Interest in passive investing has risen in recent years. Many investors, increasingly cost-sensitive in the wake of the financial crisis, are not convinced that active management will deliver excess returns, net of fees, over their benchmarks. Passive investing traditionally has focused on replicating cap-weighted benchmark indexes, either through index mutual funds, exchange-traded funds (ETFs), or the creation of matching in-house portfolios. Cap-weighted indexes provide cost-effective exposure to various segments of the equity market with a high degree of liquidity and capacity. This assures investors of a return that closely tracks the broad equity market at a low cost.

Parallel to investors’ increased interest in passive investing has been the growth in numbers of indexes based on strategies that depart from those of cap-weighted indexes. These new indexes aim to incorporate exposures or strategies that typically are not available in cap-weighted indexes. Various terms include “strategy indexes,” “smart beta indexes,” or “alternative indexes,” as they make up a middle ground between the traditional opposites of passive and active investing. They are attractive for their low cost compared to actively managed funds, and for their ability to customize exposures and incorporate specific strategies, options that generally are not possible in traditional passive investing.

Among the most innovative of these smart beta strategy indexes are “fundamentally weighted indexes” (Arnott et al. 2005). The Russell Fundamental Index methodology, which Russell developed in collaboration with Research Affiliates®, weights stocks by accounting measures such as sales revenue, cash flow, and dividends. The key characteristic of these weights is that the size of a company is measured without any direct link to current market price; see Russell (2012) for the precise construction methodology. This stands in sharp contrast to the standard practice of weighting the stocks in an index by capitalization as measured by current market price, i.e., cap weighting. As we shall see, fundamental indexes have a value tilt, but because the weights are divorced from current market prices, the result is a time-varying value strategy that is distinct from those characterizing traditional cap-weighted value indexes. This provides a complementarity that investors can exploit to diversify existing equity portfolios.

This article explores how an investor might combine cap-weighted and fundamental indexes to shape factor exposures that historically have improved the risk-return profile of the whole portfolio. The emphasis is on exploration, with no intention of arriving at a single optimal portfolio. To make the analysis more clear, we look at a hypothetical passive investor in U.S. equities who uses the Russell 3000 all-cap U.S. index as a benchmark. This investor is convinced by the extensive literature on the subject that long-term rewards are to be gained by tilling portfolios to value and small-cap factors (Fama and French 1992). The traditional approach to incorporating these views is to allocate portions of the portfolio to cap-weighted value and cap-weighted small-cap indexes. This article uses a factor analysis to show how, historically, Russell Fundamental Index strategies would have added new dimensions of diversification for this hypothetical investor.

The Fama-French-Carhart Four-Factor Model

The Fama-French-Carhart four-factor model is a workhorse in academic research. Fama and French (1992) extended the single-factor capital asset pricing model (CAPM) of Sharpe (1964) to include factors for both value and small cap. Carhart (1997) showed that a fourth factor—momentum—was an important explanation of stock returns as well.

The complete model is expressed as

\[
\text{Index} - \text{rf} = a + b \times (\text{Market} - \text{rf}) + c \times \text{SMB} + d \times \text{HML} + e \times \text{MOM} + \text{error},
\]

where \(\text{rf}\) is the risk-free rate of financial theory, proxied by the one-month T-bill. \(\text{Market}\) is the cap-weighted return of all the stocks on the NYSE, AMEX, and NASDAQ exchanges. \(\text{SMB} \) (small minus big) is the return to a portfolio of small-cap stocks minus the return to a portfolio of large-cap stocks, and thus is an estimate of how well the market rewards a tilt to small-cap stocks. Likewise, \(\text{HML} \) (high minus low) is the return to a portfolio of stocks with high book/price ratios minus the return to a portfolio of stocks with low book/price ratios. This too is an estimate of how well the market rewards a tilt to value stocks; see Fama and French (1993) for a detailed description of how the factors are constructed. \(\text{MOM} \) (momentum) is the return to a portfolio holding many of the previous 12 months’ best-performing stocks minus the return to
a portfolio holding many of the previous 12 months’ worst-performing stocks; see Carhart (1997) for details. The coefficients $b$, $c$, $d$, and $e$ measure the exposures of the index to each factor. The contribution of the factor to the index return would then be the exposure times the market or factor rewards: $b \times (\text{Market} - rf)$, $c \times \text{SMB}$, etc.

