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Factor Tilts and Asset Allocation

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FEATURE

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ABSTRACT

Factor investing has received much attention from academics and practitioners, as well as from individual and institutional investors. It has become usual for investors that aim to enhance returns to add a factor satellite to the core of their portfolios, thus tilting their portfolios toward factors that have produced a long-term risk premium. However, in most cases, investors behaving this way are not fully invested in stocks, which begs an interesting question: Should an investor with a two-asset portfolio of broadly diversified stocks and bonds tilt the stocks slice of the portfolio toward (small-cap and value) factors, or would the investor be better off simply increasing the allocation to broadly diversified stocks in the two-asset portfolio? The results discussed here, based on different samples and sample periods, support the notion of factor-tilting portfolios.

INTRODUCTION

Consider an investor with a balanced allocation to stocks and bonds implemented with two broadly diversified exchange-traded funds (ETFs) or index funds, one for each asset class. Assume the investor decides to enhance the expected return of the portfolio and an advisor suggests to do so by exploiting the well-known size and value factors, adding either one (small-cap or value) or two (one small-cap and one value) factor ETFs to the portfolio. Should the investor follow this advice, or would the investor be better off by sticking to the two-ETF portfolio and simply increasing the allocation to broadly diversified stocks?

Adding one or two factor ETFs is likely to add some basis points to the cost of the portfolio. Perhaps more importantly, it may test the investor's resolve in the strategy if small-cap or value stocks go through a typical period of underperformance. Thus, to paraphrase the previous question, should the investor tilt the equity allocation of the portfolio toward small-cap and value stocks, or is it possible to obtain the same or better performance simply by increasing (decreasing) the allocation to broadly diversified stocks (bonds) in the two-asset portfolio?

Factor investing has received much attention from academics and practitioners over the past several years. Smart beta products, which are firmly rooted in factor investing, already have crossed the $1-trillion line in assets under management.

The ultimate issue explored in this article is whether factor tilts yield quantifiable benefits that cannot be replicated by simply tweaking the asset allocation of a two-asset portfolio of broadly diversified stocks and bonds.

Besides the traditional size and value factors, which are the focus of this article, many others have been highlighted and built into financial products, including quality, low volatility, and momentum, to name but a few.

The ultimate issue explored in this article is whether factor tilts yield quantifiable benefits that cannot be replicated by simply tweaking the asset allocation of a two-asset portfolio of broadly diversified stocks and bonds. The focus here is on the two oldest and most widely debated factors, size and value, which also have the longest data histories and underlie the strategy of the largest number of smart beta products.

In a nutshell, the results from the evidence evaluated here indicate that, relative to optimized portfolios of broadly diversified stocks and bonds, adding size and value tilts results in either higher returns at the same level of risk or lower risk at the same level of return, and ultimately higher risk-adjusted returns. Put differently, overweighting small-cap and value stocks within the equity slice of a portfolio yields benefits that cannot be replicated by making the asset allocation of a two-asset stock-bond portfolio more aggressive.[1] This result is robust to several specifications, including different samples, different time periods, and different ways of factor-tilting portfolios.

THE ISSUE

The first part of this section briefly discusses the size and value factors, the reasons for focusing on them, and very briefly some relevant literature. The second part introduces all the portfolios to be evaluated empirically in the next section.

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CORE, SATELLITES, SIZE, AND VALUE

Investment legends Warren Buffett and John Bogle have argued repeatedly that investors, both individual and institutional, would be well served by holding simple, broadly diversified, low-cost portfolios. Much the same has been recommended traditionally by Vanguard and more recently by many robo-advisors. Currently, it is possible for any investor to build a portfolio of two globally diversified ETFs (or index funds), one for stocks and one for bonds, costing less than 10 basis points.[2] Investors only need to make sure they adjust the allocation between these two ETFs so that it is consistent with their goals, holding periods, and risk tolerances.

To be sure, most investors, perhaps for the wrong reasons, do not build portfolios this way. At best, some individuals follow, by design or by default, a core-satellite approach; that is, they have a simple core portfolio to which they add some satellites that overweight some regions, countries, sectors, or factors. The focus of this article is on factor satellites, and particularly on whether overweighting small-cap and value stocks results in any meaningful benefits that cannot be replicated with optimized exposures to broadly diversified stocks and bonds.

The reasons for focusing on the size and value factors are several. First, they are the oldest anomalies as well as the two most widely discussed in the literature. Second, they have the longest data history, going as far back as 1926, at least for the U.S. market. Third, they have the broadest cross-sectional data, for many countries, regions, and the global market. And fourth, they underlie the strategy of many smart beta products.

