are clustered by fund.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG	ALL
Slope (bps)	11.550	10.862	14.710	14.248	16.012	16.634	11.428	13.635
Standard errors (bps)	0.154	0.297	0.315	0.311	0.369	0.368	0.299	0.260
Model FE	No	No	No	No	No	No	No	Yes
Fund FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared (%)	13.120	5.794	7.023	6.579	11.468	11.816	6.916	7.484

Table IA.33: Alphas and Fund Flows: Large-cap funds

This table reports slope coefficients and their t-statistics for several versions of panel regression (9) for large-cap funds. Panel A considers the regression of fund flows on traditional alpha, Panel B the regression of fund flows on achievable alpha, Panel C the regression of fund flows jointly on traditional and achievable alphas, and Panel D the regression of fund flows jointly on traditional and achievable alphas and their interactions with a "Risk" indicator variable that takes a value of one for months in the top decile of months sorted by realized market volatility in the prior 36 months, and zero otherwise. For all regressions, we consider time and fund fixed effects, control for lagged values of fund flows up to 12 months, and double-cluster standard errors by time and fund.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional alpha							
Slope	0.111	0.119	0.097	0.091	0.105	0.105	0.097
	[22.134]	[31.807]	[17.720]	[17.087]	[24.983]	[29.414]	[20.873]
R2 (%)	1.241	1.427	0.932	0.835	1.100	1.100	0.945
Panel B: Achievable alpha							
Slope	0.102	0.090	0.093	0.092	0.095	0.094	0.092
	[5.472]	[5.547]	[5.542]	[5.465]	[5.582]	[5.526]	[6.364]
R2 (%)	1.037	0.808	0.860	0.842	0.907	0.877	0.844
Panel C: Traditional and achievable alpha							
Slope $\alpha_{\mathcal{T}}$	0.176	0.106	0.074	0.071	0.075	0.077	0.066
	[6.649]	[13.601]	[10.554]	[11.053]	[9.615]	[11.870]	[8.851]
Slope $\alpha_{\mathcal{A}}$	-0.068	0.021	0.068	0.072	0.052	0.054	0.052
	[-3.094]	[1.952]	[12.799]	[13.551]	[5.297]	[7.432]	[6.311]
R2 (%)	1.276	1.453	1.344	1.308	1.277	1.308	1.113
Panel D: Traditional and achievable alpha with risk-interaction terms							
Slope $\alpha_{\mathcal{T}}$	0.182	0.107	0.074	0.072	0.075	0.079	0.066
	[6.468]	[13.410]	[9.658]	[10.176]	[9.958]	[11.949]	[7.931]
Slope $\alpha_{\mathcal{A}}$	-0.077	0.019	0.066	0.070	0.048	0.050	0.048
	[-3.352]	[1.782]	[11.778]	[12.675]	[5.358]	[7.678]	[6.178]
Slope $\alpha_{\mathcal{T}}\times$Risk	-0.059	-0.019	-0.019	-0.023	-0.013	-0.023	-0.017
	[-3.017]	[-2.034]	[-2.948]	[-3.574]	[-2.072]	[-3.971]	[-2.701]
Slope $\alpha_{\mathcal{A}}\times$Risk	0.078	0.025	0.027	0.028	0.028	0.032	0.027
	[3.925]	[2.649]	[4.247]	[3.967]	[4.416]	[5.038]	[4.307]
R2 (%)	1.330	1.467	1.373	1.340	1.319	1.355	1.141

IA.7.3 Small-cap funds

Below, we reproduce the results in Tables 5, 6, 7, 8, and 9 in the main body of the manuscript for small-cap funds. Our results are generally robust to considering only small-cap funds. Tables IA.34 and IA.35 show that achievable alpha and value added are, on average, much smaller than traditional alpha and value added for all models except CAPM, and Table IA.36 shows that the relative rankings change dramatically when computing performance with achievable alpha and value added. Table IA.37 shows that the difference between traditional and achievable alpha increases during periods of financial turmoil. Table IA.38 shows that fund flows react to past performance, and the relation between achievable alpha and fund flows strengthens during periods of financial turmoil, while the relation between traditional alpha and fund flows weakens during periods of financial turmoil.

Table IA.34: Traditional and achievable alphas: Small-cap funds

This table reports cross-sectional statistics for the traditional and achievable fund gross alphas with respect to the seven factor models listed in Table 3 for small-cap funds. Panel A reports cross-sectional statistics for the traditional alpha with respect to the long-short factors, obtained by regressing the fund returns on all long-short factors for each model, and Panel B for the achievable alpha with respect to the long-only factors, obtained by regressing fund returns on just those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). We report the average alpha across funds, its t-statistic, the time-weighted average alpha (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of fund alpha and the percentage of funds with positive alpha and t-statistic greater than two. Alphas are annualized and reported in percentage. As in Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range (difference between the 90th and 10th percentiles) away from the median.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional alpha with respect to long-short factors							
Average alpha	0.05	-0.02	0.53	0.35	0.09	0.13	0.54
t-stat	0.84	-0.38	8.02	6.07	1.51	2.30	10.27
Time-weighted average alpha	0.33	0.29	0.70	0.51	0.36	0.37	0.91
t-stat	3.68	3.69	4.09	4.00	3.65	3.75	4.23
10th percentile	-2.98	-2.49	-2.53	-2.40	-2.83	-2.61	-2.13
50th percentile	0.15	0.07	0.25	0.15	0.03	0.09	0.52
90th percentile	2.94	2.49	3.96	3.37	3.40	3.12	3.14
Percentage of funds with α >0	52.46	51.46	55.00	52.79	50.49	51.64	61.51
Percentage of funds with $t(\alpha)$ >2	3.68	4.61	10.63	8.38	5.90	6.69	12.05
Panel B: Achievable alpha with respect to long-only factors							
Average alpha	0.01	-2.26	-2.42	-2.75	-3.86	-3.86	-1.30
t-stat	0.12	-27.10	-32.57	-34.30	-46.02	-46.36	-18.23
Time-weighted average alpha	0.32	-1.48	-1.74	-2.06	-3.31	-3.31	-0.43
t-stat	3.62	-4.24	-4.27	-4.28	-4.30	-4.30	-3.73
10th percentile	-3.04	-7.07	-6.40	-7.20	-8.37	-8.37	-5.27
50th percentile	0.12	-1.49	-1.77	-2.04	-3.15	-3.15	-0.77
90th percentile	2.91	1.45	1.05	0.92	-0.03	-0.01	1.98
Percentage of funds with α >0	51.93	27.81	21.05	18.64	9.74	9.96	36.58
Percentage of funds with $t(\alpha)$ >2	3.68	1.59	0.66	0.71	0.27	0.27	2.83

Table IA.35: Traditional and achievable value-added: Small-cap funds

This table reports cross-sectional statistics for the traditional and achievable fund value-added with respect to the seven factor models listed in Table 3 for small-cap funds. Panel A reports cross-sectional statistics for the traditional value-added computed as the average of the product of assets under management and abnormal returns, obtained by regressing the fund returns on all long-short factors in each model, and Panel B the achievable value-added computed using the fund abnormal returns with respect to just those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). We report the average value-added, its t-statistic, the time-weighted average value-added (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of value-added and the percentage of funds with positive average value-added. Value added is annualized and expressed in January 2000 million dollars. Like Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range away from the median.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional value-added with respect to long-short factors							
Average value-added	-3.39	-1.47	0.10	-0.52	-1.81	-1.58	1.03
t-stat	-10.62	-6.03	0.35	-1.97	-6.54	-6.12	4.10
Time-weighted average value-added	-3.75	-1.05	0.32	-0.45	-1.81	-1.57	1.98
t-stat	-4.02	-2.80	0.92	-1.41	-3.49	-3.36	3.69
10th percentile	-16.18	-10.03	-8.60	-9.14	-11.26	-10.71	-6.43
50th percentile	-0.69	-0.50	-0.26	-0.39	-0.60	-0.55	-0.06
90th percentile	4.65	4.69	9.32	7.07	4.99	5.04	9.59
% of funds with average value-added >0	31.57	32.69	40.04	35.88	32.52	32.66	46.83
Panel B: Achievable value-added with respect to long-only factors							
Average value-added	-3.41	-8.02	-11.49	-11.05	-18.45	-18.36	-6.09
t-stat	-10.69	-16.25	-20.35	-20.60	-24.48	-24.41	-16.09
Time-weighted average value-added	-3.76	-8.52	-13.59	-13.32	-23.79	-23.71	-5.58
t-stat	-4.03	-4.22	-4.29	-4.29	-4.32	-4.32	-4.16
10th percentile	-16.19	-27.68	-33.87	-33.32	-50.76	-50.65	-21.77
50th percentile	-0.72	-2.55	-3.60	-3.77	-5.84	-5.79	-1.85
90th percentile	4.62	1.24	0.15	0.18	-0.18	-0.17	1.90
% of funds with average value-added >0	30.95	17.75	12.07	12.18	5.87	6.36	19.01