The intercept of equation 1, $a$, plays an interesting role in this model. It is a systematic return that cannot be explained by the four factors. This could be due to value added or subtracted from the way the exposures change over time, or to exposures that are not in the model. Academic researchers call it “alpha” or “abnormal return,” but practitioners tend to think of true alpha as being an additional return from active stock-picking insights, which cannot be indexed. For lack of a better term, we will call it “alpha” as well, but the reader should keep in mind that it is more realistically thought of as being a return that cannot be explained by the included factors.

All four factors are derived by use of cap-weighted methodologies, so we expect that they cannot capture all of the return variation in a Fundamental Index investment. This might show up in the estimated intercept as well as in a lower R-squared. In this analysis, that turns out to be the case. But before we get into the empirical results, a brief digression on the relationship between the Fundamental Index concept and traditional value indexes is in order.

The Fundamental Index Approach and Traditional Value Indexes

One of the knockers on the Fundamental Index construct is that it is just “old wine in a new bottle,” i.e., merely a value index with a new name (Asness 2006). To illustrate the logic behind this argument, we look at a very simple version of a fundamental index, one weighted solely by book value.\(^1\)

The exact relationship between the fundamentals weight and the market-cap weight of a particular stock produces

$$W_{i,F} = W_{i,C} \times \frac{B_i/P_i}{B_m/P_m},$$

(2)

where $W_{i,F}$ is the fundamentals weight on stock $i$, $W_{i,C}$ is the market-cap weight on stock $i$, $B_i/P_i$ is the book/price ratio of stock $i$, and $B_m/P_m$ is the book/price ratio of the cap-weighted market.\(^2\) Equation 2 shows that a stock will have a greater weight in a fundamental index than in the cap-weighted market if it has a high book/price ratio relative to the market cap-weighted average book/price ratio. Because stocks with above-average book/price ratios also are classified as value stocks, it is clear that the fundamental index has a value tilt.

However, if the book value of the stock rises and the price does not move, then the fundamentals weight will rise, but the cap weight will not. Conversely, if the market price of the stock rises, but the book value stays the same, then the cap weight will rise while the fundamentals weight will not budge.\(^3\) Traditional value indexes select a subset of stocks based on price ratios such as book/price and then cap-weight that subset of stock values; see Russell (2013) for the construction methodology of all of the cap-weighted indexes in this article. We can see that it’s true that a fundamental index has a value tilt, but it’s also true that a value index has a tilt toward fundamental index characteristics. The point is that even though they are correlated, they are not the same, and they may exhibit different behaviors over market cycles. As we will see, combining these differing behaviors would have presented diversification opportunities for the hypothetical investor.

Factor Model Estimates of Large-Cap Value and Fundamental Indexes

We start in the large-cap space and look at factor exposure estimates over a long period before we look at how those exposures might vary over time. The Russell Fundamental U.S. Large Company Index (FDM LC) has the largest percentage of U.S. stocks—87.5 percent—as measured by a composite score of sales adjusted for leverage, retained cash flow, and dividends plus buybacks. The Russell 1000® Value Index (R1000V) is a cap-weighted subset of the Russell 1000® Index (the largest 1,000 U.S. stocks by cap weight), which has an above-average book/price ratio, among other characteristics. Thus, because the hypothetical investor wants exposure to value, we do not consider the Russell 1000.

Table 1 shows the exposure estimates of the R1000V Index and the FDM LC indexes.\(^4\)

Comparing the estimates in table 1 shows that both indexes had negative exposures to the small-cap factor (SMB), which is to be expected from a large company index; and that both indexes had significant exposures to the value factor (HML), which also is to be expected. The only noteworthy difference between the two is that the alpha estimate for the FDM LC was positive and statistically significant at the 10-percent level.\(^5\)

One might conclude, if table 1 were the only evidence, that the two indexes aren’t much different. But these estimates are based on averages over many years, with no indica-

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Table 1: Exposures of the Russell Fundamental Large Company and Russell 1000 Value Indexes

