Factor investing
– still a role for investment skill

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Why This Matters?

This paper shows that differences in how factor returns are measured can have consequences for portfolio construction and factor-based investing. Thus, to implement a factor-based approach, investors will still need to rely on skilled investment managers.

Who Should Read This?

The themes in this paper should be of interest to asset allocators, risk managers and portfolio constructors.

01. Introduction

The concept of "factor investing" is receiving attention from investors for two reasons. First, many studies suggest that a small number of factors have driven asset returns.[1] Second, multiple studies have suggested that the performance of individual managers can largely be accounted for by factor exposures.[2] As a result, some have suggested that investors should focus on factor investing. According to this line of argument, factor investing would become a low-cost commodity, just like indexing.

In our view, skilled managers are critical to fully exploiting factor investing. We believe this for four reasons:

- Factor returns are estimated, not observed.
- Portfolio construction may vary by manager.
- Optimal factor exposures may vary by type of investor.
- Specific factor returns may vary in their persistence.

This paper focuses on the first of these two points- factor measurement and portfolio construction. The impact of differences in factor measurement and portfolio construction can be measured over short horizons. Consequently, they represent skills for which investment managers can be compensated. Persistence of factor returns and optimal exposures to factors are discussed in our companion paper.

Our analysis shows that two popular methods of identifying factor returns produce different quantitative results. Furthermore, we show that there are differences in factor loadings across widely available factor-tilted ETFs. Finally, we show that optimally-blended ETF factor portfolios can differ, depending upon how factor returns are measured. Although our analysis focuses on ETFs, the points generalize across other implementation vehicles.

[1] See, for instance; Fama, Eugene, and Kenneth French. "Common Risk Factors in the Returns on Stocks and Bonds". Journal of Financial Economics, 1993

[2] See, for instance; Carhart, Mark. "On Persistence in Mutual Fund Performance." Journal of Finance, March, 1997.

02. Factor Measurement Matters ...

To illustrate the impact of differences in factor measurement, let's look at two popular methods for estimating size and style returns- the Fama-French and the fundamental factor models.[3] While both models are measuring the same effects, there are noticeable quantitative differences. Common to both modeling approaches is the use of cross sections of individual security returns over time to find factor returns.

The Fama-French methodology sorts an equity investment universe at any point in time according to predefined characteristics (e.g. book-to-market or size). Quantile portfolios are formed from the sorted securities, and held for a specific holding period (annually in the case of FF). At the end of the holding period, the investment universe is resorted, new quantile portfolios are created and another period of performance is calculated for each quantile portfolio. Factor returns are found by taking the return differences between the top and bottom quantile portfolios. An implication of sorting on a single factor is that each quantile-portfolio can have exposures to other important factors (e.g. industry).

In fundamental factor models, individual security returns are defined in terms of exposures to specific factors (e.g. size, style and industry) and returns to factors. Factor returns for each holding period are found by regressing the cross section of security returns on factor exposures. A time series of factor returns is found by repeating the cross-sectional regressions through time.

[3] In this paper we used the returns to fundamental factors from the MSCI-Barra fundamental factor models. We thank MSCI-Barra for providing the factor return series.

Exhibit 1 - Factor Summary Statistics

	FAMA-FRENCH			FUNDAMENTAL		
	MktExc	HML	SMB	Country	Value	Size
Mean	7.7%	2.6%	1.9%	8.3%	1.2%	2.0%
StDev	17.0%	11.7%	11.6%	17.0%	2.2%	3.6%

How do factor returns from the two models compare? Exhibit 1 shows the summary returns and risks for value and size premiums for each model, estimated over the period from 1995-2015. Each method produces roughly the same market return and market volatility (the MktExc and Country factors respectively). And, the size factor (SMB for Fama-French and Size for the fundamental model) return is about the same. However, the Fama-French value factor return (HML) is almost twice the size of the fundamental value factor return. Moreover, the risk levels of the Fama-French factors are significantly larger than the factor risk levels from the fundamental model.

