The Dumb (Timing) Luck of Smart Beta

November 18, 2019

SUMMARY

- In past research notes we have explored the impact of rebalance timing luck on strategic and tactical portfolios, even using our own Systematic Value methodology as a case study.

- In this note, we generate empirical timing luck estimates for a variety of specifications for simplified value, momentum, low volatility, and quality style portfolios.

- Relative results align nicely with intuition: higher concentration and less frequent rebalancing leads to increasing levels of realized timing luck.

- For more reasonable specifications – e.g. 100 stock portfolios rebalanced semi-annually – timing luck ranges between 100 and 400 basis points depending upon the style under investigation, suggesting a significant risk of performance dispersion due only to when a portfolio is rebalanced and nothing else.

- The large magnitude of timing luck suggests that any conclusions drawn from performance comparisons between smart beta ETFs or against a standard style index may be spurious.

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We've written about the concept of rebalance timing luck *a lot*. It's a cowbell we've been beating for over half a decade, with our first article going back to August 7th, 2013.

As a reminder, rebalance timing luck is the performance dispersion that arises from the choice of a particular rebalance date (e.g. semi-annual rebalances that occur in June and December versus March and September).

We've empirically explored the impact of rebalance timing luck as it relates to strategic asset allocation, tactical asset allocation, and even used our own Systematic Value strategy as a case study for smart beta. All of our results suggest that it has a highly non-trivial impact upon performance.

This summer we published a paper in the Journal of Index Investing that proposed a simple solution to the timing luck problem: diversification. If, for example, we believe that our momentum portfolio should be rebalanced every quarter – perhaps as an optimal balance of cost and signal freshness – then we proposed splitting our capital across the three portfolios that spanned different three-month rebalance periods (e.g. JAN-APR-JUL-OCT, FEB-MAY-AUG-NOV, MAR-JUN-SEP-DEC). This solution is referred to either as "tranching" or "overlapping portfolios."

The paper also derived a formula for estimating timing luck ex-ante, with a simplified representation of:

$$L = \left(\frac{T}{2F}\right)S$$

Where L is the timing luck measure, T is turnover rate of the strategy, F is how many times per year the strategy rebalances, and S is the volatility of a long/short portfolio that captures the difference of what a strategy is currently invested in versus what it *could* be invested in if the portfolio was reconstructed at that point in time.

Without numbers, this equation still informs some general conclusions:

- Higher turnover strategies have higher timing luck.
- Strategies that rebalance more frequently have lower timing luck.
- Strategies with a less constrained universe will have higher timing luck.

Bullet points 1 and 3 may seem similar but capture subtly different effects. This is likely best illustrated with two examples on different extremes. First consider a very high turnover strategy that trades within a universe of highly correlated securities. Now consider a very low turnover strategy that is either 100% long or 100% short U.S. equities. In the first case, the highly correlated nature of the universe means that differences in specific holdings may not matter as much, whereas in the second case the perfect inverse correlation means that small portfolio differences lead to meaningfully different performance.

L, in and of itself, is a bit tricky to interpret, but effectively attempts to capture the potential dispersion in performance between a particular rebalance implementation choice (e.g. JAN-APR-JUL-OCT) versus a timing-luck-neutral benchmark.

After half a decade, you'd would think we've spilled enough ink on this subject.

But given that just about every single major index still does not address this issue, and since our passion for the subject clearly verges on fever pitch, here comes some more cowbell.

Equity Style Portfolio Definitions

In this note, we will explore timing luck as it applies to four simplified smart beta portfolios based upon holdings of the S&P 500 from 2000-2019:

- Value: Sort on earnings yield.
- Momentum: Sort on prior 12-1 month returns.
- Low Volatility: Sort on realized 12-month volatility.
- Quality: Sort on average rank-score of ROE, accruals ratio, and leverage ratio.

Quality is a bit more complicated only because the quality factor has far less consistency in accepted definition. Therefore, we adopted the signals utilized by the S&P 500 Quality Index.

For each of these equity styles, we construct portfolios that vary across two dimensions:

- Number of Holdings: 50, 100, 150, 200, 250, 300, 350, and 400.
- Frequency of Rebalance: Quarterly, Semi-Annually, and Annually.

For the different rebalance frequencies, we also generate portfolios that represent each possible rebalance variation of that mix. For example, Momentum portfolios with 50 stocks that rebalance annually have 12 possible variations: a January rebalance, February rebalance, et cetera. Similarly, there are 12 possible variations of Momentum portfolios with 100 stocks that rebalance annually.