<table>
<thead>
<tr>
<th>Index</th>
<th>Alpha</th>
<th>Market</th>
<th>Small Cap</th>
<th>Value</th>
<th>Momentum</th>
<th>RSQ</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1000V</td>
<td>-0.50%</td>
<td>0.99</td>
<td>-0.15</td>
<td>0.39</td>
<td>-0.042</td>
<td>0.97</td>
<td>Dec. 1979–Dec. 2012</td>
</tr>
<tr>
<td></td>
<td>(-1.12)</td>
<td>(81.27)</td>
<td>(-6.34)</td>
<td>(13.75)</td>
<td>(-2.13)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FDM LC</td>
<td>1.14%</td>
<td>0.96</td>
<td>-0.11</td>
<td>0.34</td>
<td>-0.059</td>
<td>0.95</td>
<td>Dec. 1979–Dec. 2012</td>
</tr>
<tr>
<td></td>
<td>(1.83)</td>
<td>(62.14)</td>
<td>(-4.60)</td>
<td>(8.35)</td>
<td>(-3.06)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: Figures in parentheses are t-ratios calculated using Newey-West robust standard errors. A t-ratio above around 1.7 in absolute value is significant at the 10-percent level; a t-ratio above around 1.9 is significant at the 5-percent level. Alphas are compounded and annualized. The Russell Fundamental Indexes went “live” on February 24, 2011. Data on the Russell Fundamental Indexes prior to the inception date is backfilled, calculated in the same manner as the live data. None of the R1000V data is backfilled.

Source: Russell Indexes
tion of how they might vary over time. Rolling 36-month Fama-French regressions were run to examine this aspect. Figure 1 shows rolling 36-month exposures to the value factor HML. The actual HML returns also are displayed. The series are centered in the middle of the 36-month windows to visually pinpoint the timing.

Figure 1 shows that the exposure to HML was time-varying for both the R1000V and the FDM LC, but the volatility of the FDM LC exposure was 63-percent higher than the volatility of the R1000V exposure. Note that although both indexes always maintain a value exposure, the dynamic range of exposures was wider for the FDM LC. This more pronounced dynamic is a consequence of weighting by non-price measures of size. In an article about style timing, Asness et al. (2000) show that “value spreads … are important indicators of the attractiveness of value over growth.” The range of value spreads is greater with fundamental indexes than with traditional cap-weighted value indexes, which may offer additional predictive power.

Another interesting aspect of figure 1 is the differences in timing across style cycles. The exposures to both indexes would have risen dramatically in tandem during the late 1990s, just before the dot-com collapse with its resurgence of value returns. But the value exposure of the Fundamental Index would have taken a deeper dip ahead of value underperformance.

The Fundamental Index Approach and Traditional Small-Cap Indexes

Next, we turn to the hypothetical investor’s goal of obtaining an exposure to small cap. The usual suspect would be an allocation to a value index; this would have provided a tailwind, as value has underperformed growth for much of the post-2008 period. Overall, the differing dynamics of the two indexes was best illustrated by how the value exposure of the Fundamental Index would have taken a deeper dip ahead of value underperformance.

The exposur...
have shown a value tilt, with the R2000V having the largest tilt, which is expected.

Differences between the three indexes would have arisen with alpha and momentum. The FDM SC would have had an alpha over this period of almost 3 percent, which is statistically significant; the two cap-weighted indexes would have had negative alphas. On the other hand, the FDM SC would have had a negative exposure to momentum (i.e., anti-momentum) that also was statistically significant, and the two cap-weighted indexes would have had small and statistically insignificant momentum exposures. These complementary differences could have proven useful in the construction of portfolios, as shown below.

Figure 2 shows rolling 36-month exposures to the small-cap factor SMB. The actual SMB returns also are displayed. The series are centered in the middle of the 36-month windows to visually pinpoint the timing. The SMB exposure in the R2000 would have shown the least volatility of the three, and would have been consistently larger. This makes sense, because the subset of stocks in the R2000V tends to be the relatively larger companies within the R2000; the FDM SC index includes the bottom 12.5 percent of the market by accounting measures, and the R2000 includes the bottom 8 percent by cap weight.