Exhibit 2 - Regression Analysis of Factor Returns

	R-squared
Value	19%
Value + Growth	40%
+ all styles	62%
+ all industries	79%

	R-squared
Size	77%
Size + MidCap	78%
+ all styles	84%
+ all industries	91%

Because the fundamental model strips out the impact of other exposures and the Fama-French methodology does not, direct comparisons cannot be made between the factor return or risk levels. A simple alternative is to regress the Fama-French factor returns on combinations of factor returns generated from the fundamental model. The results of this analysis are shown in Exhibit 2.

The left section in Exhibit 2 shows the analysis of the Fama-French value factor, while the right section shows the analysis of the Fama-French size factor. Each section builds up from a simple single-variable regression to a multi-variate regression.

In the left section, the first regression corresponds to the fundamental value factor. The growth factor is added in the second regression, and all style factors are added in the third regression. All country factors and all industry factors are added in the fourth regressions respectively. The right section of Exhibit 2 follows the same process, with size factors replacing value factors. The first regression considers just the fundamental size factor, while the second adds the mid-cap factor. All style factors are added in the third regression, while country and industries are added in the fourth regression.

It is evident from the exhibit that "pure" style or size factors alone cannot explain the historical performance of the Fama-French factors. Explanatory power increases when other factors and industries are added to the model. This analysis corroborates the point that how factor returns are measured can make a difference. The open question is how important such differences are for implementing factor-tilted portfolios.

03. ... And So Does Portfolio Construction

Investors do not directly invest in factors- doing so requires leverage and high turnover. Instead, investors tilt their portfolios towards desired factor exposures. Such tilts may introduce exposures to other factors- for example, a tilt to the value factor might also imply a tilt to certain industries. Consequently, there is potential for variation in portfolio construction across managers who are tilting on the same factor. The effects of such variation will be seen in factor loadings of specific investment products.

The results of analyses of a small sample of value and small cap ETFs are shown in Exhibits 3 and 4. The sample uses monthly ETF returns covering the period 2007-2015.[4] The returns of each ETF were regressed on the Fama-French Market, Value and Small Cap factor returns *(Exhibit 3)* and the fundamental Country, Value and Size factors *(Exhibit 4)*. This simple model accounts for over 95% of the variation in ETF fund returns, regardless of size, style or which factor return series are used.[5]

[4] Appendix A has the list of the ETFs that we used for this analysis.
[5] Appendix A shows the R^2 for each of the regressions.