Table IA.36: Deciles for tradit. and achievable metrics: Small-cap funds

This table reports the percentage of small-cap funds whose decile rank changes when, instead of sorting funds by their traditional alpha and value-added computed with respect to the long-short version of the seven factor models listed in Table 3, we sort the funds by their achievable alpha (Panel A) and achievable value-added (Panel B) with respect to the long-only version of the seven factor models. For each factor model, we report the measure Diff defined in Equation (6) as a percentage.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Difference in rankings based on alpha							
Diff (%)	4.92	78.24	82.90	83.02	83.55	83.29	71.70
Panel B: Difference in ranking based on value-added							
Diff (%)	3.50	76.13	87.29	84.84	86.60	86.42	80.81

Table IA.37: Alpha difference during periods of turmoil: Small-cap funds

This table reports the slope coefficient for the market-risk variable in (7), along with its standard error and the regression R-squared, for small-cap funds. The independent variable is standardized, allowing the coefficients to be interpreted as the change in the difference between the traditional and achievable alphas (in basis points) resulting from a one-standard-deviation increase in market volatility. The first seven columns report the results for pooled regressions for each model, and the eighth column across all models. Model fixed effects are included only for the pooled regression across all models. Standard errors are clustered by fund.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG	ALL
Slope (bps)	12.064	4.733	10.184	9.926	12.794	13.954	8.636	10.327
Standard errors (bps)	0.133	0.256	0.270	0.264	0.294	0.284	0.251	0.215
Model FE	No	No	No	No	No	No	No	Yes
Fund FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared (%)	12.276	1.390	4.975	4.714	10.398	12.091	4.627	5.991

Table IA.38: Alphas and Fund Flows: Small-cap funds

This table reports slope coefficients and their t-statistics for several versions of panel regression (9) for small-cap funds. Panel A considers the regression of fund flows on traditional alpha, Panel B the regression of fund flows on achievable alpha, Panel C the regression of fund flows jointly on traditional and achievable alphas, and Panel D the regression of fund flows jointly on traditional and achievable alphas and their interactions with a "Risk" indicator variable that takes a value of one for months in the top decile of months sorted by realized market volatility in the prior 36 months, and zero otherwise. For all regressions, we consider time and fund fixed effects, control for lagged values of fund flows up to 12 months, and double-cluster standard errors by time and fund.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional alpha							
Slope	0.137	0.140	0.125	0.121	0.130	0.133	0.118
	[28.163]	[34.995]	[26.935]	[27.267]	[22.197]	[31.847]	[24.372]
R2 (%)	1.882	1.964	1.568	1.468	1.697	1.778	1.382
Panel B: Achievable alpha							
Slope	0.131	0.121	0.125	0.123	0.128	0.125	0.122
	[21.438]	[20.644]	[20.866]	[21.144]	[20.979]	[21.019]	[19.428]
R2 (%)	1.710	1.457	1.559	1.511	1.630	1.572	1.484
Panel C: Traditional and achievable alpha							
Slope $\alpha_{\mathcal{T}}$	0.149	0.110	0.078	0.074	0.080	0.089	0.062
	[7.254]	[16.647]	[12.333]	[11.932]	[9.747]	[13.698]	[8.007]
Slope $\alpha_{\mathcal{A}}$	-0.012	0.042	0.077	0.079	0.070	0.063	0.078
	[-0.610]	[6.818]	[12.953]	[13.699]	[10.120]	[9.725]	[9.594]
R2 (%)	1.883	2.051	1.929	1.867	1.936	1.982	1.673
Panel D: Traditional and achievable alpha with risk-interaction terms							
Slope $\alpha_{\mathcal{T}}$	0.153	0.113	0.081	0.078	0.084	0.095	0.067
	[7.145]	[16.301]	[12.193]	[11.777]	[10.000]	[14.061]	[8.044]
Slope $\alpha_{\mathcal{A}}$	-0.019	0.038	0.073	0.075	0.064	0.057	0.073
	[-0.954]	[6.115]	[12.099]	[12.819]	[9.254]	[8.760]	[8.753]
Slope $\alpha_{\mathcal{T}}\times$Risk	-0.048	-0.024	-0.029	-0.026	-0.025	-0.030	-0.024
	[-2.170]	[-2.714]	[-4.319]	[-4.131]	[-3.174]	[-4.574]	[-2.866]
Slope $\alpha_{\mathcal{A}}\times$Risk	0.058	0.026	0.033	0.029	0.035	0.035	0.027
	[2.667]	[3.088]	[5.011]	[4.481]	[4.911]	[5.364]	[3.720]
R2 (%)	1.902	2.067	1.969	1.901	1.989	2.034	1.698

IA.7.4 Aggressive-growth funds

Below, we reproduce the results in Tables 5, 6, 7, 8, and 9 in the main body of the manuscript for aggressive-growth funds. Our results are generally robust to considering only small-cap funds. Tables IA.39 and IA.40 show that achievable alpha and value added are, on average, much smaller than traditional alpha and value added for all models except CAPM, and Table IA.41 shows that the relative rankings change dramatically when computing performance with achievable alpha and value added. Table IA.42 shows that the difference between traditional and achievable alpha increases during periods of financial turmoil. Table IA.43 shows that fund flows react to past performance, and the relation between achievable alpha and fund flows strengthens during periods of financial turmoil, while the relation between traditional alpha and fund flows weakens during periods of financial turmoil.

Table IA.39: Traditional and achievable alphas: Aggressive-growth funds

This table reports cross-sectional statistics for the traditional and achievable fund gross alphas with respect to the seven factor models listed in Table 3 for small-cap funds. Panel A reports cross-sectional statistics for the traditional alpha with respect to the long-short factors, obtained by regressing the fund returns on all long-short factors for each model, and Panel B for the achievable alpha with respect to the long-only factors, obtained by regressing fund returns on just those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). We report the average alpha across funds, its t-statistic, the time-weighted average alpha (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of fund alpha and the percentage of funds with positive alpha and t-statistic greater than two. Alphas are annualized and reported in percentage. As in Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range (difference between the 90th and 10th percentiles) away from the median.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional alpha with respect to long-short factors							
Average alpha	-0.10	0.12	1.37	0.93	0.67	0.58	0.74
t-stat	-0.41	0.49	4.11	3.12	2.07	1.91	3.14
Time-weighted average alpha	0.43	0.45	1.39	0.97	0.84	0.75	1.35
t-stat	1.01	1.02	1.10	1.08	1.06	1.06	1.11
10th percentile	-4.33	-4.03	-3.87	-2.93	-4.12	-3.48	-2.75
50th percentile	0.42	0.55	1.49	1.04	0.95	0.90	1.03
90th percentile	3.01	3.06	5.75	4.47	4.73	4.13	3.80
Percentage of funds with α >0	59.74	61.69	70.78	64.29	64.94	61.04	66.88
Percentage of funds with $t(\alpha)$ >2	3.90	6.49	22.08	18.18	12.34	13.64	16.23
Panel B: Achievable alpha with respect to long-only factors							
Average alpha	-0.10	-3.20	-2.74	-3.52	-4.91	-4.90	-0.37
t-stat	-0.41	-9.06	-8.81	-10.48	-13.56	-13.57	-1.34
Time-weighted average alpha	0.43	-2.10	-1.87	-2.51	-3.96	-3.94	0.59
t-stat	1.01	-1.11	-1.11	-1.12	-1.12	-1.12	1.04
10th percentile	-4.33	-8.42	-7.65	-8.48	-10.00	-9.93	-4.79
50th percentile	0.42	-2.31	-1.79	-2.59	-3.96	-3.87	0.27
90th percentile	3.01	1.51	1.00	0.73	-0.85	-0.85	3.11
Percentage of funds with α >0	59.74	21.43	19.48	15.58	2.60	2.60	54.55
Percentage of funds with $t(\alpha)$ >2	3.90	1.30	0.65	0.65	0.00	0.00	7.79