Looking at the time variation of the exposures, we can see that they all would have jumped in the aftermath of the bursting of the dot-com bubble. We also can see that an upward trend would have occurred in exposures to the SMB factor, especially with FDM SC. Since the financial crisis, the FDM SC would have had exposures close to, and at times larger than, those of the R2000. This would have been fortuitous for FDM SC returns, because small cap has outperformed large cap for most of the period since 2008.

Portfolios of Indexes for Large- and Small-Cap Segments
The preceding analysis of the characteristics of Russell Fundamental Index strategies and cap-weighted indexes leads us to consider how the hypothetical investor might have combined the indexes to produce a portfolio with a desirable set of exposures.

We start with the large-cap segment of the investor’s portfolio. Given the hypothetical investor’s belief in a value premium, a good place to start building a passive portfolio might be the Russell 1000 Value (R1000V) Index. The factor exposure estimates in table 1 and figure 1 suggest that the R1000V would have delivered substantial value exposures, which is the primary goal. But it is useful to get a clearer picture of other factors that would have contributed positively—or negatively—to returns. Figure 3 shows rolling exposure estimates...
multiplied by three-year average factor returns to get smoothed cumulative returns to each of the factors, shown as the growth of a dollar. This amounts to a kind of factor-based performance attribution.

Figure 3 shows that the R1000V would have delivered on its promised value exposure over this period, and that value would have been rewarded. In spite of the dips in the value cycle in the 1990s and in the most recent period, the value factor in the Russell Value Index would have delivered a 66-percent cumulative return (1.7 percent annualized). However, the next most notable aspect of figure 3 is that all three other sources of return—alpha, momentum, and small cap—would have detracted from performance. This is where we could have turned to an alternatively weighted index for additional diversification.

Figure 4 shows the growth of a dollar by factor for the Russell Fundamental U.S. Large Company Index (FDM LC). Contrasting figure 4 with figure 3, several things stand out. First, the return on the value factor in the FDM LC would have been 53 percent (1.4 percent annualized)—significant, but less than the value factor in the R1000V. That is as expected, given that the R1000V is designed to capture the value factor as measured by book/price and the HML return is also book/price. What also stands out is that the negative small-cap return we saw in the R1000V would have been neutralized in the FDM LC. Importantly, alpha would have become a major contributor to returns. Momentum would have been a drag on returns, but that is typical for an alternatively weighted index, because weights don’t change when market prices go on a run but accounting measures stay the same.

Given the contrasting returns to the small-cap factor and to alpha, it might have made sense for the investor to explore a blend of the two indexes. Figure 5 shows the growth of a dollar by factor for a 50/50 blend of the R1000V and the FDM LC. We can see this would have resulted in only a small diminution of cumulative returns to the value factor, while alpha would have been pulled into positive territory and the negative return to the small-cap factor would have been neutralized.

Summary statistics in table 3 show how these different return streams would have sorted out for the R1000V, the FDM LC, and the 50/50 blend. Note that the 50/50 blend would have had a lower tracking error with respect to the Russell 3000 benchmark than either index alone, illustrating the diversification benefits.

Turning to the investor’s small-cap segment, table 2 and figure 2 indicate that
the Russell 2000 would have supplied a consistently larger exposure to the small-cap premium. Figure 6 shows the cumulative returns to the factors. As advertised, the R2000 would have delivered a large return to the small-cap factor. It would even have had a decent return to the value factor, and the momentum factor return would have been neutral. The one negative component would have been the alpha return.

We now turn to the Russell Fundamental Small Company (FDM SC) index to look for complements to the R2000. Figure 7 shows that the FDM SC would not have delivered as much return to the small-cap factor as the R2000 would have. But the FDM SC would have delivered a larger return to the value factor and a very large alpha. Momentum would still have been a detractor, but a relatively minor one.