By explicitly calculating the rebalance date variations of each Style x Holding x Frequency combination, we can construct an overlapping portfolios solution. To estimate empirical annualized timing luck, we calculate the standard deviation of monthly return dispersion between the different rebalance date variations of the overlapping portfolio solution and annualize the result.
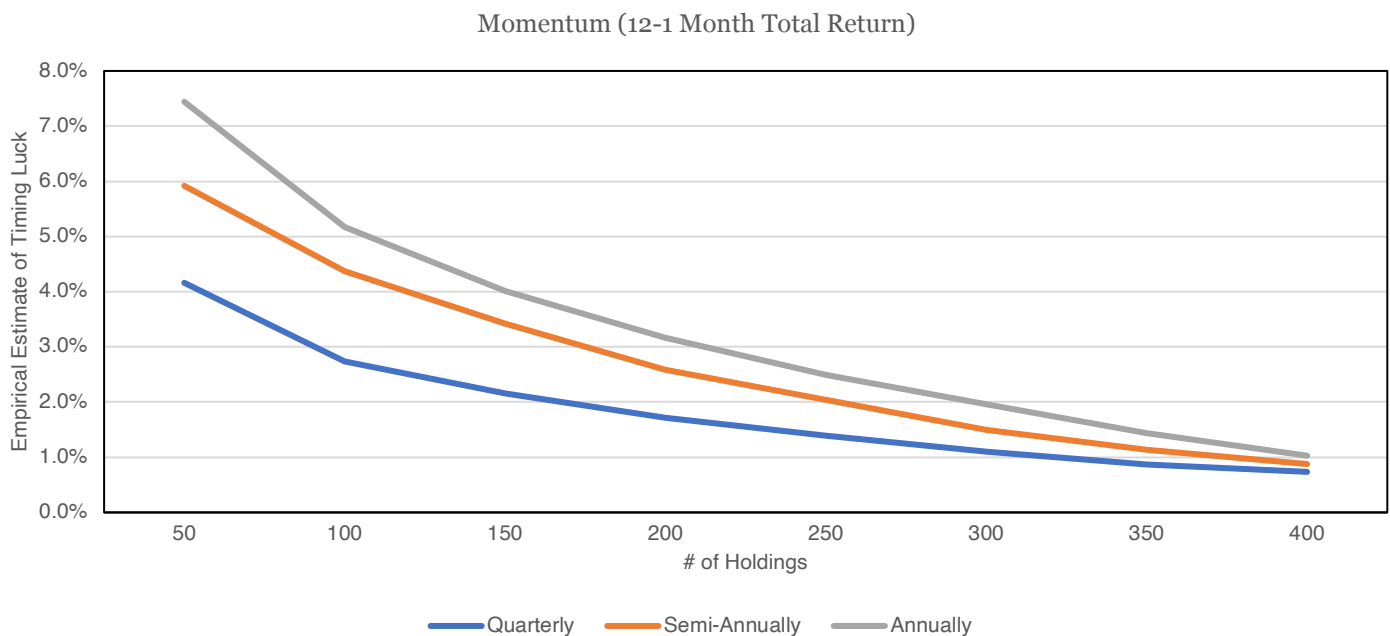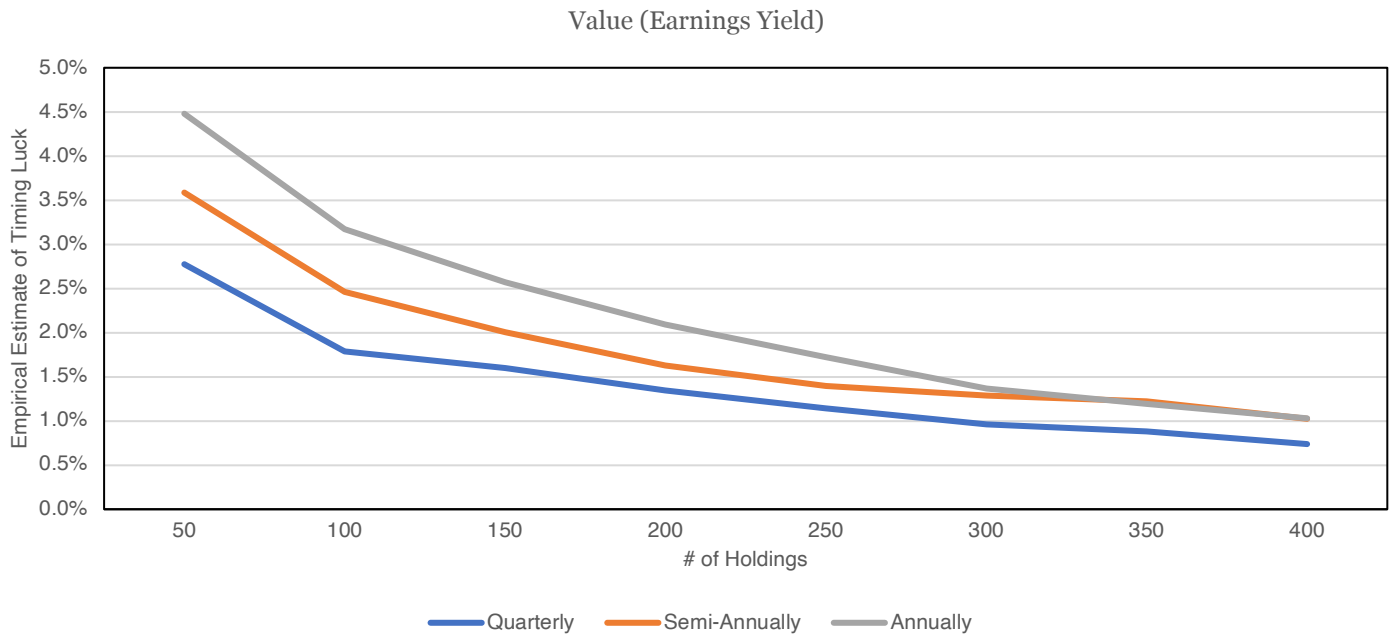
Empirical Timing Luck Results

Before looking at the results plotted below, we would encourage readers to hypothesize as to what they expect to see. Perhaps not in absolute magnitude, but at least in relative magnitude.
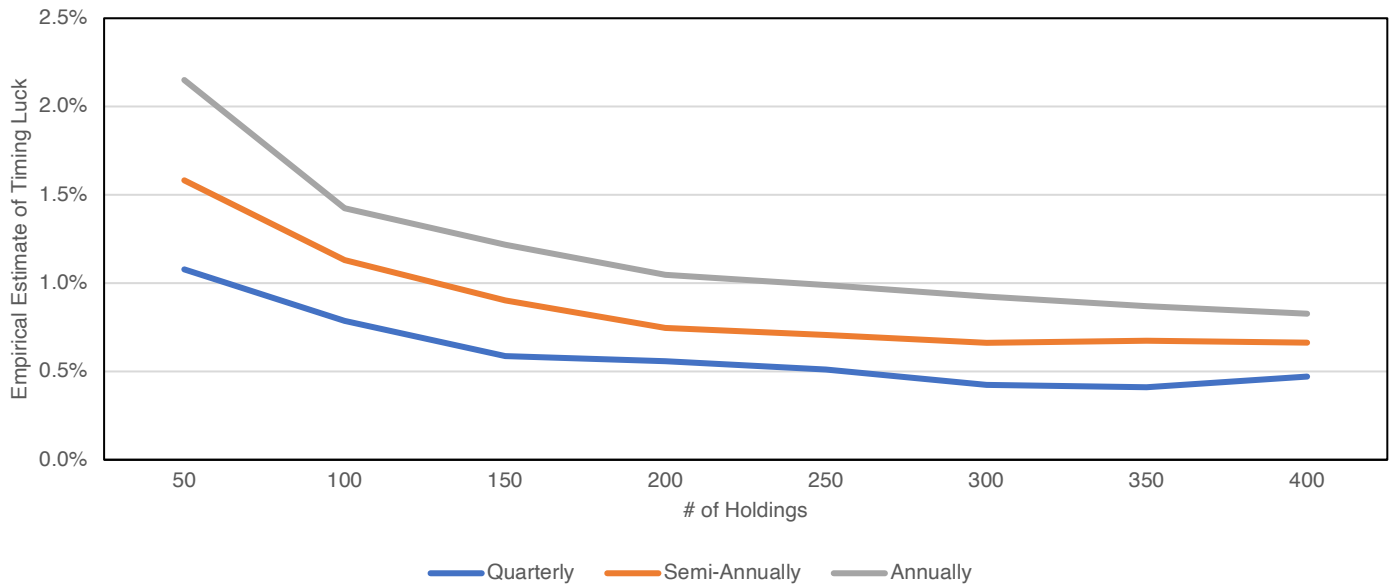
For example, based upon our understanding of the variables affecting timing luck, would we expect an annually rebalanced portfolio to have more or less timing luck than a quarterly rebalanced one?