Table IA.40: Traditional and achievable value-added: Aggressive-growth funds

This table reports cross-sectional statistics for the traditional and achievable fund value-added with respect to the seven factor models listed in Table 3 for aggressive-growth funds. Panel A reports cross-sectional statistics for the traditional value-added computed as the average of the product of assets under management and abnormal returns, obtained by regressing the fund returns on all long-short factors in each model, and Panel B the achievable value-added computed using the fund abnormal returns with respect to just those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). We report the average value-added, its t-statistic, the time-weighted average value-added (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of value-added and the percentage of funds with positive average value-added. Value added is annualized and expressed in January 2000 million dollars. Like Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range away from the median.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional value-added with respect to long-short factors							
Average value-added	-6.17	-0.73	6.66	2.90	-2.36	-2.77	1.94
t-stat	-3.28	-0.50	2.83	1.30	-1.20	-1.32	1.32
Time-weighted average value-added	-6.64	-0.74	6.16	1.31	-3.94	-4.77	2.87
t-stat	-1.06	-0.43	1.02	0.47	-0.94	-0.97	0.96
10th percentile	-27.60	-16.32	-12.85	-17.41	-20.73	-22.19	-11.23
50th percentile	-0.81	-0.23	0.37	-0.04	-0.30	-0.26	0.14
90th percentile	7.49	12.47	43.58	23.82	11.37	12.27	18.40
% of funds with average value-added >0	31.82	41.18	56.21	49.02	44.44	43.14	53.25
Panel B: Achievable value-added with respect to long-only factors							
Average value-added	-6.17	-19.70	-29.91	-26.32	-41.92	-41.72	-7.79
t-stat	-3.28	-5.65	-6.12	-6.21	-6.48	-6.46	-4.61
Time-weighted average value-added	-6.64	-19.85	-35.51	-28.70	-49.28	-49.00	-6.63
t-stat	-1.06	-1.12	-1.11	-1.12	-1.12	-1.12	-1.08
10th percentile	-27.60	-61.29	-79.55	-67.44	-115.53	-115.53	-29.37
50th percentile	-0.81	-6.95	-7.41	-7.83	-12.20	-12.20	-1.35
90th percentile	7.49	0.95	-0.24	-0.26	-0.60	-0.60	7.14
% of funds with average value-added >0	31.82	12.58	5.84	5.92	2.61	2.61	25.49

Table IA.41: Deciles for tradit. and achievable metrics: Aggressive-growth funds

This table reports the percentage of aggressive-growth funds whose decile rank changes when, instead of sorting funds by their traditional alpha and value-added computed with respect to the long-short version of the seven factor models listed in Table 3, we sort the funds by their achievable alpha (Panel A) and achievable value-added (Panel B) with respect to the long-only version of the seven factor models. For each factor model, we report the measure Diff defined in Equation (6) as a percentage.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Difference in rankings based on alpha							
Diff (%)	0.00	74.03	83.12	83.77	85.71	85.06	62.34
Panel B: Difference in ranking based on value-added							
Diff (%)	0.00	84.77	93.46	92.05	84.87	88.16	85.62

Table IA.42: Alpha difference during periods of turmoil: Aggressive-growth funds

This table reports the slope coefficient for the market-risk variable in (7), along with its standard error and the regression R-squared, for aggressive-growth funds. The independent variable is standardized, allowing the coefficients to be interpreted as the change in the difference between the traditional and achievable alphas (in basis points) resulting from a one-standard-deviation increase in market volatility. The first seven columns report the results for pooled regressions for each model, and the eighth column across all models. Model fixed effects are included only for the pooled regression across all models. Standard errors are clustered by fund.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG	ALL
Slope (bps)	11.980	6.318	10.269	10.290	13.883	14.367	11.036	11.163
Standard errors (bps)	0.489	0.712	0.911	0.885	1.149	1.051	0.786	0.734
Model FE	No	No	No	No	No	No	No	Yes
Fund FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared (%)	10.798	1.858	3.279	3.369	8.247	8.845	6.064	4.992

Table IA.43: Alphas and Fund Flows: Aggressive-growth funds

This table reports slope coefficients and their t-statistics for several versions of panel regression (9) for aggressive-growth funds. Panel A considers the regression of fund flows on traditional alpha, Panel B the regression of fund flows on achievable alpha, Panel C the regression of fund flows jointly on traditional and achievable alphas, and Panel D the regression of fund flows jointly on traditional and achievable alphas and their interactions with a "Risk" indicator variable that takes a value of one for months in the top decile of months sorted by realized market volatility in the prior 36 months, and zero otherwise. For all regressions, we consider time and fund fixed effects, control for lagged values of fund flows up to 12 months, and double-cluster standard errors by time and fund.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional alpha							
Slope	0.154	0.143	0.138	0.126	0.152	0.152	0.131
	[16.294]	[17.852]	[15.260]	[14.613]	[14.885]	[16.775]	[13.629]
R2 (%)	2.378	2.043	1.905	1.598	2.301	2.299	1.706
Panel B: Achievable alpha							
Slope	0.152	0.139	0.147	0.143	0.147	0.143	0.139
	[11.746]	[11.310]	[11.471]	[11.602]	[11.855]	[11.825]	[11.332]
R2 (%)	2.318	1.946	2.164	2.036	2.168	2.043	1.925
Panel C: Traditional and achievable alpha							
Slope $\alpha_{\mathcal{T}}$	0.105	0.087	0.073	0.061	0.095	0.101	0.052
	[3.463]	[5.523]	[5.230]	[4.125]	[5.625]	[6.521]	[2.444]
Slope $\alpha_{\mathcal{A}}$	0.051	0.073	0.099	0.104	0.078	0.071	0.097
	[1.596]	[4.429]	[7.698]	[7.795]	[5.122]	[5.051]	[4.764]
R2 (%)	2.397	2.260	2.468	2.261	2.584	2.552	2.030
Panel D: Traditional and achievable alpha with risk-interaction terms							
Slope $\alpha_{\mathcal{T}}$	0.113	0.088	0.075	0.061	0.100	0.105	0.054
	[3.508]	[5.549]	[5.237]	[4.089]	[5.623]	[6.500]	[2.471]
Slope $\alpha_{\mathcal{A}}$	0.041	0.070	0.095	0.101	0.072	0.066	0.093
	[1.227]	[4.373]	[7.415]	[7.649]	[4.654]	[4.634]	[4.604]
Slope $\alpha_{\mathcal{T}}\times$Risk	-0.117	-0.016	-0.027	-0.013	-0.024	-0.023	-0.016
	[-1.539]	[-0.773]	[-1.704]	[-0.810]	[-1.591]	[-1.509]	[-0.794]
Slope $\alpha_{\mathcal{A}}\times$Risk	0.125	0.024	0.033	0.024	0.034	0.031	0.027
	[1.676]	[1.127]	[1.978]	[1.356]	[2.026]	[1.999]	[1.300]
R2 (%)	2.433	2.276	2.506	2.284	2.634	2.593	2.051

IA.7.5 Large-cap value funds

Below, we reproduce the results in Tables 5, 6, 7, 8, and 9 in the main body of the manuscript for large-cap value funds. Our results are generally robust to considering only large-cap funds. Tables IA.44 and IA.45 show that achievable alpha and value added are, on average, much smaller than traditional alpha and value added for all models except CAPM, and Table IA.46 shows that the relative rankings change dramatically when computing performance with achievable alpha and value added. Table IA.47 shows that the difference between traditional and achievable alpha increases during periods of financial turmoil. Table IA.48 shows that fund flows react to past performance, and the relation between achievable alpha and fund flows strengthens during periods of financial turmoil, while the relation between traditional alpha and fund flows weakens during periods of financial turmoil.