As is well known, the size effect refers to the fact that small-cap stocks tend to outperform large-cap stocks; the value effect, in turn, refers to the fact that relatively cheap stocks tend to outperform relatively expensive stocks.[3] In the case of size, it is clear that the variable used to rank companies is market capitalization; in the case of value, however, several variables (as well as combinations of variables) have been proposed to screen companies, including the book-to-market ratio and the price-earnings ratio, to name but two.

The literature on the size and value effects is massive and too long to summarize here. Basu (1977) and Banz (1981) are widely credited with being the seminal articles on the outperformance of small-caps over large-caps and value stocks over growth stocks. Fama and French (1992) added the size and value factors to the capital asset pricing model, thus giving birth to the three-factor model; Fama and French (2012) explored the global evidence on both factors. Asness et al. (2015) provide a good overview of the literature on the value effect, and Alquist et al. (2018) do the same for the size effect.[4]

FACTOR-ENHANCED PORTFOLIOS VS. OPTIMIZED STOCK-BOND PORTFOLIOS

The ultimate empirical question explored here is whether an investor that wants to enhance the expected return of a balanced portfolio of broadly diversified stocks and bonds would be better off by (1) adding size and value tilts to the equity slice of the portfolio, or (2) simply making the asset allocation of the two-asset portfolio of stocks and bonds more aggressive. The first step of the inquiry is to introduce all the portfolios to be evaluated.

Consider an investor with a two-asset portfolio consisting of a 60-40 allocation to broadly diversified stocks and bonds, and assume that the investor aims to enhance the expected return of this portfolio. Assume, also, that an advisor suggests to replace part of the exposure to stocks with exposures to small-cap and value stocks through the addition of one or two satellites, thus recommending a factor-enhanced portfolio (FEP).

Four FEPs are considered here. Two of them have two satellites, small-cap stocks and value stocks, with exposures of either 10 percent (2S10) or 20 percent (2S20) to each; the other two have one satellite, small-cap/value stocks, with an exposure of either 20 percent (1S20) or 40 percent (1S40) to it. More precisely, the four FEPs considered are:

- 2S10: A 40-10-10-40 allocation to stocks, small-cap stocks, value stocks, and bonds
- 2S20: A 20-20-20-40 allocation to stocks, small-cap stocks, value stocks, and bonds
- 1S20: A 40-20-40 allocation to stocks, small-cap/value stocks, and bonds
- 1S40: A 20-40-40 allocation to stocks, small-cap/value stocks, and bonds

In all cases the total allocation to stocks and bonds remains at 60 percent and 40 percent. The only differences across FEPs stem from the exposure to broadly diversified stocks, which is either 20 percent or 40 percent; and from the inclusion of either one (small-cap/value) satellite or two (small-cap and value) satellites. More details about the five portfolio components (stocks, small-cap stocks, value stocks, small-cap/value stocks, and bonds) are discussed below.

The performance of these four FEPs is evaluated against optimized two-asset portfolios of broadly diversified stocks and bonds. An optimized stock-bond portfolio (OSBP) may have the goal of minimizing risk subject to an FEP return or maximizing return subject to an FEP level of risk. More details about the two portfolio components (stocks and bonds) are discussed below.

In order to assess the relative performance of FEPs and OSBPs, three critical questions are posed:

- Given the mean return of an FEP, what is the lowest volatility that can be obtained by optimally combining broadly diversified stocks and bonds?
- Given the volatility of an FEP, what is the highest mean return that can be obtained by optimally combining broadly diversified stocks and bonds?
- How do the mean return, volatility, and risk-adjusted return of an FEP compare to those of an OSBP?

EVIDENCE

The first part of this section introduces the three samples used in this study, as well as the assets in each sample. The second part discusses the results from the different samples and sample periods considered here.

DATA AND METHODOLOGY

Three different samples are used in this study. Sample 1 consists of annual returns between 1927 and 2018. Stocks are represented by the S&P 500; small-cap stocks, value stocks, and small-cap/value stocks by the Fama-French small, high, and small/high portfolios; and bonds by 10-year Treasury notes.[5]

Sample 2 consists of Russell and Bloomberg Barclays indexes between 1979 and 2018. Stocks are represented by the Russell 1000 Index; small-cap stocks by the Russell 2000 Index; value stocks by the Russell 1000 Value Index; small-cap/value stocks by the Russell 2000 Value Index; and bonds by the Bloomberg Barclays U.S. Aggregate Bond Index.