Should a more concentrated portfolio have more or less timing luck than a less concentrated variation?
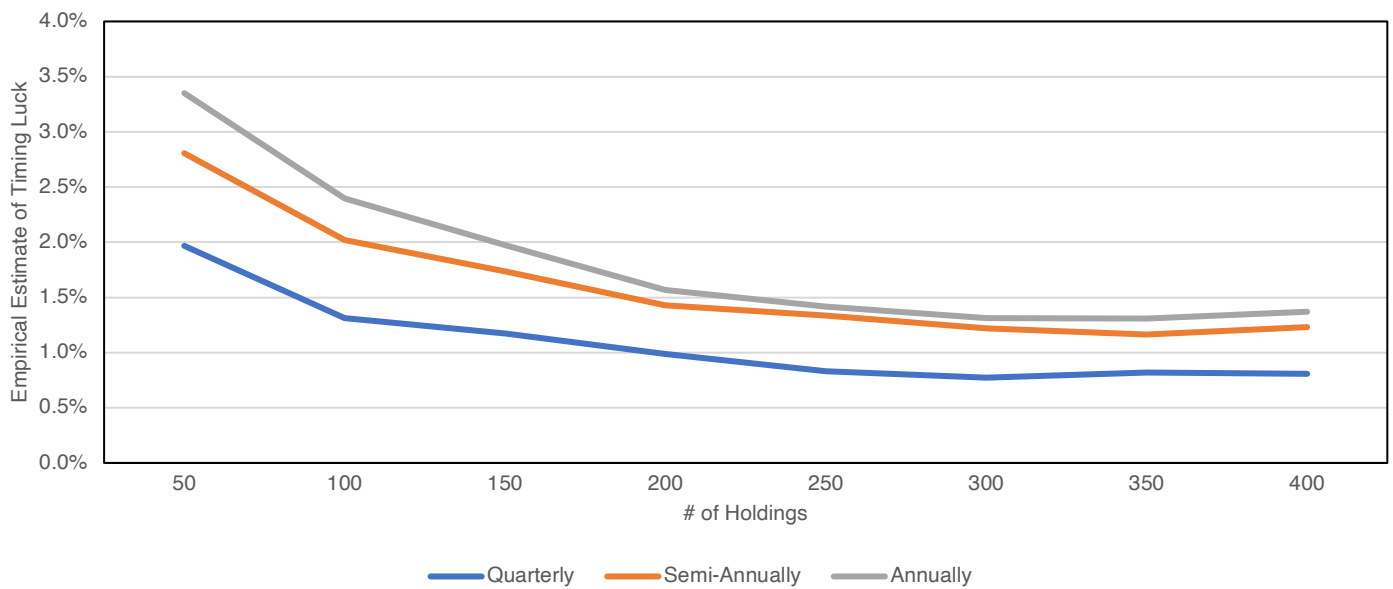
Which factor has the greatest risk of exhibiting timing luck?

Value (Earnings Yield)

Quarterly — Semi-Annually — Annually

Momentum (12-1 Month Total Return)

Quarterly — Semi-Annually — Annually

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Low Volatility (12 Month Realized Volatilty)

Quality (ROE; Accruals; Leverage)

Source: Sharadar. Calculations by Newfound Research.

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To create a sense of scale across the styles, below we isolate the results for semi-annual rebalancing for each style and plot it.

Empirical Timing Luck for Semi-Annual Rebalance
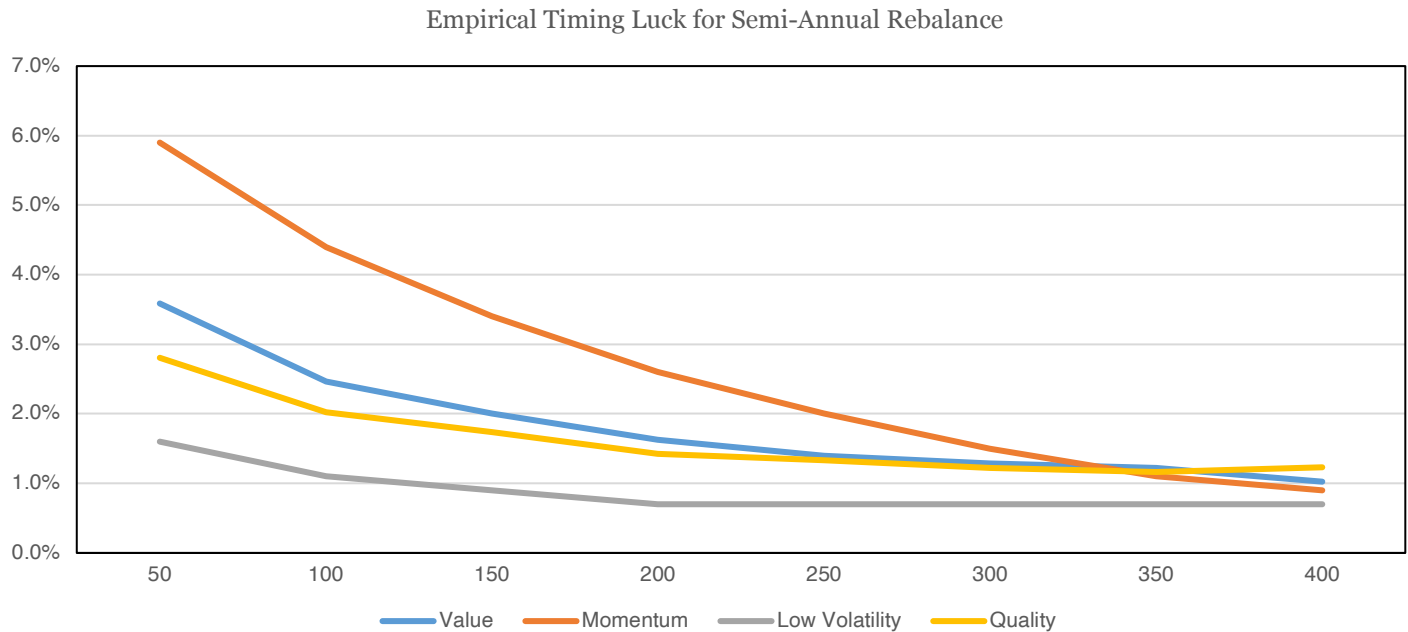
Source: Sharadar. Calculations by Newfound Research.