Table IA.44: Traditional and achievable alphas: Large-cap value funds

This table reports cross-sectional statistics for the traditional and achievable fund gross alphas with respect to the seven factor models listed in Table 3 for large-cap value funds. Panel A reports cross-sectional statistics for the traditional alpha with respect to the long-short factors, obtained by regressing the fund returns on all long-short factors for each model, and Panel B for the achievable alpha with respect to the long-only factors, obtained by regressing fund returns on just those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). We report the average alpha across funds, its t-statistic, the time-weighted average alpha (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of fund alpha and the percentage of funds with positive alpha and t-statistic greater than two. Alphas are annualized and reported in percentage. As in Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range (difference between the 90th and 10th percentiles) away from the median.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional alpha with respect to long-short factors							
Average alpha	0.23	0.04	-0.98	-0.65	-0.99	-0.83	0.21
t-stat	2.47	0.47	-11.36	-7.97	-10.76	-9.98	2.68
Time-weighted average alpha	0.42	0.21	-0.80	-0.48	-0.85	-0.70	0.50
t-stat	1.67	1.53	-1.74	-1.71	-1.74	-1.74	1.71
10th percentile	-2.05	-1.70	-2.87	-2.27	-3.01	-2.73	-1.55
50th percentile	0.24	0.05	-0.86	-0.70	-1.00	-0.87	0.21
90th percentile	2.44	1.77	0.99	1.27	1.15	1.12	1.92
Percentage of funds with α >0	56.08	51.59	25.86	29.55	24.87	27.25	57.14
Percentage of funds with $t(\alpha)$ >2	3.44	4.76	1.32	2.11	1.32	1.59	8.20
Panel B: Achievable alpha with respect to long-only factors							
Average alpha	0.18	-1.20	-1.92	-1.92	-2.54	-2.53	-1.01
t-stat	1.84	-9.99	-17.72	-17.35	-23.13	-22.99	-8.88
Time-weighted average alpha	0.40	-0.58	-1.44	-1.43	-2.23	-2.22	-0.38
t-stat	1.66	-1.69	-1.76	-1.76	-1.76	-1.76	-1.59
10th percentile	-2.12	-4.04	-4.41	-4.47	-5.13	-5.13	-3.82
50th percentile	0.21	-0.90	-1.68	-1.67	-2.35	-2.31	-0.79
90th percentile	2.40	1.32	0.34	0.40	-0.13	-0.13	1.53
Percentage of funds with α >0	55.56	30.42	14.55	14.29	9.26	9.52	32.01
Percentage of funds with $t(\alpha)$ >2	3.44	3.44	0.53	0.53	0.00	0.00	3.97

Table IA.45: Traditional and achievable value-added: Large-cap value funds

This table reports cross-sectional statistics for the traditional and achievable fund value-added with respect to the seven factor models listed in Table 3 for large-cap value funds. Panel A reports cross-sectional statistics for the traditional value-added computed as the average of the product of assets under management and abnormal returns, obtained by regressing the fund returns on all long-short factors in each model, and Panel B the achievable value-added computed using the fund abnormal returns with respect to just those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). We report the average value-added, its t-statistic, the time-weighted average value-added (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of value-added and the percentage of funds with positive average value-added. Value added is annualized and expressed in January 2000 million dollars. Like Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range away from the median.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional value-added with respect to long-short factors							
Average value-added	-2.86	-2.31	-8.30	-5.71	-7.67	-6.01	-1.77
t-stat	-4.94	-4.18	-9.11	-8.36	-9.52	-8.79	-3.55
Time-weighted average value-added	-2.91	-2.25	-10.22	-6.81	-9.82	-7.53	-1.18
t-stat	-1.65	-1.60	-1.75	-1.75	-1.76	-1.75	-1.33
10th percentile	-13.66	-12.38	-26.05	-20.21	-23.57	-20.53	-8.76
50th percentile	-0.39	-0.51	-1.76	-1.19	-1.88	-1.42	-0.30
90th percentile	3.39	2.51	0.10	0.80	0.41	0.79	3.21
% of funds with average value-added >0	34.58	32.09	13.07	19.73	15.86	18.82	36.27
Panel B: Achievable value-added with respect to long-only factors							
Average value-added	-2.91	-4.42	-8.68	-8.35	-13.37	-13.32	-4.82
t-stat	-5.01	-5.41	-10.10	-10.34	-10.55	-10.50	-7.46
Time-weighted average value-added	-2.93	-3.84	-9.67	-9.29	-16.37	-16.35	-3.89
t-stat	-1.66	-1.65	-1.77	-1.77	-1.78	-1.78	-1.70
10th percentile	-14.46	-18.50	-26.53	-25.99	-41.64	-41.64	-16.20
50th percentile	-0.42	-1.89	-3.07	-3.12	-4.56	-4.62	-1.80
90th percentile	3.39	2.12	-0.04	-0.01	-0.24	-0.18	1.56
% of funds with average value-added >0	34.05	18.97	9.43	9.97	5.36	6.43	18.28

Table IA.46: Deciles for tradit. and achievable metrics: Large-cap value funds

This table reports the percentage of large-cap value funds whose decile rank changes when, instead of sorting funds by their traditional alpha and value-added computed with respect to the long-short version of the seven factor models listed in Table 3, we sort the funds by their achievable alpha (Panel A) and achievable value-added (Panel B) with respect to the long-only version of the seven factor models. For each factor model, we report the measure Diff defined in Equation (6) as a percentage.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Difference in rankings based on alpha							
Diff (%)	8.20	78.57	74.07	78.31	77.25	75.93	71.96
Panel B: Difference in ranking based on value-added							
Diff (%)	4.02	73.44	64.05	69.19	67.48	71.27	69.81

Table IA.47: Alpha difference during periods of turmoil: Large-cap value funds

This table reports the slope coefficient for the market-risk variable in (7), along with its standard error and the regression R-squared, for large-cap value funds. The independent variable is standardized, allowing the coefficients to be interpreted as the change in the difference between the traditional and achievable alphas (in basis points) resulting from a one-standard-deviation increase in market volatility. The first seven columns report the results for pooled regressions for each model, and the eighth column across all models. Model fixed effects are included only for the pooled regression across all models. Standard errors are clustered by fund.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG	ALL
Slope (bps)	10.538	13.476	15.694	14.560	10.475	10.878	12.150	12.538
Standard errors (bps)	0.219	0.363	0.421	0.430	0.423	0.445	0.384	0.314
Model FE	No	No	No	No	No	No	No	Yes
Fund FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared (%)	14.079	10.386	5.926	5.235	4.572	4.605	8.056	5.160

Table IA.48: Alphas and Fund Flows: Large-cap value funds

This table reports slope coefficients and their t-statistics for several versions of panel regression (9) for large-cap value funds. Panel A considers the regression of fund flows on traditional alpha, Panel B the regression of fund flows on achievable alpha, Panel C the regression of fund flows jointly on traditional and achievable alphas, and Panel D the regression of fund flows jointly on traditional and achievable alphas and their interactions with a "Risk" indicator variable that takes a value of one for months in the top decile of months sorted by realized market volatility in the prior 36 months, and zero otherwise. For all regressions, we consider time and fund fixed effects, control for lagged values of fund flows up to 12 months, and double-cluster standard errors by time and fund.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional alpha							
Slope	0.098	0.118	0.073	0.069	0.108	0.104	0.091
	[10.162]	[17.301]	[7.850]	[7.697]	[16.398]	[15.319]	[10.036]
R2 (%)	0.965	1.387	0.527	0.480	1.163	1.081	0.828
Panel B: Achievable alpha							
Slope	0.093	0.090	0.089	0.090	0.093	0.092	0.090
	[2.106]	[2.069]	[2.058]	[2.050]	[2.062]	[2.053]	[2.284]
R2 (%)	0.866	0.802	0.796	0.809	0.859	0.854	0.819
Panel C: Traditional and achievable alpha							
Slope $\alpha_{\mathcal{T}}$	0.152	0.103	0.081	0.082	0.085	0.086	0.062
	[3.466]	[8.757]	[9.450]	[9.044]	[9.574]	[10.535]	[4.034]
Slope $\alpha_{\mathcal{A}}$	-0.055	0.024	0.097	0.100	0.061	0.070	0.061
	[-1.860]	[0.912]	[6.760]	[7.037]	[2.976]	[3.955]	[2.776]
R2 (%)	0.980	1.420	1.452	1.471	1.483	1.541	1.116
Panel D: Traditional and achievable alpha with risk-interaction terms							
Slope $\alpha_{\mathcal{T}}$	0.146	0.100	0.079	0.080	0.083	0.085	0.059
	[3.307]	[8.143]	[8.583]	[8.421]	[9.515]	[10.157]	[3.543]
Slope $\alpha_{\mathcal{A}}$	-0.056	0.022	0.093	0.097	0.058	0.067	0.058
	[-1.892]	[0.902]	[6.595]	[6.884]	[3.013]	[4.059]	[2.775]
Slope $\alpha_{\mathcal{T}}\times$Risk	0.020	-0.023	-0.017	-0.017	-0.013	-0.020	-0.013
	[0.719]	[-2.249]	[-1.929]	[-2.110]	[-1.629]	[-2.736]	[-1.477]
Slope $\alpha_{\mathcal{A}}\times$Risk	0.015	0.042	0.032	0.031	0.033	0.036	0.036
	[0.530]	[3.795]	[3.347]	[3.336]	[3.408]	[3.995]	[3.917]
R2 (%)	1.093	1.469	1.492	1.509	1.535	1.594	1.184

IA.7.6 Small-cap growth funds

Below, we reproduce the results in Tables 5, 6, 7, 8, and 9 in the main body of the manuscript for small-cap growth funds. Our results are generally robust to considering only small-cap growth funds. Tables IA.49 and IA.50 show that achievable alpha and value added are, on average, much smaller than traditional alpha and value added for all models except CAPM, and Table IA.51 shows that the relative rankings change dramatically when computing performance with achievable alpha and value added. Table IA.52 shows that the difference between traditional and achievable alpha increases during periods of financial turmoil. Table IA.53 shows that fund flows react to past performance, and the relation between achievable alpha and fund flows strengthens during periods of financial turmoil, while the relation between traditional alpha and fund flows weakens during periods of financial turmoil.