Finally, Sample 3 consists of Vanguard index funds between 1999 and 2018. Stocks are represented by the Vanguard 500 Index Fund (VFINX); small-cap stocks by the Vanguard Small-Cap Index Fund (NAESX); value stocks by the Vanguard Value Index Fund (VIVAX); small-cap/value stocks by the Vanguard Small-Cap Value Index Fund (VISVX); and bonds by the Vanguard Total Bond Market Index Fund (VBMFX).

The data for Sample 1 is from Global Financial Data and Ken French's web page; the data for Samples 2 and 3 is from Morningstar Direct. In all cases returns are annual, nominal, and account for both capital gains/losses and cash flows paid. Summary statistics on the performance of all the components of all three samples are reported in table A1 in the appendix.

All the FEPs and OSBPs considered are annually rebalanced. Also, as is done in most of the literature, transaction costs and taxes are ignored, although they should not be substantially different across the strategies considered. Finally, except in the sample of index funds (Sample 3), the fees related to obtaining exposure to the different slices of the portfolio are ignored.

The starting point of the evaluation is a 60-40 allocation to broadly diversified stocks and bonds; it is the expected return of this balanced portfolio that the investor aims to enhance. One possibility to achieve this goal is to tilt the equity slice of the portfolio toward small-cap and value stocks, thus investing in one of the FEPs already introduced (2S10, 2S20, 1S20, and 1S40); the other possibility is to try to replicate the return or risk that would be obtained from an FEP by increasing (decreasing) the allocation to broadly diversified stocks (bonds), thus investing in an OSBP with a more aggressive allocation than 60-40.

RESULTS

Table 1 reports summary statistics on the performance of the four FEPs already introduced (2S10, 2S20, 1S20, and 1S40) and their respective OSBPs, where the optimization aims to either minimize risk subject to an FEP's return (panel A), or maximize return subject to an FEP's level of risk (panel B). Both panels show the proportion of stocks in the OSBPs (S), with the rest of the portfolio allocated to bonds; they also show the arithmetic (AM) and geometric (GM) mean return, volatility (SD), risk-adjusted return (RAR=AM/SD), and terminal value of $1 compounded over the number of years in the sample period (TV). The last column of each panel shows the difference in performance between an OSBP and an FEP.

The starting point of the evaluation is a 60-40 allocation to broadly diversified stocks and bonds; it is the expected return of this balanced portfolio that the investor aims to enhance.

Panel A shows that at the same level of return (AM) of an FEP, OSBPs clearly underperform. In fact, OSBPs have lower compounding power (GM between 10 and 50 basis points a year), higher annual volatility (between 1.3 and 3.7 percentage points), and lower risk-adjusted return. Panel B reinforces these results, showing that at the same level of volatility of an FEP, OSBPs have lower compounding power (between 40 and 120 basis points a year) and lower risk-adjusted return.[6]

These results show that adding size and value tilts to a portfolio that is not fully invested in stocks produces benefits that cannot be replicated by simply making a stock-bond allocation more aggressive. Even when stock-bond portfolios are optimized to match one characteristic of an FEP, they underperform in some other characteristics.

It is of course possible that the previous results apply only to the specific assets and sample period considered. In order

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Table 1

SAMPLE 1 (1927–2018)

Table 1 shows the performance of factor-enhanced portfolios (FEPs) and optimized stock-bond portfolios (OSBPs) between 1927 and 2018. The four FEPs are described in the "Factor-Enhanced Portfolios vs. Optimized Stock-Bond Portfolios" section and the assets in the sample in the "Data and Methodology" section. Performance is summarized with the arithmetic (AM) and geometric (GM) mean return, standard deviation (SD), risk-adjusted return (RAR=AM/SD), and the terminal value of $1 compounded over ninety-two years (TV). S indicates the proportion of stocks in OSBPs, with the rest of the portfolio allocated to bonds. Panel A (B) compares FEPs to OSBPs that minimize risk (maximize return) subject to an FEP's return (risk). The last column of each panel (Diff) shows the difference in performance between an OSBP and an FEP.