In relative terms, there is no great surprise in these results:

- More frequent rebalancing limits the risk of portfolios changing significantly between rebalance dates, thereby decreasing the impact of timing luck.

- More concentrated portfolios exhibit larger timing luck.

- Faster-moving signals (e.g. momentum) tend to exhibit more timing luck than more stable, slower-moving signals (e.g. low volatility).

What is perhaps the most surprising is the sheer magnitude of timing luck. Consider that the S&P 500 Enhanced Value, Momentum, Low Volatility, and Quality portfolios all hold 100 securities and are rebalanced semi-annually. Our study suggests that timing luck for such approaches may be as large as 2.5%, 4.4%, 1.1%, and 2.0% respectively.

But what does that really mean? Consider the realized performance dispersion of different rebalance date variations of a Momentum portfolio that holds the top 100 securities in equal weight and is rebalanced on a semi-annual basis.

Timing Luck in Momentum Models (Top 100; Equal Weight; Semi-Annual Rebalance)
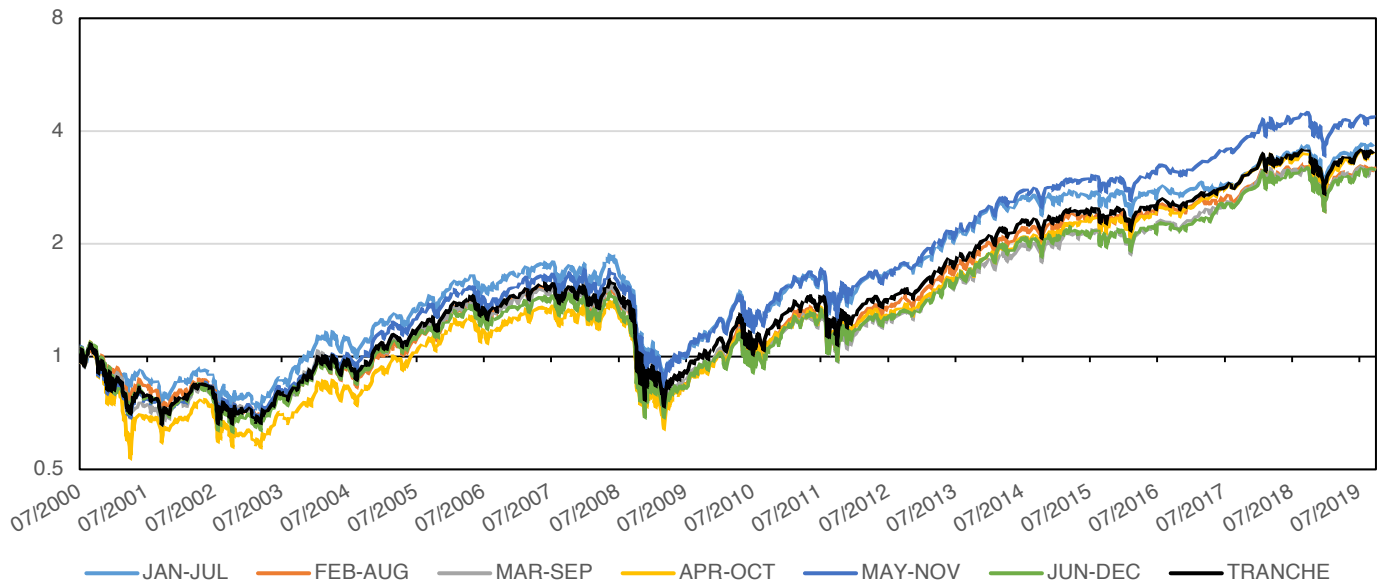
Legend: JAN-JUL, FEB-AUG, MAR-SEP, APR-OCT, MAY-NOV, JUN-DEC, TRANCHE

Source: Sharadar. Calculations by Newfound Research. Past performance is not an indicator of future results. Performance is backtested and hypothetical. Performance figures are gross of all fees, including, but not limited to, manager fees, transaction costs, and taxes. Performance assumes the reinvestment of all distributions.

The 4.4% estimate of annualized timing luck is a measure of dispersion between each underlying variation and the overlapping portfolio solution. If we isolate two sub-portfolios and calculate rolling 12-month performance dispersion, we can see that the difference can be far larger, as one might exhibit positive timing luck while the other exhibits negative timing luck. Below we do precisely this for the APR-OCT and MAY-NOV rebalance variations.

Rolling 12-Month Performance Difference
Mometum Models: APR-OCT vs MAY-NOV

Source: Sharadar. Calculations by Newfound Research. Past performance is not an indicator of future results. Performance is backtested and hypothetical. Performance figures are gross of all fees, including, but not limited to, manager fees, transaction costs, and taxes. Performance assumes the reinvestment of all distributions.

In fact, since these variations are identical in every which way *except* for the date on which they rebalance, a portfolio that is long the APR-OCT variation and short the MAY-NOV variation would explicitly capture the effects of rebalance timing luck. If we assume the rebalance timing luck realized by these two portfolios is independent (which our research suggests it is), then the volatility of this long/short is approximately the rebalance timing luck estimated above scaled by the square-root of two.[1]

Thus, if we are comparing two identically-managed 100-stock momentum portfolios that rebalance semi-annually, our 95% confidence interval for performance dispersion due to timing luck is +/- 12.4% (2 x SQRT(2) x 4.4%).

Even for more diversified, lower turnover portfolios, this remains an issue. Consider a 400-stock low-volatility portfolio that is rebalanced quarterly. Empirical timing luck is still 0.5%, suggesting a 95% confidence interval of 1.4%.

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[1] For variations v_i and v_j and overlapping-portfolio solution V, then:

$$\sigma\left(v_i - v_j\right) = \sigma\left((v_i - V) - (v_j - V)\right) = \sqrt{\sigma^2(v_i - V) + \sigma^2(v_j - V)} = \sqrt{2}L$$

S&P 500 Style Index Examples

One critique of the above analysis is that it is purely hypothetical: the portfolios studied above aren't really those offered in the market today.