Exhibit 3 - ETF Analysis With Fama-French Factors

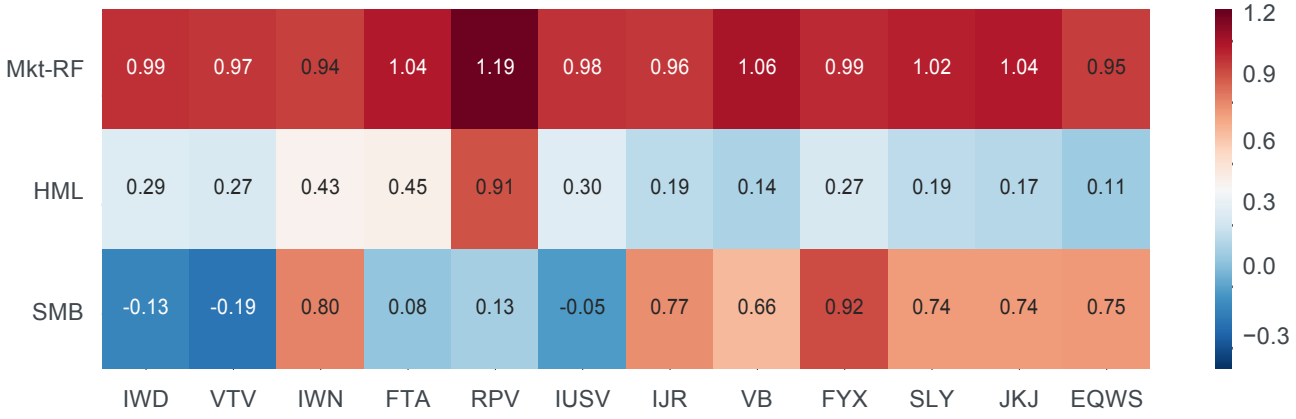
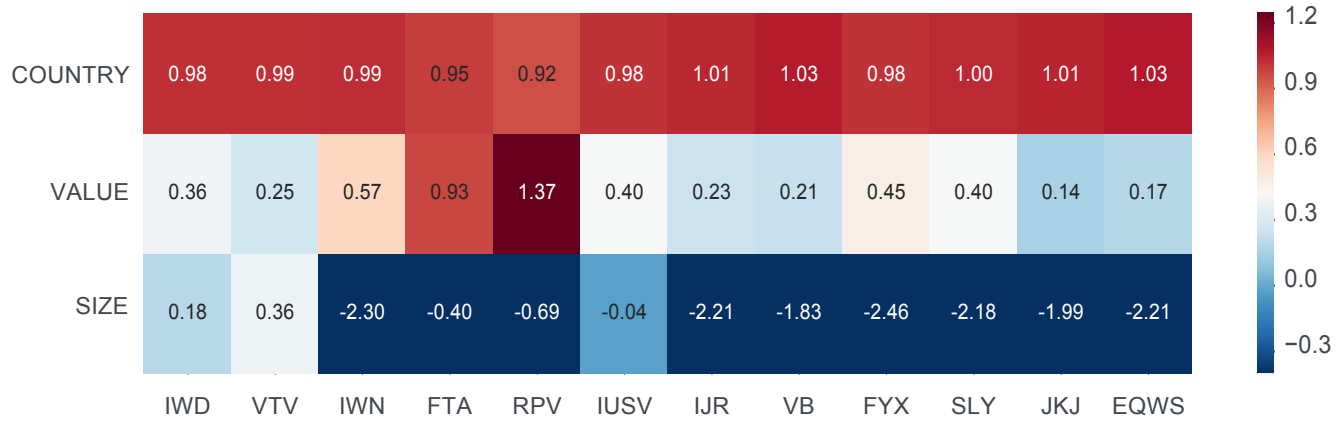


Exhibit 4 - ETF Analysis with Fundamental Factors



For value ETFs, all funds were long the market, with an average estimated beta to the market of 1.0. All the value funds had positive exposure to the value factor, although with quantitative differences in the factor exposure. There was more variation in exposure to the small cap factor, with some funds having a negative exposure to the small cap factor.

For the small cap funds, the qualitative story is roughly the same. All funds had positive exposure to both the small cap and value factors, with fairly tight ranges around the average exposure. Evidently there is more substitutability across small cap funds than value funds.