Panel A: Minimize Risk Subject to Target Return				Panel B: Maximize Risk Subject to Target Return			
	2S10	**OSBP**	**Diff (%)**		**2S10**	**OSBP**	**Diff (%)**
S		74.2		S		67.1	
AM	10.1	10.1	N/A	AM	10.1	9.7	-0.5
GM	9.2	9.1	-0.1	GM	9.2	8.8	-0.4
SD	13.6	14.9	1.3	SD	13.6	13.6	N/A
RAR	0.74	0.68	-8.4	RAR	0.74	0.71	-4.5
TV	$3,395	$3,077	-9.4	TV	$3,395	$2,402	-29.3
	2S20	**OSBP**	**Diff (%)**		**2S20**	**OSBP**	**Diff (%)**
S		88.3		S		76.8	
AM	11.0	11.0	N/A	AM	11.0	10.3	-0.7
GM	9.9	9.7	-0.3	GM	9.9	9.2	-0.7
SD	15.4	17.5	2.1	SD	15.4	15.4	N/A
RAR	0.72	0.63	-12.2	RAR	0.72	0.67	-6.7
TV	$6,041	$4,819	-20.2	TV	$6,041	$3,366	-44.3
	1S20	**OSBP**	**Diff (%)**		**1S20**	**OSBP**	**Diff (%)**
S		80.6		S		68.8	
AM	10.5	10.5	N/A	AM	10.5	9.8	-0.8
GM	9.6	9.4	-0.2	GM	9.6	8.9	-0.7
SD	13.9	16.1	2.1	SD	13.9	13.9	N/A
RAR	0.76	0.66	-13.3	RAR	0.76	0.70	-7.1
TV	$4,637	$3,800	-18.1	TV	$4,637	$2,554	-44.9
	1S40	**OSBP**	**Diff (%)**		**1S40**	**OSBP**	**Diff (%)**
S		101.1		S		81.7	
AM	11.9	11.9	N/A	AM	11.9	10.6	-1.2
GM	10.6	10.1	-0.5	GM	10.6	9.4	-1.2
SD	16.3	20.0	3.7	SD	16.3	16.3	N/A
RAR	0.73	0.59	-18.6	RAR	0.73	0.65	-10.5
TV	$10,727	$6,854	-36.1	TV	$10,727	$3,945	-63.2

to evaluate this possibility, the same analysis is performed on Sample 2, which features both different assets and a different sample period. The results are shown in table 2.

The results from Sample 2 are consistent with those from Sample 1. It remains the case that given the return of an FEP, OSBPs generally have higher volatility and both lower compounding power and risk-adjusted return (panel A). It also remains the case that given the risk of an FEP, OSBPs generally have both lower compounding power and risk-adjusted return (panel B). However, the magnitude of these differences is lower than that observed for Sample 1.

To test whether this differential magnitude is due to the different assets or the different sample periods, table A2 in the appendix reports the results of the same analysis made in table 2, but in this case using the assets of Sample 1 and the sample period of Sample 2. As table A2 shows clearly, the results are markedly different.

Although directionally the same, table A2 shows, relative to the results in table 2, a much larger increase in volatility and decrease in both compounding power and risk-adjusted return when minimizing risk subject to an FEP return (panel A); and a much higher decrease in both compounding

Table 2

SAMPLE 2 (1979–2018)

Table 2 shows the performance of factor-enhanced portfolios (FEPs) and optimized stock-bond portfolios (OSBPs) between 1979 and 2018. The four FEPs are described in the "Factor-Enhanced Portfolios vs. Optimized Stock-Bond Portfolios" section and the assets in the sample in the "Data and Methodology" section. Performance is summarized with the arithmetic (AM) and geometric (GM) mean return, standard deviation (SD), risk-adjusted return (RAR=AM/SD), and the terminal value of $1 compounded over forty years (TV). S indicates the proportion of stocks in OSBPs, with the rest of the portfolio allocated to bonds. Panel A (B) compares FEPs to OSBPs that minimize risk (maximize return) subject to an FEP's return (risk). The last column of each panel (Diff) shows the difference in performance between an OSBP and an FEP.

Panel A: Minimize Risk Subject to Target Return				Panel B: Maximize Risk Subject to Target Return			
	2S10	**OSBP**	**Diff (%)**		**2S10**	**OSBP**	**Diff (%)**
S		59.7		S		58.8	
AM	10.7	10.7	N/A	AM	10.7	10.7	-0.1
GM	10.2	10.2	0.0	GM	10.2	10.2	0.0
SD	10.5	10.6	0.1	SD	10.5	10.5	N/A
RAR	1.02	1.01	-1.1	RAR	1.02	1.02	-0.5
TV	$48.6	$48.8	0.4	TV	$48.6	$48.1	-1.0
	2S20	**OSBP**	**Diff (%)**		**2S20**	**OSBP**	**Diff (%)**
S		59.4		S		58.8	
AM	10.7	10.7	N/A	AM	10.7	10.7	0.0
GM	10.2	10.2	0.0	GM	10.2	10.2	0.0
SD	10.5	10.5	0.1	SD	10.5	10.5	N/A
RAR	1.02	1.01	-0.7	RAR	1.02	1.02	-0.3
TV	$48.3	$48.6	0.6	TV	$48.3	$48.2	-0.2
	1S20	**OSBP**	**Diff (%)**		**1S20**	**OSBP**	**Diff (%)**
S		64.2		S		57.5	
AM	11.0	11.0	N/A	AM	11.0	10.6	-0.4
GM	10.5	10.4	-0.1	GM	10.5	10.1	-0.3
SD	10.3	11.2	0.9	SD	10.3	10.3	N/A
RAR	1.06	0.98	-7.7	RAR	1.06	1.03	-3.3
TV	$53.4	$52.2	-2.2	TV	$53.4	$47.2	-11.5
	1S40	**OSBP**	**Diff (%)**		**1S40**	**OSBP**	**Diff (%)**
S		68.4		S		60.9	
AM	11.2	11.2	N/A	AM	11.2	10.8	-0.4
GM	10.6	10.6	-0.1	GM	10.6	10.3	-0.4
SD	10.7	11.7	1.0	SD	10.7	10.7	N/A
RAR	1.04	0.95	-8.5	RAR	1.04	1.00	-3.6
TV	$57.1	$55.5	-2.9	TV	$57.1	$49.7	-12.9