Table IA.49: Traditional and achievable alphas: Small-cap growth funds

This table reports cross-sectional statistics for the traditional and achievable fund gross alphas with respect to the seven factor models listed in Table 3 for small-cap growth funds. Panel A reports cross-sectional statistics for the traditional alpha with respect to the long-short factors, obtained by regressing the fund returns on all long-short factors for each model, and Panel B for the achievable alpha with respect to the long-only factors, obtained by regressing fund returns on just those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). We report the average alpha across funds, its t-statistic, the time-weighted average alpha (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of fund alpha and the percentage of funds with positive alpha and t-statistic greater than two. Alphas are annualized and reported in percentage. As in Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range (difference between the 90th and 10th percentiles) away from the median.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional alpha with respect to long-short factors							
Average alpha	0.33	-0.17	0.94	0.50	0.34	0.32	1.15
t-stat	2.46	-1.46	6.67	3.82	2.40	2.47	9.95
Time-weighted average alpha	0.56	0.29	1.09	0.72	0.65	0.63	1.49
t-stat	2.03	1.81	2.14	2.10	2.05	2.06	2.18
10th percentile	-3.76	-3.39	-2.96	-3.10	-3.52	-3.17	-1.96
50th percentile	0.43	0.01	0.70	0.42	0.33	0.44	1.25
90th percentile	3.92	3.00	4.84	3.78	4.12	4.10	3.94
Percentage of funds with α >0	56.39	50.09	61.16	57.07	56.90	57.07	73.42
Percentage of funds with $t(\alpha)$ >2	3.24	5.96	13.80	10.22	8.52	9.20	17.38
Panel B: Achievable alpha with respect to long-only factors							
Average alpha	0.29	-2.93	-2.87	-3.43	-4.94	-4.95	-1.16
t-stat	2.19	-16.68	-18.85	-20.66	-29.21	-29.26	-7.92
Time-weighted average alpha	0.54	-1.95	-2.09	-2.55	-4.16	-4.16	-0.27
t-stat	2.02	-2.17	-2.18	-2.19	-2.20	-2.20	-1.61
10th percentile	-3.76	-8.31	-7.64	-8.42	-10.37	-10.32	-5.59
50th percentile	0.42	-1.97	-2.19	-2.51	-4.08	-4.08	-0.53
90th percentile	3.92	1.25	0.61	0.39	-1.03	-1.03	2.47
Percentage of funds with α >0	55.71	20.95	14.82	12.27	5.11	5.11	40.72
Percentage of funds with $t(\alpha)$ >2	3.24	1.02	0.17	0.34	0.17	0.17	2.21

Table IA.50: Traditional and achievable value-added: Small-cap growth funds

This table reports cross-sectional statistics for the traditional and achievable fund value-added with respect to the seven factor models listed in Table 3 for small-cap growth funds. Panel A reports cross-sectional statistics for the traditional value-added computed as the average of the product of assets under management and abnormal returns, obtained by regressing the fund returns on all long-short factors in each model, and Panel B the achievable value-added computed using the fund abnormal returns with respect to just those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). We report the average value-added, its t-statistic, the time-weighted average value-added (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of value-added and the percentage of funds with positive average value-added. Value added is annualized and expressed in January 2000 million dollars. Like Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range away from the median.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional value-added with respect to long-short factors							
Average value-added	-4.27	-2.08	0.85	-0.70	-2.12	-1.97	2.60
t-stat	-5.78	-3.94	1.57	-1.43	-4.03	-3.54	4.64
Time-weighted average value-added	-4.64	-1.36	1.39	-0.29	-1.54	-1.34	3.70
t-stat	-2.06	-1.55	1.61	-0.53	-1.65	-1.50	2.07
10th percentile	-21.82	-12.69	-8.88	-10.93	-11.82	-11.62	-5.59
50th percentile	-1.26	-1.11	-0.19	-0.50	-0.80	-0.72	0.25
90th percentile	7.31	6.36	10.41	7.14	6.25	5.93	13.87
% of funds with average value-added >0	29.90	30.70	44.85	36.60	33.39	33.50	57.04
Panel B: Achievable value-added with respect to long-only factors							
Average value-added	-4.30	-10.61	-13.97	-13.49	-21.73	-21.68	-7.07
t-stat	-5.80	-13.39	-13.20	-13.86	-14.76	-14.74	-10.40
Time-weighted average value-added	-4.65	-11.16	-16.29	-15.49	-26.74	-26.71	-6.80
t-stat	-2.06	-2.19	-2.18	-2.19	-2.19	-2.19	-2.15
10th percentile	-22.14	-30.85	-35.53	-35.07	-54.36	-54.36	-23.39
50th percentile	-1.26	-4.82	-6.41	-6.25	-9.54	-9.55	-3.06
90th percentile	7.31	0.06	-0.38	-0.38	-0.89	-0.86	3.22
% of funds with average value-added >0	29.55	10.50	5.82	6.35	2.05	2.05	17.50

Table IA.51: Deciles for tradit. and achievable metrics: Small-cap growth funds

This table reports the percentage of small-cap growth funds whose decile rank changes when, instead of sorting funds by their traditional alpha and value-added computed with respect to the long-short version of the seven factor models listed in Table 3, we sort the funds by their achievable alpha (Panel A) and achievable value-added (Panel B) with respect to the long-only version of the seven factor models. For each factor model, we report the measure Diff defined in Equation (6) as a percentage.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Difference in rankings based on alpha							
Diff (%)	5.11	69.68	78.71	82.28	80.92	81.26	68.48
Panel B: Difference in ranking based on value-added							
Diff (%)	2.92	76.47	89.83	84.43	85.71	85.57	83.97

Table IA.52: Alpha difference during periods of turmoil: Small-cap growth funds

This table reports the slope coefficient for the market-risk variable in (7), along with its standard error and the regression R-squared, for small-cap growth funds. The independent variable is standardized, allowing the coefficients to be interpreted as the change in the difference between the traditional and achievable alphas (in basis points) resulting from a one-standard-deviation increase in market volatility. The first seven columns report the results for pooled regressions for each model, and the eighth column across all models. Model fixed effects are included only for the pooled regression across all models. Standard errors are clustered by fund.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG	ALL
Slope (bps)	14.072	-2.013	3.726	4.306	8.709	10.053	6.009	6.408
Standard errors (bps)	0.253	0.441	0.474	0.481	0.552	0.518	0.520	0.391
Model FE	No	No	No	No	No	No	No	Yes
Fund FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared (%)	12.902	0.261	0.648	0.869	5.287	6.889	1.864	2.212