We will take our analysis one step further and replicate (to the best of our ability) the S&P 500 Enhanced Value, Momentum, Low Volatility, and Quality indices. We then created different rebalance schedule variations. Note that the S&P 500 Low Volatility index rebalances quarterly, so there are only three possible rebalance variations to compute.
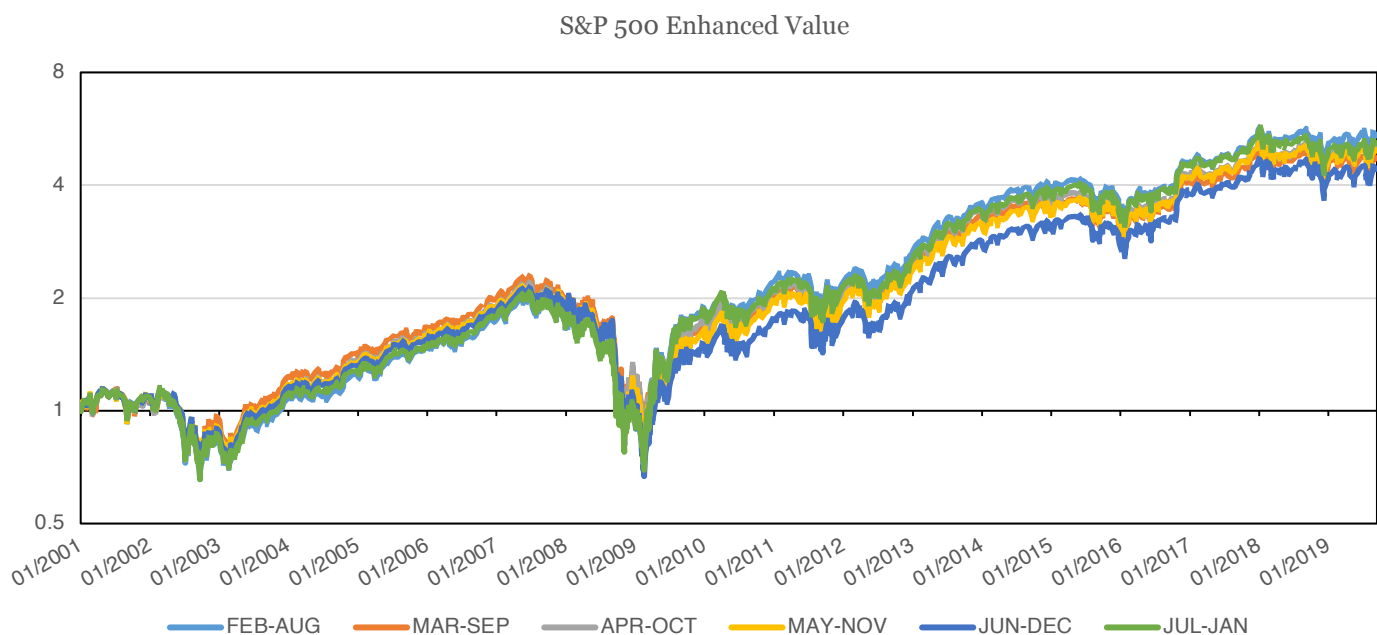
S&P 500 Enhanced Value
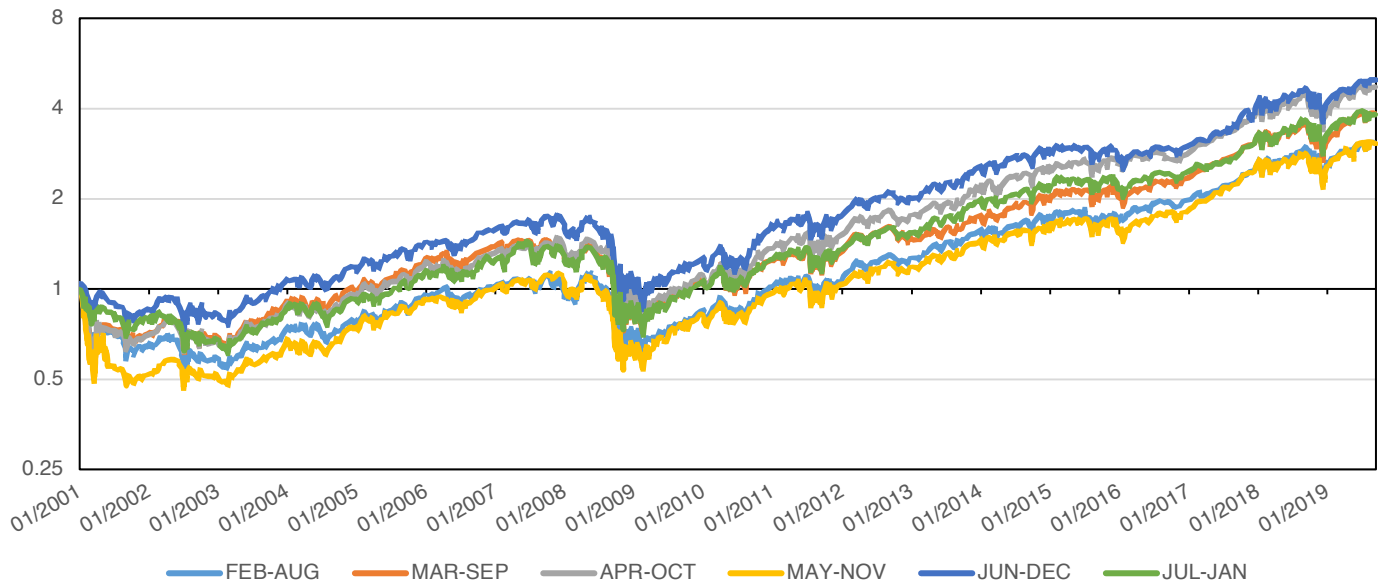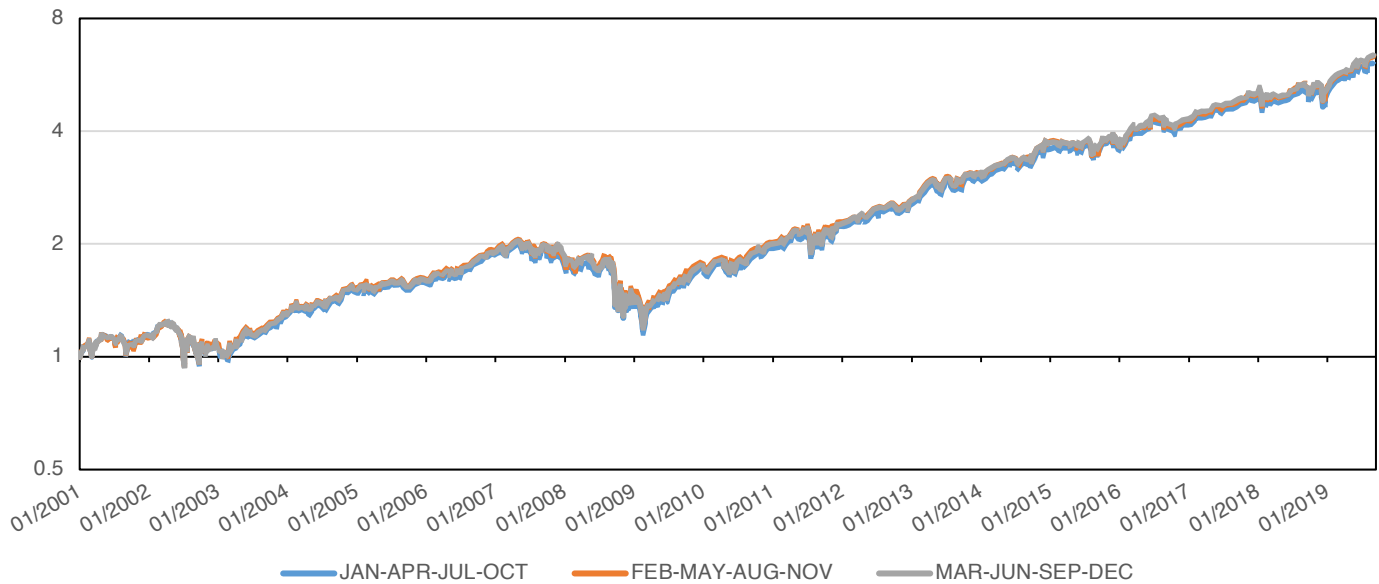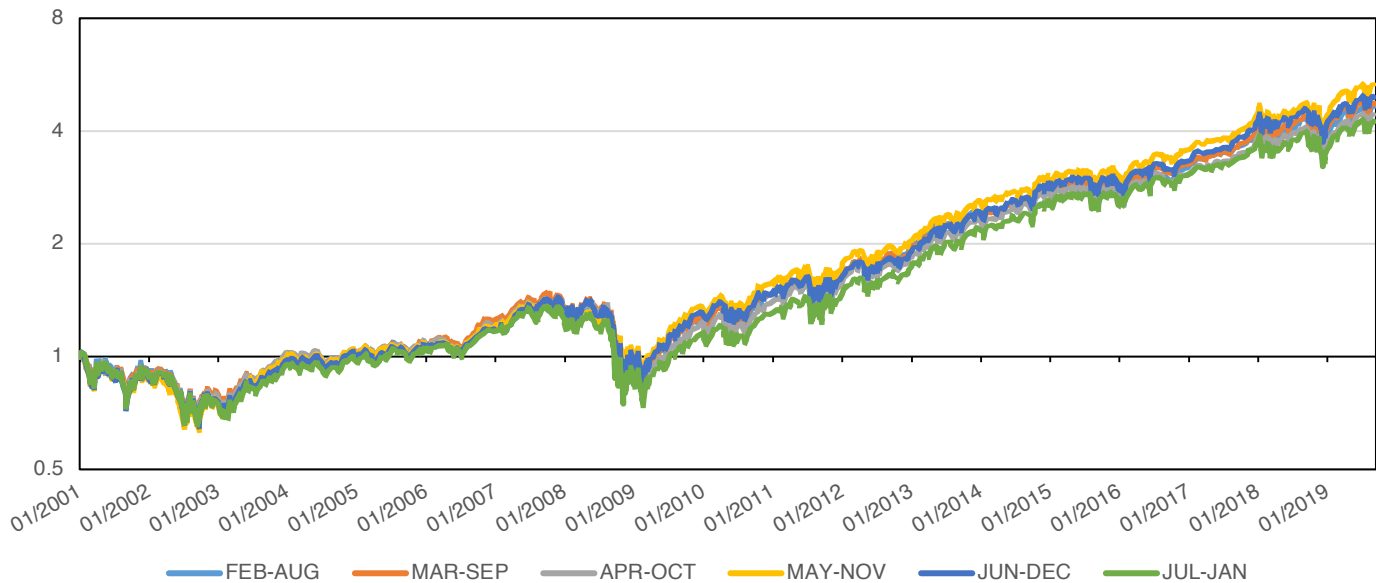
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S&P 500 Momentum