power and risk-adjusted return when maximizing return subject to an FEP's risk (panel B). Thus, the differences between the results in tables 2 and A2 reveal an important fact: *It does matter how small-cap and value portfolios are constructed.* The Fama-French definitions and the Russell definitions of small-cap and value stocks lead to considerably different results over the same sample period.

Table 3 repeats the analysis of the previous tables but with Sample 3, consisting of Vanguard index funds. The results are again consistent with those of the previous two samples. More precisely, given the return of an FEP, OSBPs have higher volatility and both lower compounding power and risk-adjusted return (panel A); and given the risk of an FEP, OSBPs have both lower compounding power and risk-adjusted return (panel B).

Interestingly, the magnitude of the differences in this case is the highest of all the cases explored so far, particularly regarding the impact on risk-adjusted return. Panel A shows that given the return of an FEP, OSBPs deliver lower risk-adjusted returns; panel B shows that given the risk of an FEP, OSBPs deliver lower risk-adjusted returns. Because these results are based on index funds, all these figures account for the cost of the exposures considered.

Having observed before that portfolio construction matters, table A3 in the appendix reports the results of the same

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Table 3

SAMPLE 3 (1999–2018)

Table 3 shows the performance of factor-enhanced portfolios (FEPs) and optimized stock-bond portfolios (OSBPs) between 1999 and 2018. The four FEPs are described in the "Factor-Enhanced Portfolios vs. Optimized Stock-Bond Portfolios" section and the assets in the sample in the "Data and Methodology" section. Performance is summarized with the arithmetic (AM) and geometric (GM) mean return, standard deviation (SD), risk-adjusted return (RAR=AM/SD), and the terminal value of $1 compounded at GM over twenty years (TV). S indicates the proportion of stocks in OSBPs, with the rest of the portfolio allocated to bonds. Panel A (B) compares FEPs to OSBPs that minimize risk (maximize return) subject to an FEP's return (risk). The last column of each panel (Diff) shows the difference in performance between an OSBP and an FEP.

Panel A: Minimize Risk Subject to Target Return				Panel B: Maximize Risk Subject to Target Return			
	2S10	**OSBP**	**Diff (%)**		**2S10**		**Diff (%)**
S		73.2		S		60.5	
AM	6.3	6.3	N/A	AM	6.3	6.0	-0.3
GM	5.9	5.6	-0.2	GM	5.9	5.5	-0.3
SD	9.8	12.1	2.3	SD	9.8	9.8	N/A
RAR	0.65	0.52	-19.0	RAR	0.65	0.61	-5.3
TV	$3.1	$3.0	-3.8	TV	$3.1	$2.9	-5.7
	2S20	**OSBP**	**Diff (%)**		**2S20**	**OSBP**	**Diff (%)**
S		86.3		S		61.4	
AM	6.7	6.7	N/A	AM	6.7	6.0	-0.7
GM	6.2	5.7	-0.5	GM	6.2	5.6	-0.6
SD	10.0	14.5	4.5	SD	10.0	10.0	N/A
RAR	0.67	0.46	-31.3	RAR	0.67	0.60	-9.9
TV	$3.3	$3.0	-8.8	TV	$3.3	$2.9	-11.3
	1S20	**OSBP**	**Diff (%)**		**1S20**	**OSBP**	**Diff (%)**
S		84.9		S		58.9	
AM	6.6	6.6	N/A	AM	6.6	6.0	-0.7
GM	6.2	5.7	-0.5	GM	6.2	5.5	-0.7
SD	9.5	14.2	4.7	SD	9.5	9.5	N/A
RAR	0.70	0.47	-33.3	RAR	0.70	0.63	-10.4
TV	$3.3	$3.0	-8.9	TV	$3.3	$2.9	-11.8
	1S40	**OSBP**	**Diff (%)**		**1S40**	**OSBP**	**Diff (%)**
S		109.8		S		60.9	
AM	7.3	7.3	N/A	AM	7.3	6.0	-1.3
GM	6.8	5.7	-1.2	GM	6.8	5.5	-1.3
SD	9.9	18.8	9.0	SD	9.9	9.9	N/A
RAR	0.74	0.39	-47.6	RAR	0.74	0.61	-17.8
TV	$3.7	$3.0	-19.6	TV	$3.7	$2.9	-21.4