Exhibit 5 - Time-Varying Factor Loadings, Fama-French

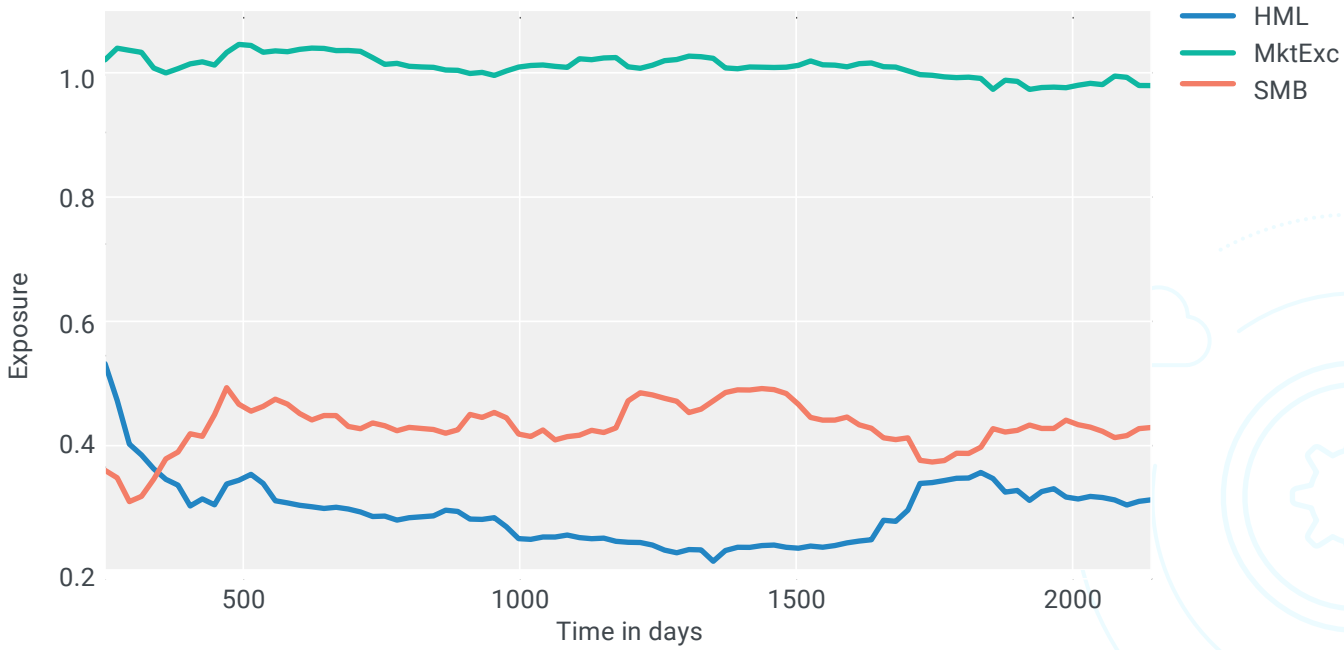
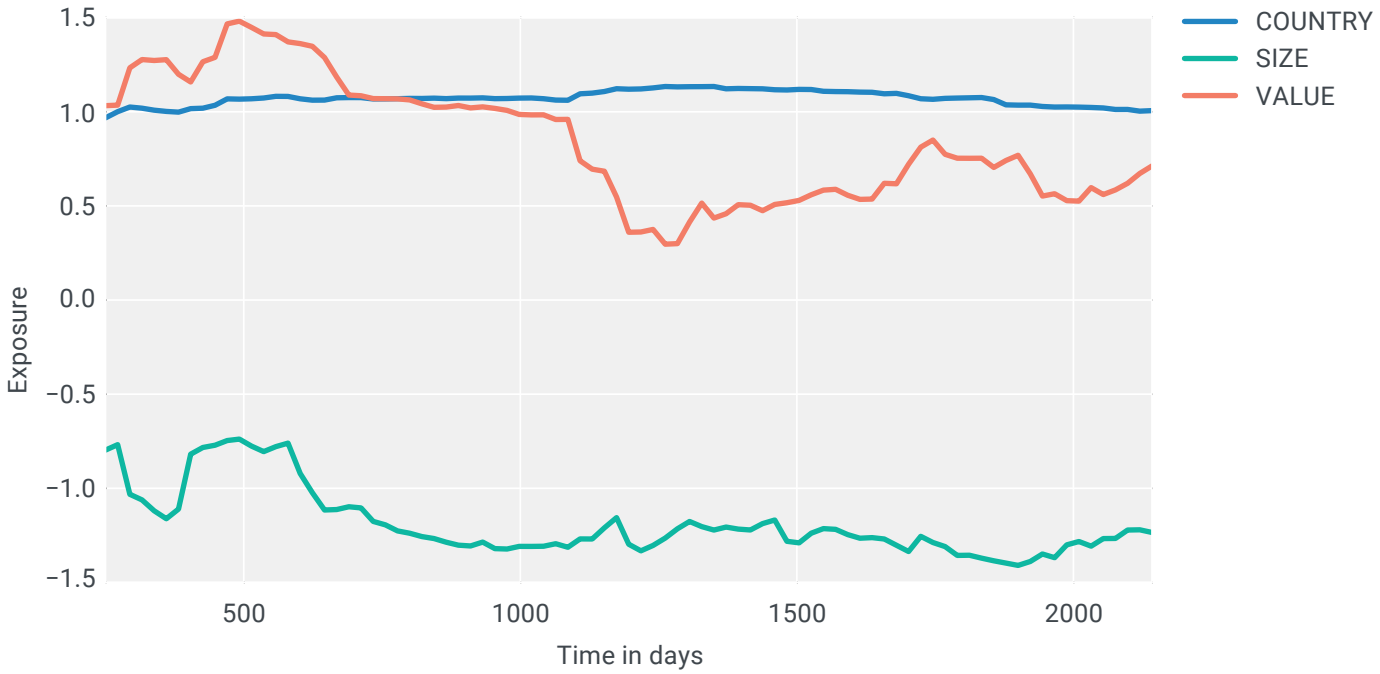