Following what was done for the large-cap segment, we constructed a 50/50 blend of the R2000 and the FDM SC. The cumulative return attribution is shown in figure 8. The strong returns to the small-cap and value factors would have been maintained in the blended portfolio. The real benefit of combining the indexes would have been in how the FDM SC alpha brought up the negative alpha of the R2000 while the R2000 momentum returns brought up the negative FDM SC momentum returns. The portfolio of blended indexes would have had no significant systematic return drag tied to any factor. The summary statistics in table 4 show that tracking error to the Russell 3000 benchmark would have been reduced with a blended portfolio.
All-Size Portfolios of Indexes

In this final set of comparisons we looked at the whole portfolio of U.S. stock indexes. To recap: the hypothetical passive investor wished to have significant exposure to both value and small-cap premiums while still maintaining substantial market exposure. We assumed a 60/40 portfolio of the R1000V and the R2000 in order to obtain significant value and small-cap exposures. As the R2000 is only 8 percent of the cap weight of the R3000, the 40-percent small-cap weight was a rather large overweight—perhaps more than a tracking-error-sensitive investor would have been comfortable with. There was nothing magical about the 60/40 mix; the purpose was simply to make the small-cap exposure large enough to illustrate its effect in an all-cap portfolio.

Figure 9 shows what the cumulative returns to all factors would have been. It also shows what the returns to the market factor would have been, illustrating that most of the index return volatility would have been attributable to broad market movements. Figure 9 demonstrates that the R1000V/R2000 combination would have delivered the required exposures and returns to the value and small-cap premiums. The return detractors would have been momentum and alpha.

Next we drew on the results in the previous section to construct a 60/40 large/small portfolio, but with the 50/50 R1000V/FDM LC portfolio for the large-cap segment and the 50/50 R2000/FDM SC portfolio for the small-cap segment. The overall portfolio, then, was 30-percent R1000V, 30-percent FDM LC, 20-percent R2000, and 20-percent FDM SC. Cumulative return attributions are displayed in figure 10, which

<table>
<thead>
<tr>
<th>Index</th>
<th>Return</th>
<th>Volatility</th>
<th>Sharpe Ratio</th>
<th>Excess Return</th>
<th>Tracking Error</th>
<th>Information Ratio</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>R2000</td>
<td>9.02%</td>
<td>21.04%</td>
<td>0.41</td>
<td>1.04%</td>
<td>10.57%</td>
<td>0.10</td>
<td>Jul. 1996–Dec. 2012</td>
</tr>
<tr>
<td>FDM SC</td>
<td>14.00%</td>
<td>19.47%</td>
<td>0.71</td>
<td>6.03%</td>
<td>9.34%</td>
<td>0.65</td>
<td>Jul. 1996–Dec. 2012</td>
</tr>
<tr>
<td>50 FDM SC 50 R2000</td>
<td>11.51%</td>
<td>19.89%</td>
<td>0.56</td>
<td>3.54%</td>
<td>9.17%</td>
<td>0.39</td>
<td>Jul. 1996–Dec. 2012</td>
</tr>
</tbody>
</table>

Notes: Excess return and tracking error are calculated relative to the Russell 3000 all-cap benchmark. All values are annualized and arithmetic. The Russell Fundamental Indexes went “live” on February 24, 2011. Performance data for the Russell Fundamental Indexes prior to February 24, 2011 is backfilled, but was calculated in the same manner as the more recent, live data. None of the R2000 data is backfilled.

Source: Russell Indexes
would have been −53.17 percent, while it would have been −54.43 percent for the all-cap-weighted portfolio. Additional diversification from blending in a portion of the Fundamental Index strategy would have contributed additional downside protection.

**Summary and Conclusion**

This article has examined how Fundamental Index strategies would have been a beneficial addition to cap-weighted passive portfolios. We employed the Fama-French-Carhart four-factor model to allow a decomposition of returns by factor. Rolling regressions of factor exposures demonstrated clear differences between Fundamental Index investments and those of cap-weighted value indexes, debunking the claim that they are the same. Cumulative returns by factor provided a return attribution that showed the strengths and weaknesses of the Fundamental Index approach and its cap-weighted counterparts. The analysis showed that combining Fundamental Index strategies and cap-weighted indexes would have increased diversification across factor exposures. This would have resulted in better downside risk and return properties. Negative momentum was the one factor that would not have been effectively diversified away. Offsetting negative momentum would have been a possible opportunity for active management or a momentum index, but that is a question for another article.