analysis in table 3 but in this case using the assets of Sample 1 and the sample period of Sample 3. As table A3 shows, the Fama–French definitions of small-cap and value stocks lead once again to results that point in the same direction, but are of larger magnitude, than those based on Vanguard funds.

In table A3, panels A and B, the Fama–French data results in larger differences than the Vanguard data on index funds in table 3, over the same period. In table A3, panel A, the lower compounding power and risk-adjusted return, as well as the higher volatility, of OSPBs relative to FEPs are all larger in absolute value when based on the Fama–French data. Similarly, in table A3, panel B, the lower compounding power and risk-adjusted return of OSBPs relative to FEPs are larger in absolute value when based on the Fama–French data.[7] This evidence strengthens a result already highlighted, namely, portfolio construction does matter.

ASSESSMENT

Warren Buffett has advised the trustee that will manage his wife's inheritance to invest 90 percent of the money in a very low-cost S&P 500 index fund and the rest in short-term government bonds. His advice to individual and institutional investors has not been very different, except for the suggestion of a specific asset allocation. John Bogle's standard recommendation to all investors, again individual and institutional, has echoed a very similar idea. And both Vanguard traditionally

and many robo-advisors more recently have recommended portfolios based on the same principles.

A simple, low-cost, two-asset portfolio of broadly diversified stocks and bonds has an obvious appeal and much going for it in terms of performance. As argued by Kinniry et al. (2019), a simple portfolio is not necessarily simplistic; it may enable an investor to embrace a strategy with confidence and better endure the markets' inevitable fluctuations. In other words, simplicity is likely to be a strength rather than a weakness.

Simple, broadly diversified, and low-cost portfolios, combined with an appropriate asset allocation, are currently a feasible and plausible choice for investors. But so is factor investing implemented as satellites added to the equity slice of a core portfolio. Either by investing in traditional small-cap or value funds, or in smart beta products, any long-term investor can enhance returns by tilting stocks toward factors that have produced a reliable risk premium.

Thus, when attempting to enhance returns, which is better? Should an investor make the asset allocation of a two-asset portfolio of broadly diversified stocks and bonds more aggressive, or should the investor tilt the equity slice of the portfolio toward factors, particularly small-cap and value stocks? The evidence reported and discussed here, from three different samples and three different sample periods, suggests that the latter is the better alternative.

Factor-enhanced portfolios result in benefits that cannot be reproduced by optimizing stock-bond portfolios. More precisely, if a stock-bond portfolio is optimized to match the return of a factor-enhanced portfolio, the former will have higher volatility and both lower compounding power and risk-adjusted return than the latter. Furthermore, if a stock-bond portfolio is optimized to match the volatility of a factor-enhanced portfolio, the former will have both lower compounding power and risk-adjusted return than the latter. In many cases the differences are substantial, particularly regarding the impact on risk-adjusted returns.

These results suggest that although tilting stocks toward factors may add a small degree of complexity and a few basis points in fees to a portfolio, the benefits obtained clearly outweigh the costs. This is particularly the case given the current product landscape, which makes it very easy to add low-cost small-cap, value, or smart beta funds to a portfolio.

To be sure, these results are not necessarily a defense of smart beta investing; factor tilting can be obtained with smart beta products, as well as with traditional small-cap, value, or small-cap/value funds. Similarly, these results are not necessarily a defense of passive investing; factor tilting can be obtained with

Table A1

SAMPLES 1-3 SUMMARY STATISTICS

Table A1 shows the number of observations (T), arithmetic (AM) and geometric (GM) mean return, and standard deviation (SD) for the series of annual returns of stocks (S), small-cap stocks (SC), value stocks (V), small-cap/value stocks (SC/V) and bonds (B), for the three samples described in the "Data and Methodology" section. All returns are nominal and account for capital gains/losses and cash flows paid. All figures in % except T (in years).