Exhibit 6 - Time-Varying Factor Loadings, Fundamental



Of equal interest is the variation in average factor loadings across time. These are shown in Exhibit 5 (Fama-French factors) and Exhibit 6 (fundamental factors). Factor loadings were estimated for each fund using an exponentially decaying weighting scheme with 1 year half-life, and then averaged across funds. It is evident from the exhibits that factor loadings appear to be more stable across time with the Fama-French factors than with the fundamental factors.

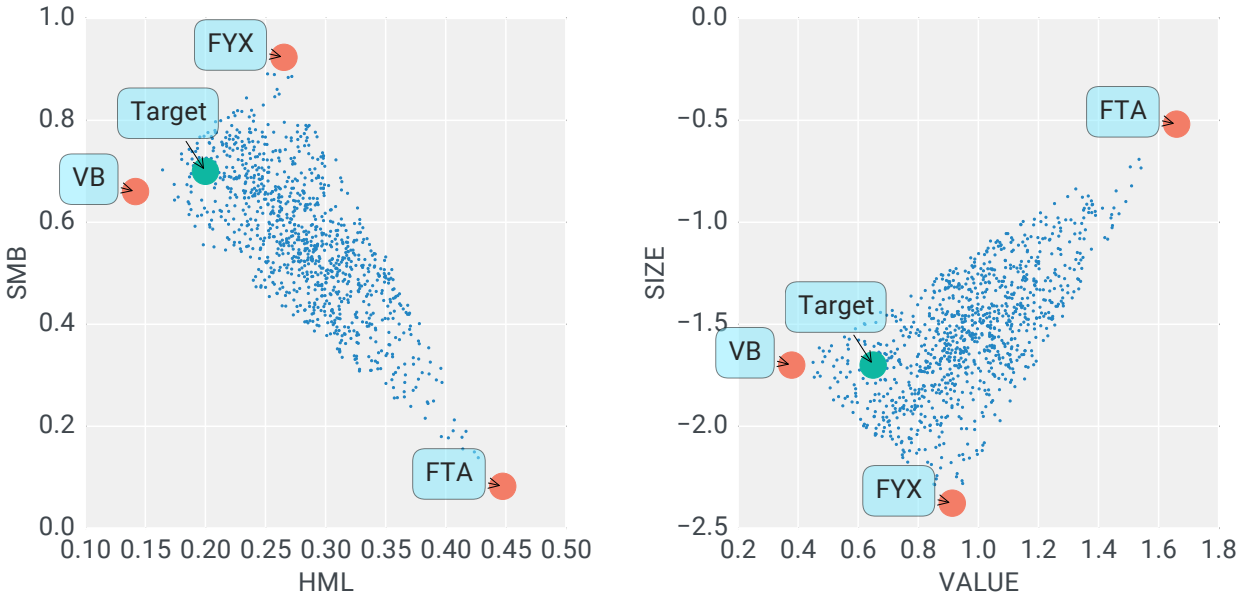
04. Managing Aggregate Factor Exposures

Why do we care about ETF factor loadings? The principal reasons are (a) to gain a better understanding of the sources of performance differentials across ETFs and (b) to better manage portfolios of ETFs.

Management of a portfolio of ETFs is relevant when desired factor exposures don't match the factor exposures of any specific ETF. However, the desired factor exposure may be achievable with a combination of ETFs. Hence, factor measurement and the stability of factor exposures can matter for sizing and trading allocations to specific ETFs.