Table IA.53: Alphas and Fund Flows: Small-cap growth funds

This table reports slope coefficients and their t-statistics for several versions of panel regression (9) for small-cap growth funds. Panel A considers the regression of fund flows on traditional alpha, Panel B the regression of fund flows on achievable alpha, Panel C the regression of fund flows jointly on traditional and achievable alphas, and Panel D the regression of fund flows jointly on traditional and achievable alphas and their interactions with a "Risk" indicator variable that takes a value of one for months in the top decile of months sorted by realized market volatility in the prior 36 months, and zero otherwise. For all regressions, we consider time and fund fixed effects, control for lagged values of fund flows up to 12 months, and double-cluster standard errors by time and fund.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional alpha							
Slope	0.169	0.169	0.153	0.149	0.161	0.166	0.142
	[26.417]	[26.921]	[22.829]	[23.285]	[18.268]	[25.348]	[19.371]
R2 (%)	2.845	2.869	2.326	2.221	2.599	2.741	2.010
Panel B: Achievable alpha							
Slope	0.163	0.156	0.159	0.158	0.163	0.161	0.156
	[16.233]	[16.340]	[16.391]	[16.686]	[16.334]	[16.214]	[15.373]
R2 (%)	2.668	2.422	2.527	2.491	2.669	2.594	2.448
Panel C: Traditional and achievable alpha							
Slope $\alpha_{\mathcal{T}}$	0.151	0.123	0.083	0.080	0.086	0.102	0.057
	[6.474]	[9.278]	[7.824]	[7.481]	[5.907]	[8.581]	[4.417]
Slope $\alpha_{\mathcal{A}}$	0.018	0.059	0.103	0.105	0.096	0.083	0.114
	[0.752]	[5.227]	[9.978]	[10.617]	[7.146]	[7.033]	[8.440]
R2 (%)	2.848	3.000	2.905	2.860	2.952	3.033	2.591
Panel D: Traditional and achievable alpha with risk-interaction terms							
Slope $\alpha_{\mathcal{T}}$	0.157	0.127	0.087	0.084	0.093	0.109	0.063
	[6.700]	[9.318]	[7.866]	[7.533]	[6.270]	[8.943]	[4.725]
Slope $\alpha_{\mathcal{A}}$	0.009	0.054	0.098	0.101	0.086	0.076	0.107
	[0.384]	[4.722]	[9.521]	[10.104]	[6.504]	[6.377]	[7.895]
Slope $\alpha_{\mathcal{T}}\times$Risk	-0.107	-0.031	-0.041	-0.033	-0.039	-0.039	-0.038
	[-1.835]	[-2.228]	[-4.595]	[-4.414]	[-3.189]	[-3.502]	[-2.695]
Slope $\alpha_{\mathcal{A}}\times$Risk	0.119	0.037	0.046	0.038	0.052	0.048	0.044
	[2.013]	[3.570]	[4.085]	[3.923]	[4.390]	[4.048]	[3.652]
R2 (%)	2.887	3.025	2.969	2.910	3.052	3.115	2.646

IA.8 Skill and Scale: Log Assets Under Management

In the main body of the manuscript, we compare the skill and scalability of mutual funds estimated using traditional and achievable alphas. We now show that our finding that the scalability of mutual-fund performance is substantially smaller from the perspective of shortsale-constrained investors is robust when scalability is estimated using *log* assets under management rather than assets under management, as in the main body of the manuscript.

This result is important for two reasons. First, it shows that our findings do not rely on the assumption that there is a linear relation between fund performance and assets under management. Second, Huang, Lu, Song, and Xiang (2023) show that estimates of mutual fund scalability obtained using log assets under management are robust to including the assets under management in institutional investment vehicles that are co-managed with their "twin" mutual funds. Therefore, the robustness of our findings to considering log assets under management suggests that they are also robust to accounting for the assets under management in "twin" institutional investment vehicles.

Table IA.54 reports cross-sectional statistics for the scale and scalability parameters obtained from the traditional or achievable alphas using log assets under management as the explanatory variable, instead of assets under management, as in Table 10. Comparing Panels A and B in Table IA.54, we find that the average skill obtained from achievable alpha is substantially higher than that obtained from traditional alpha for every model except CAPM, with the difference ranging from 22% to 55% across models. Importantly, comparing Panels C and D we observe that the average scalability parameter obtained from achievable alpha is almost double that obtained from traditional alpha for every model except CAPM. That is, our main finding that the scalability of mutual-fund strategies is substantially smaller from the perspective of shortsale-constrained investors is robust to considering log assets under management as the explanatory variable instead of assets under management.

Table IA.54: Achievable skill and scalability: log assets under management

This table reports cross-sectional statistics for the scale and scalability parameters obtained from the traditional or achievable alphas using log assets under management as the explanatory variable, instead of assets under management as in Table 10. For each fund, we estimate the time-series regression in equation (5) of Barras et al. (2022) separately for the cases with traditional and achievable realized alphas, after replacing assets under management with their natural logarithm. We report the average scale and scalability parameters across funds, their t-statistic, the time-weighted average scale and scalability parameters, where the weight is proportional to the length of the sample period for which we have return data for the fund, and their t-statistic. We also report percentiles of the cross-sectional distribution of fund scale and scalability parameters and the percentage of funds with positive scale and scalability parameters and t-statistic greater than two. Scale and scalability parameters are annualized and reported in percentage. Like Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range (difference between the 90th and 10th percentiles) away from the median.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Skill based on traditional alpha							
Average	10.63	6.98	7.07	6.81	8.01	7.54	7.56
Standard dev	18.49	12.58	13.45	13.13	15.77	14.47	14.46
10th percentile	-4.55	-4.11	-4.54	-4.42	-5.34	-4.93	-4.63
50th percentile	8.48	5.96	5.80	5.65	6.06	5.93	5.98
90th percentile	30.70	20.77	22.08	20.74	24.58	23.20	22.52
Percentage funds a >0	78.87	77.88	75.77	76.34	75.50	75.99	76.92
Panel B: Skill based on achievable alpha							
Average	10.62	9.85	10.05	8.55	9.77	9.50	11.71
Standard dev	18.92	21.07	22.87	20.24	22.77	22.35	24.25
10th percentile	-4.54	-7.44	-7.71	-7.70	-8.46	-8.60	-7.40
50th percentile	8.49	7.10	6.52	5.99	6.18	5.85	8.00
90th percentile	31.00	31.93	33.10	29.08	33.09	32.43	36.85
Percentage funds a >0	78.78	73.76	72.34	70.62	70.52	69.83	74.12
Panel C: Scale based on traditional alpha							
Average	2449.18	1555.96	1562.05	1500.88	1836.93	1707.42	1598.92
Standard dev	4705.81	3162.59	3458.40	3266.55	3896.03	3401.38	3714.07
10th percentile	-1275.62	-1084.84	-1157.13	-1156.47	-1233.96	-1146.12	-1291.05
50th percentile	1768.42	1206.54	1205.39	1158.48	1360.43	1279.27	1170.58
90th percentile	7026.31	4612.65	4717.26	4502.30	5540.27	5099.26	5083.95
Percentage funds b >0	78.38	77.13	75.35	76.70	75.59	77.03	74.12
Panel D: Scale based on achievable alpha							
Average	2479.36	2736.04	2812.86	2554.21	3104.14	3053.96	2991.45
Standard dev	5064.85	5473.73	5748.22	5241.17	5870.68	5836.58	6065.20
10th percentile	-1296.19	-1530.93	-1506.06	-1522.71	-1550.56	-1469.81	-1622.17
50th percentile	1807.77	1811.28	1839.57	1722.17	1991.19	2027.80	1876.24
90th percentile	7263.20	8044.05	8235.62	7644.08	8853.32	8695.11	8688.93
Percentage funds b >0	78.14	76.76	76.41	76.43	76.41	76.93	75.91

IA.9 Subsample Analysis

In the main body of the manuscript, we evaluate mutual fund performance using each fund's full return history. Here, we replicate the analyses in Tables 5 and 6, but separately for funds with return histories in the first half of our sample (January 1970–December 1999) and in the second half (January 2000–December 2024). Tables IA.55 and IA.56 report results for the first subsample, while Tables IA.57 and IA.58 present results for the second. Our findings are robust across the two subsamples. In general, achievable alpha and value added are substantially smaller than their traditional counterparts across all factor models. Notably, in the second half of the sample, the gap between traditional and achievable performance measures is especially pronounced under the CAPM. This indicates that, in the more recent period, even within the CAPM framework, achievable fund performance has been considerably weaker than traditional measures would suggest.

Table IA.55: Traditional and achievable mutual-fund alphas for the first half of our sample between January 1970 and December 1999