Finally, perhaps the most striking differences were between the positive alphas of the Fundamental Index strategy and the negative alphas of the purely passive cap-weighted strategy. In principle, many things could have contributed to those intercepts.

![Figure 10: 30/30/20/20 Portfolio of R1000V, FDM LC, R2000, FDM SC—Growth of a Dollar by Factor](image)

Source: Russell Indexes

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**Table 5: Summary Statistics of the All-Cap Portfolios**

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>Return</th>
<th>Volatility</th>
<th>Sharpe Ratio</th>
<th>Excess Return</th>
<th>Tracking Error</th>
<th>Information Ratio</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 R1000V 40 R2000</td>
<td>8.75%</td>
<td>16.98%</td>
<td>0.49</td>
<td>0.78%</td>
<td>4.83%</td>
<td>0.16</td>
<td>Jul. 1996–Dec. 2012</td>
</tr>
<tr>
<td>30 R1000V 30 FDM LC 20 R2000 20 FDM SC</td>
<td>10.08%</td>
<td>16.75%</td>
<td>0.58</td>
<td>2.11%</td>
<td>5.30%</td>
<td>0.40</td>
<td>Jul. 1996–Dec. 2012</td>
</tr>
</tbody>
</table>

Notes: Excess return and tracking error are calculated relative to the Russell 3000 all-cap benchmark. All values are annualized and arithmetic.

Source: Russell Indexes

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shows that the strong value and small-cap returns would have been maintained while alpha would have been brought well into positive territory. Momentum would have remained a detractor to performance.

The summary statistics in table 5 show that the portfolio including Russell Fundamental Index investments would have shown improvement over the all-cap-weighted portfolio along several dimensions. Total returns, Sharpe ratio, and excess returns all would have been higher than in an all-cap-weighted portfolio. Tracking-error-sensitive investors might have been put off by the higher tracking error, but the risk/reward trade-off as measured by the information ratio shows that the additional benchmark-relative volatility would have been rewarded. The tracking error could have been reduced by reducing the level of small-cap exposure to something below 40 percent.

Finally, we compare downside risk between the two portfolios by looking at maximum drawdown, which measures the maximum drop in the portfolio’s value from peak to trough. Rolling 36-month maximum drawdown for the portfolio with Fundamental Index exposures would have been the same as or less than the drawdown of the all-cap-weighted portfolio during the period July 1996–December 2012. Over that entire period, the maximum drawdown for the portfolio with Fundamental Index assets
Proponents of the Fundamental Index strategy have claimed that the negative alphas of the cap-weighted strategy would have been due in part to the performance drag inherent in cap-weighting; i.e., that overvalued stocks have tended to be overweighted and undervalued stocks have tended to be underweighted. Proponents also have claimed that the positive alpha deriving from the Fundamental Index approach would have been due in part to the way the dynamics of the fundamental value tilt would have had a greater style spread, compared to cap-weighted value indexes. So when divergence from cap-weighted spreads is high, the Fundamental Index will have a larger value tilt, and this tends to precede an increase in value's outperformance. Future research will endeavor to reveal more about this compelling strategy.

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Endnotes

1. Russell does not use book value in its Fundamental Indexes because it was found to essentially duplicate the other three size measures of adjusted sales, retained operating cash flow, and dividends plus buybacks. But book value divided by price is the single value factor used in Russell value indexes.

2. The equation can be verified by noting that $B_n = \sum_i B_i N_i$ and $P_n = \sum_i P_i N_i$, where $N_i$ is the number of shares of stock $i$ in the cap-weighted market.

3. Strictly speaking, this is only true once a year at annual rebalancing.

4. Factor returns have been downloaded from French (2013). We use French's estimate of market returns in the regressions to maintain consistency with the other factor returns. Substituting the returns of the Russell 3000 for French's market returns makes little difference. All Russell index data are from Russell Investments (2012, 2013).

5. Russell indexes are unmanaged and cannot be invested in directly. One must invest in either an index mutual fund or an exchange-traded fund (ETF), both of which incur tracking error (a measure of how accurately the investment tracks the index) and fees. Throughout this article, we assume that both tracking error and fees are small enough to be ignored.


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