Exhibit 7 illustrates the point about feasibility of factor exposures. The blue dots on the exhibit show the factor exposures of long only combinations of three ETFs (red dots). The panel on the left corresponds to factor exposures measured using

Exhibit 7 - Feasible Factor Exposures in long-only combinations of 3 ETFs

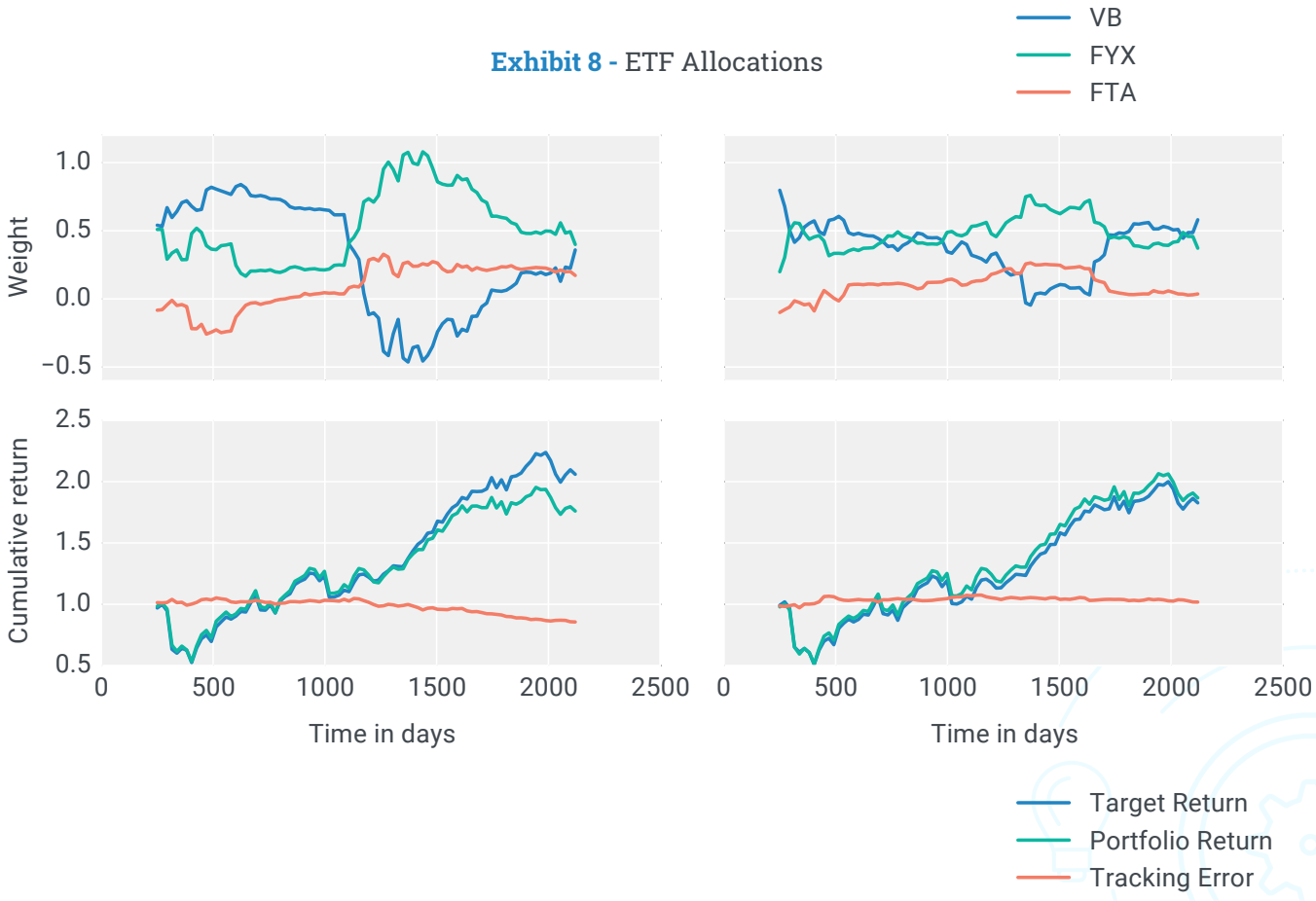


Fama-French factor returns, and the panel on the right corresponds to using fundamental factors. Because the factor-return series are estimated differently, the portfolio factor exposures are not directly comparable.