This table reports cross-sectional statistics for the traditional and achievable fund gross alphas with respect to the seven factor models listed in Table 3 for the first half of our sample between January 1970 and December 1999. Panel A reports cross-sectional statistics for the traditional alpha with respect to the long-short factors, obtained by regressing the fund returns on all long-short factors for each model, and Panel B for the achievable alpha with respect to the long-only factors, obtained by regressing fund returns on just those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). We report the average alpha across funds, its t-statistic, the time-weighted average alpha (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of fund alpha and the percentage of funds with positive alpha and t-statistic greater than two. Alphas are annualized and reported in percentage. As in Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range (difference between the 90th and 10th percentiles) away from the median.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional alpha with respect to long-short factors							
Average alpha	-0.73	0.82	0.88	0.61	1.44	1.06	1.72
t-stat	-4.52	7.35	6.71	5.19	7.58	8.04	13.37
Time-weighted average alpha	-0.50	0.39	0.84	0.41	0.60	0.39	1.45
t-stat	-3.52	3.57	4.27	3.47	3.40	3.18	4.73
10th percentile	-9.55	-4.68	-6.45	-5.56	-8.29	-5.32	-4.40
50th percentile	-0.90	0.02	0.13	0.03	-0.30	-0.12	0.56
90th percentile	6.69	6.55	9.44	7.47	12.95	9.01	8.55
Percentage of funds with α >0	41.50	50.18	51.06	50.26	47.95	48.79	56.49
Percentage of funds with $t(\alpha)$ >2	6.30	8.95	16.43	11.01	17.30	11.96	13.57
Panel B: Achievable alpha with respect to long-only factors							
Average alpha	-0.73	-2.86	-1.04	-2.86	-1.93	-2.99	-0.51
t-stat	-4.52	-18.60	-6.40	-18.57	-11.70	-19.32	-3.09
Time-weighted average alpha	-0.50	-2.66	-1.08	-2.66	-2.46	-2.86	0.21
t-stat	-3.52	-4.85	-4.47	-4.85	-4.82	-4.86	1.87
10th percentile	-9.55	-12.38	-9.90	-12.37	-11.27	-12.63	-9.33
50th percentile	-0.90	-2.45	-1.19	-2.44	-2.18	-2.57	-0.72
90th percentile	6.69	3.87	6.36	3.80	5.77	3.88	7.23
Percentage of funds with α >0	41.50	27.86	38.71	27.93	29.91	27.20	43.55
Percentage of funds with $t(\alpha)$ >2	6.30	3.30	6.09	3.30	5.43	3.23	7.04

Table IA.56: Traditional and achievable mutual-fund value-added for the first half of our sample between January 1970 and December 1999

This table reports cross-sectional statistics for the traditional and achievable fund value-added with respect to the seven factor models listed in Table 3 for the first half of our sample between January 1970 and December 1999. Panel A reports cross-sectional statistics for the traditional value-added computed as the average of the product of assets under management and abnormal returns, obtained by regressing the fund returns on all long-short factors in each model, and Panel B the achievable value-added computed using the fund abnormal returns with respect to just those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). We report the average value-added, its t-statistic, the time-weighted average value-added (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of value-added and the percentage of funds with positive average value-added. Value added is annualized and expressed in January 2000 million dollars. Like Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range away from the median.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional value-added with respect to long-short factors							
Average value-added	-3.76	-2.03	-0.36	-1.25	0.26	-0.70	0.10
t-stat	-6.41	-6.08	-0.81	-3.22	0.42	-1.70	0.30
Time-weighted average value-added	-5.19	-3.43	-0.78	-2.60	-0.89	-1.92	-0.56
t-stat	-4.21	-4.36	-1.48	-3.82	-1.29	-3.11	-1.45
10th percentile	-28.68	-17.47	-15.42	-17.73	-22.12	-17.61	-13.51
50th percentile	-1.39	-0.55	-0.38	-0.38	-0.63	-0.39	-0.21
90th percentile	12.99	7.39	13.33	9.80	20.34	11.62	11.52
Percentage of funds with value-added >0	32.37	36.21	43.45	41.32	41.39	41.58	44.51
Panel B: Achievable value-added with respect to long-only factors							
Average value-added	-3.76	-9.73	-3.60	-9.60	-4.81	-8.15	-2.19
t-stat	-6.41	-18.88	-6.49	-18.77	-7.97	-15.66	-3.74
Time-weighted average value-added	-5.19	-12.40	-4.53	-12.33	-7.59	-9.75	-2.38
t-stat	-4.21	-4.84	-4.15	-4.84	-4.49	-4.74	-3.08
10th percentile	-28.68	-34.91	-26.36	-34.91	-30.32	-32.22	-25.70
50th percentile	-1.39	-3.32	-1.46	-3.26	-2.05	-3.13	-1.25
90th percentile	12.99	4.47	12.90	4.49	11.03	4.90	14.91
Percentage of funds with value-added >0	32.37	22.24	32.29	22.02	30.29	22.54	34.77

Table IA.57: Traditional and achievable mutual-fund alphas for the second half of our sample between January 2000 and December 2024

This table reports cross-sectional statistics for the traditional and achievable fund gross alphas with respect to the seven factor models listed in Table 3 for the first half of our sample between January 2000 and December 2024. Panel A reports cross-sectional statistics for the traditional alpha with respect to the long-short factors, obtained by regressing the fund returns on all long-short factors for each model, and Panel B for the achievable alpha with respect to the long-only factors, obtained by regressing fund returns on just those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). We report the average alpha across funds, its t-statistic, the time-weighted average alpha (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of fund alpha and the percentage of funds with positive alpha and t-statistic greater than two. Alphas are annualized and reported in percentage. As in Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range (difference between the 90th and 10th percentiles) away from the median.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional alpha with respect to long-short factors							
Average alpha	0.42	0.01	0.25	0.27	-0.18	-0.17	0.00
t-stat	6.09	0.25	5.06	5.62	-3.11	-3.35	0.01
Time-weighted average alpha	0.54	0.32	0.40	0.39	0.16	0.19	0.42
t-stat	4.45	4.30	4.46	4.46	3.05	3.54	4.50
10th percentile	-3.42	-2.51	-2.26	-2.18	-2.88	-2.62	-2.79
50th percentile	0.28	0.09	0.11	0.07	-0.02	-0.06	0.24
90th percentile	4.34	2.53	3.02	2.99	2.75	2.54	2.56
Percentage of funds with α >0	54.44	52.05	52.34	51.52	49.36	49.04	56.09
Percentage of funds with $t(\alpha)$ >2	7.99	5.71	5.42	5.71	4.32	4.50	9.57
Panel B: Achievable alpha with respect to long-only factors							
Average alpha	-0.84	-3.55	-4.22	-4.23	-4.48	-4.50	-3.64
t-stat	-9.04	-27.63	-34.04	-34.10	-41.52	-41.11	-29.72
Time-weighted average alpha	0.16	-1.57	-2.47	-2.47	-3.26	-3.26	-1.77
t-stat	2.31	-4.77	-4.87	-4.87	-4.90	-4.90	-4.82
10th percentile	-5.33	-12.56	-12.75	-12.75	-11.32	-11.35	-11.40
50th percentile	-0.07	-1.39	-2.26	-2.27	-2.99	-3.00	-1.77
90th percentile	3.47	1.57	0.82	0.82	0.27	0.29	1.31
Percentage of funds with α >0	48.73	30.46	18.15	17.97	12.23	12.41	25.68
Percentage of funds with $t(\alpha)$ >2	5.49	2.32	0.86	0.89	0.36	0.32	2.32

Table IA.58: Traditional and achievable mutual-fund value-added for the second half of our sample between January 2000 and December 2024

This table reports cross-sectional statistics for the traditional and achievable fund value-added with respect to the seven factor models listed in Table 3 for the second half of our sample between January 2000 and December 2024. Panel A reports cross-sectional statistics for the traditional value-added computed as the average of the product of assets under management and abnormal returns, obtained by regressing the fund returns on all long-short factors in each model, and Panel B the achievable value-added computed using the fund abnormal returns with respect to just those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). We report the average value-added, its t-statistic, the time-weighted average value-added (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of value-added and the percentage of funds with positive average value-added. Value added is annualized and expressed in January 2000 million dollars. Like Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range away from the median.

	CAPM	FFC	FF5	FF6	HXZ	HXZM	VANG
Panel A: Traditional value-added with respect to long-short factors							
Average value-added	-2.30	-0.74	-0.43	-0.20	-2.31	-2.04	0.03
t-stat	-6.29	-3.13	-1.62	-0.81	-8.63	-8.12	0.14
Time-weighted average value-added	-2.60	-0.30	-0.44	-0.30	-2.10	-1.61	1.22
t-stat	-3.98	-1.12	-1.47	-1.10	-4.16	-3.86	3.37
10th percentile	-16.39	-9.48	-9.53	-9.04	-12.16	-11.43	-7.88
50th percentile	-0.44	-0.32	-0.36	-0.40	-0.58	-0.54	-0.12
90th percentile	8.31	6.55	7.84	8.04	5.25	4.86	8.69
Percentage of funds with value-added >0	38.51	37.61	36.56	36.14	33.91	33.93	44.39
Panel B: Achievable value-added with respect to long-only factors							
Average value-added	-5.99	-10.73	-16.15	-16.00	-20.51	-20.58	-10.84
t-stat	-12.43	-16.41	-22.78	-22.49	-27.32	-27.23	-17.55
Time-weighted average value-added	-4.26	-7.02	-15.09	-14.86	-22.25	-22.25	-7.35
t-stat	-4.35	-4.55	-4.86	-4.86	-4.92	-4.92	-4.62
10th percentile	-25.68	-37.97	-49.63	-49.17	-61.22	-61.36	-36.84
50th percentile	-0.97	-2.39	-4.04	-4.03	-5.46	-5.45	-2.70
90th percentile	6.77	2.41	0.21	0.21	-0.10	-0.09	1.64
Percentage of funds with value-added >0	32.09	20.23	12.41	12.37	7.55	7.87	17.23

IA.10 Achievable Performance Using Both Long and Short Legs of Factors

In the main body of the manuscript, we measure achievable fund performance using only the long leg of the long-short factor models. Here, we re-estimate achievable performance by expanding the benchmark set to include both the long and short legs of the long-short factors; i.e., we allow the investor to take long positions in both the long and short legs of the factors in each benchmark model. Tables IA.59 and IA.60 report the traditional and achievable alpha and value-added, respectively, for these models. Our results remain robust when both legs are included in the computation of achievable performance. Overall, achievable alpha and value-added remain substantially smaller than their traditional counterparts across all factor models.