	S	SC	V	SC/V	B
Sample 1 (1927–2018)					
T	92	92	92	92	92
AM	11.8	16.1	16.5	18.4	5.4
GM	9.9	12.2	12.7	13.8	5.1
SD	19.8	29.8	28.6	31.7	8.4
Sample 2 (1979–2018)					
T	40	40	40	40	40
AM	12.9	12.8	12.8	14.0	7.5
GM	11.5	11.1	11.7	12.4	7.3
SD	16.3	18.8	15.1	18.3	6.8
Sample 3 (1999–2018)					
T	20	20	20	20	20
AM	7.0	10.1	7.5	10.4	4.4
GM	5.5	8.3	6.1	8.8	4.3
SD	17.0	19.4	16.5	17.9	3.3

both active or passive funds. That said, the same reasons that explain the flows out of active products and into passive products over the past several years (namely, the underperformance and higher cost of active managers) also would justify using ETFs or index funds for the factor satellites of a portfolio.

In short, the evidence discussed here clearly suggests that factor investing can be beneficial to both individual and institutional investors. It provides benefits beyond those that can be obtained by more-aggressive stock-bond allocations in terms of volatility, compounding power, and risk-adjusted returns. And given that factor satellites can be incorporated into portfolios easily and cheaply with ETFs, factor-enhanced portfolios seem to be a plausible strategy for all investors to seriously consider.

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APPENDIX

See tables A1 through A3.

Table A2

SAMPLE 1 (1979–2018)

Table A2 shows the performance of factor-enhanced portfolios (FEPs) and optimized stock-bond portfolios (OSBPs) between 1979 and 2018. The four FEPs are described in the "Factor-Enhanced Portfolios vs. Optimized Stock-Bond Portfolios" section and the assets in the sample in the "Data and Methodology" section. Performance is summarized with the arithmetic (AM) and geometric (GM) mean return, standard deviation (SD), risk-adjusted return (RAR=AM/SD), and the terminal value of $1 compounded over forty years (TV). S indicates the proportion of stocks in OSBPs, with the rest of the portfolio allocated to bonds. Panel A (B) compares FEPs to OSBPs that minimize risk (maximize return) subject to an FEP's return (risk). The last column of each panel (Diff) shows the difference in performance between an OSBP and an FEP.

Panel A: Minimize Risk Subject to Target Return				Panel B: Maximize Risk Subject to Target Return			
	2S10	**OSBP**	**Diff (%)**		**2S10**		**Diff (%)**
S		70.9		S		61.3	
AM	11.4	11.4	N/A	AM	11.4	11.0	-0.5
GM	10.9	10.8	-0.1	GM	10.9	10.5	-0.4
SD	10.6	11.8	1.1	SD	10.6	10.6	N/A
RAR	1.07	0.97	-9.7	RAR	1.07	1.03	-4.0
TV	$62.6	$60.3	-3.7	TV	$62.6	$53.3	-14.9
	2S20	**OSBP**	**Diff (%)**		**2S20**	**OSBP**	**Diff (%)**
S		81.8		S		67.6	
AM	11.9	11.9	N/A	AM	11.9	11.3	-0.7
GM	11.3	11.1	-0.2	GM	11.3	10.7	-0.7
SD	11.4	13.3	1.9	SD	11.4	11.4	N/A
RAR	1.05	0.90	-14.3	RAR	1.05	0.99	-5.6
TV	$73.3	$68.5	-6.6	TV	$73.3	$57.9	-21.0
	1S20	**OSBP**	**Diff (%)**		**1S20**	**OSBP**	**Diff (%)**
S		80.4		S		62.9	
AM	11.9	11.9	N/A	AM	11.9	11.0	-0.8
GM	11.3	11.1	-0.2	GM	11.3	10.5	-0.8
SD	10.8	13.1	2.3	SD	10.8	10.8	N/A
RAR	1.10	0.91	-17.3	RAR	1.10	1.02	-7.0
TV	$73.2	$67.4	-7.9	TV	$73.2	$54.5	-25.5
	1S40	**OSBP**	**Diff (%)**		**1S40**	**OSBP**	**Diff (%)**
S		100.8		S		75.4	
AM	12.8	12.8	N/A	AM	12.8	11.6	-1.2
GM	12.1	11.7	-0.5	GM	12.1	10.9	-1.2
SD	12.4	16.2	3.8	SD	12.4	12.4	N/A
RAR	1.04	0.79	-23.5	RAR	1.04	0.94	-9.3
TV	$97.4	$82.6	-15.2	TV	$97.4	$63.7	-34.6

Table A3

SAMPLE 1 (1999–2018)