Legend: FEB-AUG, MAR-SEP, APR-OCT, MAY-NOV, JUN-DEC, JUL-JAN

S&P 500 Low Volatility

Legend: JAN-APR-JUL-OCT, FEB-MAY-AUG-NOV, MAR-JUN-SEP-DEC

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S&P 500 Quality

Legend: FEB-AUG, MAR-SEP, APR-OCT, MAY-NOV, JUN-DEC, JUL-JAN

Source: Sharadar. Calculations by Newfound Research. Past performance is not an indicator of future results. Performance is backtested and hypothetical. Performance figures are gross of all fees, including, but not limited to, manager fees, transaction costs, and taxes. Performance assumes the reinvestment of all distributions.

We see a meaningful dispersion in terminal wealth levels, even for the S&P 500 Low Volatility index, which appears at first glance in the graph to have little impact from timing luck.

	Minimum Terminal Wealth	Maximum Terminal Wealth
Enhanced Value	$4.45	$5.45
Momentum	$3.07	$4.99
Low Volatility	$6.16	$6.41
Quality	$4.19	$5.25

We should further note that there does not appear to be one set of rebalance dates that does significantly better than the others. For Value, FEB-AUG looks best while JUN-DEC looks the worst; for Momentum it's almost precisely the opposite.

Furthermore, we can see that even seemingly closely related rebalances can have significant dispersion: consider MAY-NOV and JUN-DEC for Momentum. Here is a real doozy of a statistic: at one point, the MAY-NOV implementation for Momentum is down -50.3% while the JUN-DEC variation is down just -13.8%.

These differences are even more evident if we plot the annual returns for each strategy's rebalance variations. Note, in particular, the extreme differences in Value in 2009, Momentum in 2017, and Quality in 2003.