Table IA.59: Traditional and achievable mutual-fund alphas

This table reports cross-sectional statistics for the traditional and achievable fund gross alphas with respect to the seven factor models listed in Table 3. Panel A reports cross-sectional statistics for the traditional alpha with respect to the long-short factors, obtained by regressing the fund returns on all long-short factors for each model, and Panel B for the achievable alpha with respect to the long-only factors, obtained by regressing fund returns on those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). We report the average alpha across funds, its t-statistic, the time-weighted average alpha (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of fund alpha and the percentage of funds with positive alpha and t-statistic greater than two. Alphas are annualized and reported in percentage. As in Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range (difference between the 90th and 10th percentiles) away from the median.

	FFC	FF5	FF6	HXZ	HXZM
Panel A: Traditional alpha with respect to long-short factors					
Average alpha	0.01	0.25	0.15	-0.06	-0.00
t-stat	0.16	4.77	3.14	-1.14	-0.10
Time-weighted average alpha	0.30	0.45	0.34	0.19	0.22
t-stat	4.27	4.39	4.22	3.18	3.62
10th percentile	-2.35	-2.60	-2.44	-2.84	-2.60
50th percentile	0.09	0.01	-0.02	-0.12	-0.06
90th percentile	2.40	3.45	3.01	3.05	2.89
Percentage of funds with α >0	51.70	50.24	49.47	47.46	49.05
Percentage of funds with $t(\alpha)$ >2	5.04	8.82	7.08	5.21	5.93
Panel B: Achievable alpha with respect to long-only factors					
Average alpha	-2.11	-2.32	-2.58	-3.59	-3.59
t-stat	-30.90	-37.83	-39.07	-52.90	-52.15
Time-weighted average alpha	-1.41	-1.71	-1.95	-3.12	-3.13
t-stat	-4.84	-4.88	-4.89	-4.91	-4.91
10th percentile	-6.35	-5.92	-6.50	-7.67	-7.64
50th percentile	-1.40	-1.76	-1.94	-3.00	-3.00
90th percentile	1.36	0.94	0.87	0.06	0.06
Percentage of funds with α >0	26.99	20.09	18.35	10.28	10.31
Percentage of funds with $t(\alpha)$ >2	1.87	0.72	0.78	0.27	0.24

Table IA.60: Traditional and achievable mutual-fund value-added

This table reports cross-sectional statistics for the traditional and achievable fund value-added with respect to the seven factor models listed in Table 3. Panel A reports cross-sectional statistics for the traditional value-added computed as the average of the product of assets under management and abnormal returns, obtained by regressing the fund returns on all long-short factors in each model, and Panel B the achievable value-added computed using the fund abnormal returns with respect to just those long-only factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). We report the average value-added, its t-statistic, the time-weighted average value-added (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of value-added and the percentage of funds with positive average value-added. Value added is annualized and expressed in January 2000 million dollars. Like Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range away from the median.

	FFC	FF5	FF6	HXZ	HXZM
Panel A: Traditional value-added with respect to long-short factors					
Average value-added	-1.33	-0.98	-1.26	-2.51	-2.08
t-stat	-6.55	-4.02	-6.00	-11.00	-9.77
Time-weighted average value-added	-0.99	-0.97	-1.29	-2.79	-2.26
t-stat	-3.18	-2.83	-3.67	-4.52	-4.38
10th percentile	-9.72	-9.70	-9.64	-11.78	-11.04
50th percentile	-0.45	-0.45	-0.52	-0.72	-0.63
90th percentile	4.52	6.44	4.92	3.83	3.96
% of funds with average value-added >0	33.44	34.94	32.57	30.21	30.98
Panel B: Achievable value-added with respect to long-only factors					
Average value-added	-7.83	-10.32	-10.00	-16.52	-16.47
t-stat	-21.86	-24.65	-24.61	-28.14	-28.57
Time-weighted average value-added	-8.67	-12.52	-12.10	-21.14	-21.11
t-stat	-4.88	-4.91	-4.91	-4.93	-4.94
10th percentile	-26.58	-30.61	-30.38	-46.51	-46.35
50th percentile	-2.49	-3.25	-3.39	-5.30	-5.30
90th percentile	0.83	0.12	0.13	-0.15	-0.16
% of funds with average value-added >0	16.15	11.74	11.88	6.40	6.44

IA.11 Replacing VANG Missing Observations with Benchmark Mean Instead of Zero

In the main body of the manuscript, we replace missing observations in the VANG model with zeros. We now examine the robustness of our results to replacing missing observations in the VANG model with the average of the benchmark factors. Tables IA.61 and IA.62 report the cross-sectional statistics for the traditional and achievable alpha and value-added, respectively. We see that, for both performance measures, replacing VANG's missing observations with the factor mean rather than zero does not affect our main conclusions. Indeed, both achievable alpha and value added are substantially smaller than the traditional ones.

Table IA.61: Traditional and achievable mutual-fund alphas

This table reports cross-sectional statistics for the traditional and achievable fund gross alphas with respect to the VANG model. Panel A reports cross-sectional statistics for the traditional alpha with respect to the VANG factors, obtained by regressing the fund returns on all VANG factors, and Panel B for the achievable alpha obtained by regressing fund returns on just those VANG factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). We report the average alpha across funds, its t-statistic, the time-weighted average alpha (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of fund alpha and the percentage of funds with positive alpha and t-statistic greater than two. Alphas are annualized and reported in percentage. As in Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range (difference between the 90th and 10th percentiles) away from the median.

Panel A: Traditional alpha with respect to long-short factors	
Average alpha	0.44
t-stat	9.73
Time-weighted average alpha	0.79
t-stat	4.80
10th percentile	-2.12
50th percentile	0.46
90th percentile	2.97
Percentage of funds with α >0	60.88
Percentage of funds with $t(\alpha)$ >2	11.37
Panel B: Achievable alpha with respect to long-only factors	
Average alpha	-1.61
t-stat	-27.36
Time-weighted average alpha	-0.90
t-stat	-4.77
10th percentile	-5.32
50th percentile	-1.13
90th percentile	1.52
Percentage of funds with α >0	30.27
Percentage of funds with $t(\alpha)$ >2	1.36

Table IA.62: Traditional and achievable mutual-fund value-added

This table reports cross-sectional statistics for the traditional and achievable fund value-added with respect to the VANG model. Panel A reports cross-sectional statistics for the traditional value-added computed as the average of the product of assets under management and abnormal returns, obtained by regressing the fund returns on the VANG factors, and Panel B the achievable value-added computed using the fund abnormal returns with respect to just those VANG factors with a strictly positive weight in the shortsale-constrained mean-variance portfolio (over the sample period for which we have return data for the fund). We report the average value-added, its t-statistic, the time-weighted average value-added (where the weight is proportional to the length of the sample period for which we have return data for the fund), and its t-statistic. We also report percentiles of the cross-sectional distribution of value-added and the percentage of funds with positive average value-added. Value added is annualized and expressed in January 2000 million dollars. Like Barras et al. (2022), we winsorize observations that are more than five times the inter-decile range away from the median.

Panel A: Traditional value-added with respect to long-short factors	
Average value-added	0.71
t-stat	3.49
Time-weighted average value-added	1.62
t-stat	4.05
10th percentile	-6.28
50th percentile	-0.09
90th percentile	8.43
% of funds with average value-added >0	45.68
Panel B: Achievable value-added with respect to long-only factors	
Average value-added	-6.95
t-stat	-20.51
Time-weighted average value-added	-7.28
t-stat	-4.83
10th percentile	-23.25
50th percentile	-2.26
90th percentile	0.99
% of funds with average value-added >0	16.40