Table A3 shows the performance of factor-enhanced portfolios (FEPs) and optimized stock-bond portfolios (OSBPs) between 1999 and 2018. The four FEPs are described in the "Factor-Enhanced Portfolios vs. Optimized Stock-Bond Portfolios" section and the assets in the sample in the "Data and Methodology" section. Performance is summarized with the arithmetic (AM) and geometric (GM) mean return, standard deviation (SD), risk-adjusted return (RAR=AM/SD), and the terminal value of $1 compounded over twenty years (TV). S indicates the proportion of stocks in OSBPs, with the rest of the portfolio allocated to bonds. Panel A (B) compares FEPs to OSBPs that minimize risk (maximize return) subject to an FEP's return (risk). The last column of each panel (Diff) shows the difference in performance between an OSBP and an FEP.

Panel A: Minimize Risk Subject to Target Return				Panel B: Maximize Risk Subject to Target Return			
	2S10	**OSBP**	**Diff (%)**		**2S10**		**Diff (%)**
S		95.5		S		63.8	
AM	7.1	7.1	N/A	AM	7.1	6.3	-0.8
GM	6.7	5.9	-0.8	GM	6.7	5.9	-0.8
SD	8.9	16.0	7.1	SD	8.9	8.9	N/A
RAR	0.79	0.44	-44.4	RAR	0.79	0.70	-11.2
TV	$3.6	$3.1	-14.0	TV	$3.6	$3.1	-13.5
	2S20	**OSBP**	**Diff (%)**		**2S20**	**OSBP**	**Diff (%)**
S		131.1		S		70.5	
AM	7.9	7.9	N/A	AM	7.9	6.4	-1.5
GM	7.4	5.2	-2.2	GM	7.4	5.9	-1.5
SD	10.4	24.3	13.9	SD	10.4	10.4	N/A
RAR	0.77	0.33	-57.4	RAR	0.77	0.62	-18.9
TV	$4.2	$2.8	-33.4	TV	$4.2	$3.2	-24.4
	1S20	**OSBP**	**Diff (%)**		**1S20**	**OSBP**	**Diff (%)**
S		117.0		S		66.3	
AM	7.6	7.6	N/A	AM	7.6	6.3	-1.3
GM	7.2	5.6	-1.6	GM	7.2	5.9	-1.2
SD	9.4	21.0	11.6	SD	9.4	9.4	N/A
RAR	0.80	0.36	-55.0	RAR	0.80	0.67	-16.6
TV	$4.0	$2.9	-26.0	TV	$4.0	$3.2	-20.9
	1S40	**OSBP**	**Diff (%)**		**1S40**	**OSBP**	**Diff (%)**
S		174.0		S		78.7	
AM	9.0	9.0	N/A	AM	9.0	6.6	-2.4
GM	8.3	3.7	-4.6	GM	8.3	5.9	-2.4
SD	12.2	34.4	22.2	SD	12.2	12.2	N/A
RAR	0.74	0.26	-64.6	RAR	0.74	0.54	-26.3
TV	$4.9	$2.1	-58.1	TV	$4.9	$3.2	-35.8

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ENDNOTES

1. Given two asset allocations, the term "more aggressive" is used throughout this paper to refer to the asset allocation with a higher proportion of stocks (hence with a lower proportion of bonds).
2. For example, the Vanguard Total World Stock ETF (VT) for stocks and the Vanguard Total World Bond ETF (BNDW) for bonds, which have (as of August 2020) total expense ratios of 8 and 6 basis points.
3. Needless to say, small-cap and value stocks, as well as stocks with other characteristics identified in the literature, are expected to produce *long*-term outperformance. In the short term they may underperform, and they may do so for long periods of time, as small stocks and value stocks have been doing over the past several years.
4. Arnott et al. (2005), Hsu and Campollo (2006), and Estrada (2008) explore the size and value effects in the context of fundamental indexation, an early characterization of smart beta strategies.
5. Admittedly, 10-year Treasury notes are not a broadly diversified exposure to bonds. However, they have the advantage of having a long history, consistent with that of the rest of the assets in the sample. The bonds in the other two samples considered are far more broadly diversified.
6. Furthermore, the bottom of panel A shows that in order to match the return of the 1S40 portfolio, the OSBP needs to (slightly) short bonds, which long-only mutual funds are unable to do, and many individual investors may be unable or unwilling to do.
7. In three of the four cases in table A3, panel A, OSBPs need to short bonds to match the return of FEPs. As already mentioned, this is not possible for long-only mutual funds, and not possible or desirable for individual investors. Thus, in some cases, FEPs enable investors to obtain results that they would not be able to obtain without taking short positions.

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