Annual Returns - S&P 500 Value

FEB-AUG MAR-SEP APR-OCT MAY-NOV JUN-DEC JUL-JAN
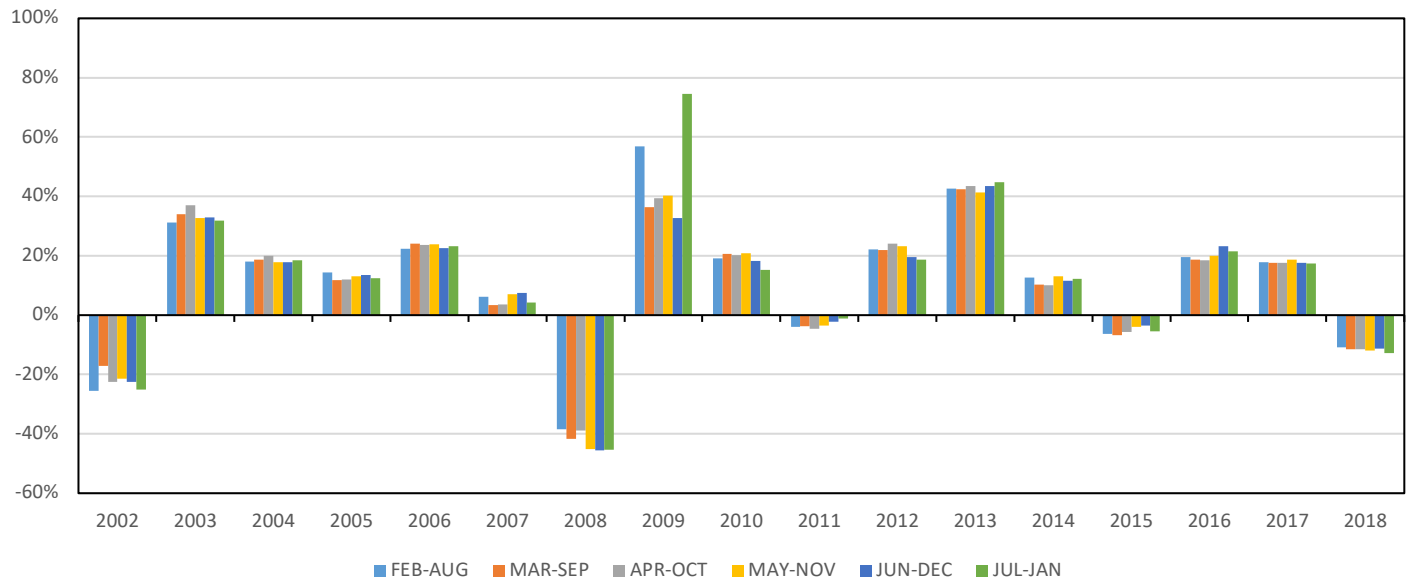
Annual Returns - S&P 500 Momentum

FEB-AUG MAR-SEP APR-OCT MAY-NOV JUN-DEC JUL-JAN
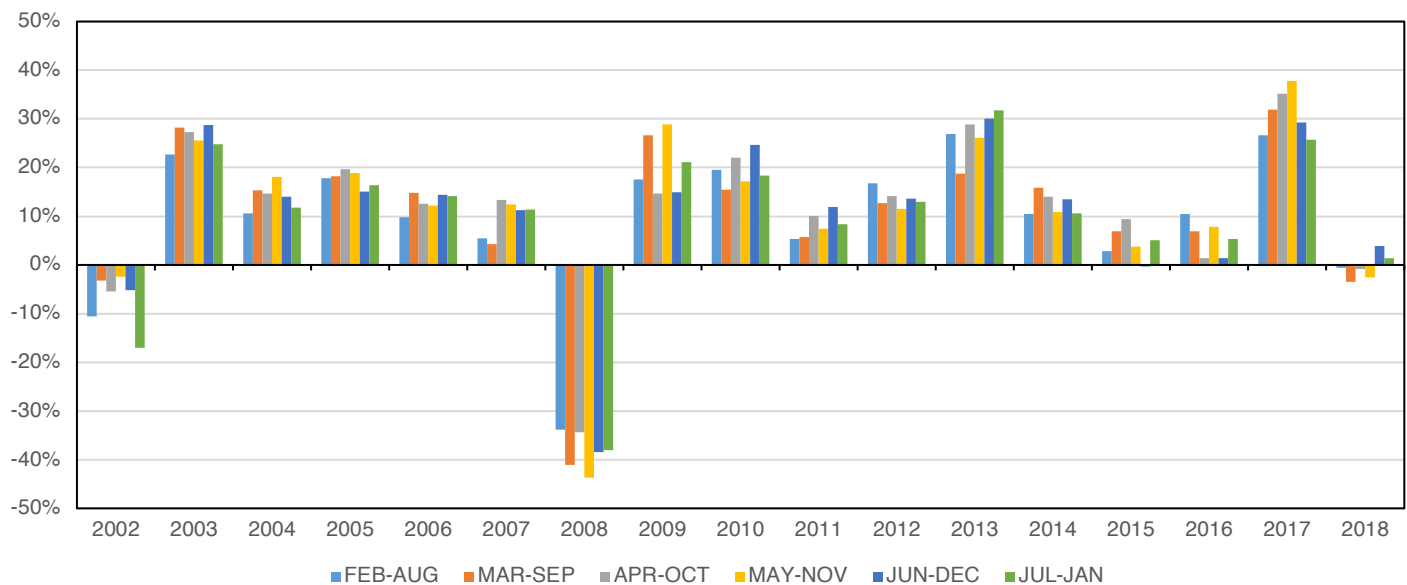
Annual Returns - S&P 500 Low Volatility