In our companion piece, we discuss how to find the optimal factor exposures. Conditioned on a feasible factor exposure target (either Fama-French or fundamental), and factor exposures for each ETF, we can calculate optimal ETF allocations. And, given updated factor exposures for each ETF, we can analyze how ETF allocations change across time.

To illustrate, Exhibit 8 plots the time series of ETF holdings for a portfolio designed to track a factor-tilted portfolio. For the purposes of this paper, we'll assume that the target factor exposure is given by the green dot in each panel that corresponds to 100% Market, 20% Value and 70% Small Cap in the Fama-French space. (The Fundamental Target exposures were defined to match the ETF weights of the Fama-French counterpart in the last rebalancing period.) The panels on the left show the ETF exposures and realized performance using Fama-French factors, while the panels on the right show ETF exposures and realized performance using

Exhibit 8 - ETF Allocations



fundamental factors. The panels on the right show the ETF exposures and realized performance using Fama-French factors, while the panels on the left show ETF exposures and realized performance using fundamental factors.

As expected, there is variation in the ETF allocations across time, regardless of which method is used to estimate factor returns. The implication is that all else equal, ETF allocations should be dynamically managed.[6]

In addition to showing time variation in ETF allocations, Exhibit 8 also shows that there would have been more variation in ETF allocations when the fundamental factors are used. This may be because the ETF allocations based on fundamental factors included only the impact of size and style premiums. As discussed, industry factors can be important in accounting for differences between the Fama-French value factor and the fundamental value factor.

Finally, the lower panels of Exhibit 8 show the cumulative historical performance of each ETF portfolio. Over the sample period, the Fama-French based factor ETF portfolio tracked the target-factor exposure portfolio quite well. By contrast, some performance differences materialized later in the sample period for the fundamental based factor ETF portfolio.

The analysis presented here has focused on understanding the factor exposures of ETFs. The ETF factor exposures have then been used to build ETF portfolios that match specific desired factor exposures. The main conclusions are that factor exposures in ETFs depend on which method is used to measure factor returns, and that how we measure factor exposures can have implications for the management of a portfolio of ETFs. Although the analysis has focused on ETFs, the same principles can be applied to other investment vehicles (e.g. institutional separate accounts or mutual funds).

[6] This analysis did not include transactions costs or other expenses. Introduction of costs would most likely reduce turnover.

05. Implications and Conclusions

The advent of factor investing (and the availability of ETFs) has led some to suggest that investment management skill will play no role in the future. The perspective of this paper is the opposite- factor investing (and ETFs) imply a role for managers with skill in factor measurement and portfolio construction. Factor investing differs from traditional passive investing in one crucial way- there is no standard for measurement of factor returns. Even if all market participants agree on which factors are important, it is likely that there will be differences in how each manager measures factor performance. These differences, in turn, can lead to differences in portfolio construction, both for individual managers and for investors seeking to blend managers.

Rather than the end of active management, a more likely consequence of factor investing is factor-investing programs tailored to the needs of specific client segments. These programs will depend on the identification and measurement of a small number of factors with persistence returns. Moreover, these programs will depend on the ability of investors (or their advisors) to design factor exposures suitable for specific client-segment needs. These topics are covered in our companion paper.

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Appendix A

ETF Symbol	Description	FF R-squared	Fundamental R-squared
EQWS	Russell 2000 Equal Weight Portfolio	0.897	0.886
FTA	Large Cap Value AlphaDEX Fund	0.916	0.920
FYX	Small Cap Core AlphaDEX Fund	0.959	0.944
IJR	Core S&P Small-Cap ETF	0.984	0.966
IUSV	Core U.S. Value ETF	0.990	0.977
IWD	iShares Russell 1000 Value ETF	0.989	0.975
IWN	iShares Russell 2000 Value ETF	0.985	0.956
JKJ	iShares Morningstar Small-Cap ETF	0.977	0.969
RPV	S&P 500 Pure Value ETF	0.910	0.886
SLY	SPDR S&P 600 Small Cap ETF	0.959	0.955
VB	Vanguard Small-Cap ETF	0.988	0.982
VTV	Vanguard Value ETF	0.984	0.969