Legend: JAN-APR-JUL-OCT · FEB-MAY-AUG-NOV · MAR-JUN-SEP-DEC
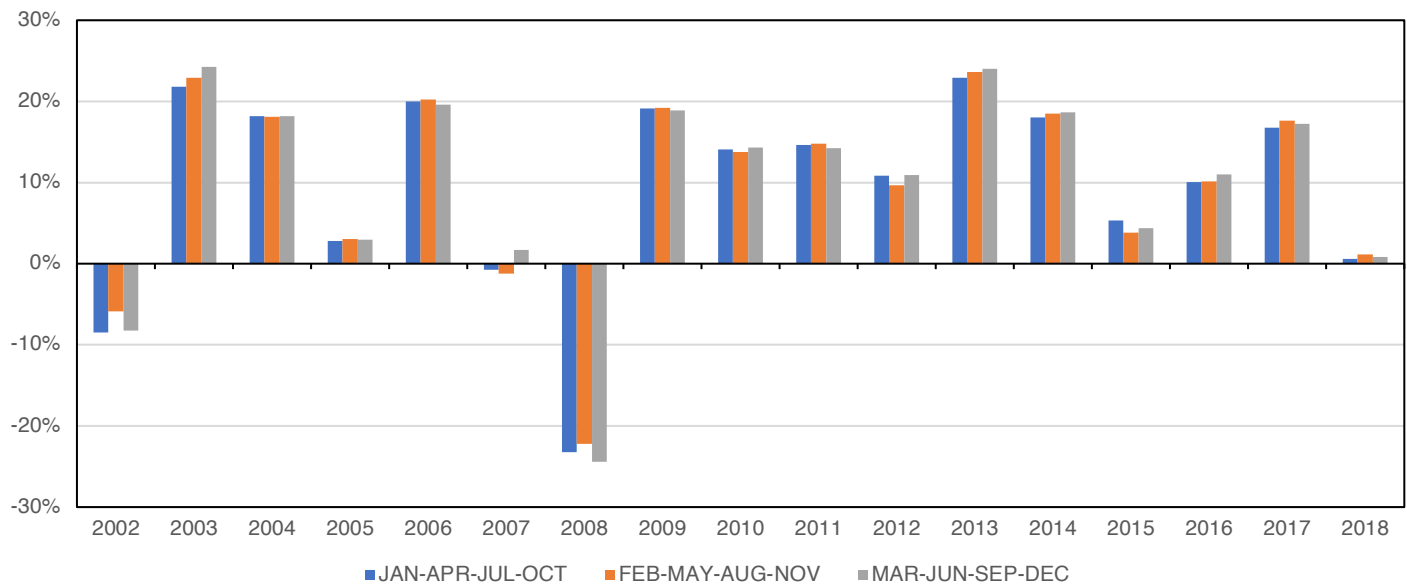
Annual Returns - S&P 500 Quality
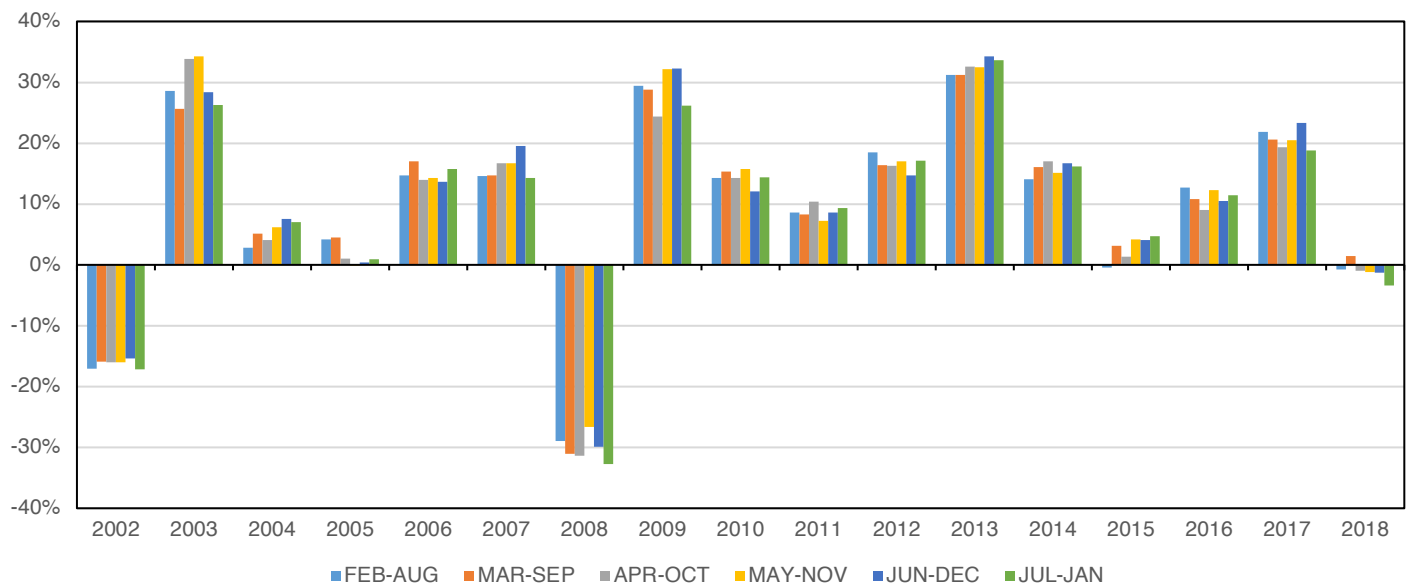
Legend: FEB-AUG · MAR-SEP · APR-OCT · MAY-NOV · JUN-DEC · JUL-JAN

Source: Sharadar. Calculations by Newfound Research. Past performance is not an indicator of future results. Performance is backtested and hypothetical. Performance figures are gross of all fees, including, but not limited to, manager fees, transaction costs, and taxes. Performance assumes the reinvestment of all distributions.

Conclusion

In this study, we have explored the impact of rebalance timing luck on the results of smart beta / equity style portfolios.

We empirically tested this impact by designing a variety of portfolio specifications for four different equity styles (Value, Momentum, Low Volatility, and Quality). The specifications varied by concentration as well as rebalance frequency. We then constructed all possible rebalance variations of each specification to calculate the realized impact of rebalance timing luck over the test period (2000-2019).

In line with our mathematical model, we generally find that those strategies with higher turnover have higher timing luck and those that rebalance more frequently have less timing luck.

The sheer magnitude of timing luck, however, may come as a surprise to many. For reasonably concentrated portfolios (100 stocks) with semi-annual rebalance frequencies (common in many index definitions), annual timing luck ranged from 1-to-4%, which translated to a 95% confidence interval in annual performance dispersion of about +/-1.5% to +/-12.5%.

The sheer magnitude of timing luck calls into question our ability to draw meaningful relative performance conclusions between two strategies.

We then explored more concrete examples, replicating the S&P 500 Enhanced Value, Momentum, Low Volatility, and Quality indices. In line with expectations, we find that Momentum (a high turnover strategy) exhibits significantly higher realized timing luck than a lower turnover strategy rebalanced more frequently (i.e. Low Volatility).

For these four indices, the amount of rebalance timing luck leads to a staggering level of dispersion in realized terminal wealth.

"But Corey," you say, "this only has to do with systematic factor managers, right?"

Consider that most of the major equity style benchmarks are managed with annual or semi-annual rebalance schedules. Good luck to anyone trying to identify manager skill when your benchmark might be realizing hundreds of basis points of positive or negative performance luck a year.

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