Alternative Thinking

Challenges of Incorporating Tactical Views

We emphasize strategic diversification over tactical view-taking for two main reasons:

- Tactical timing is inherently more difficult than it seems
- Tactical tilts tend to forgo some powerful diversification benefits

In this article, we illustrate and provide evidence to support these assertions. We also explore which types of tactical views *are* worth taking, and the conditions under which tactical decisions have a better chance of improving long-term performance.

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AQR Capital Management, LLC
Two Greenwich Plaza
Greenwich, CT 06830

p: +1.203.742.3600
f: +1.203.742.3100
w: aqr.com

Executive Summary

"A wise man … proportions his belief to the evidence." David Hume, *An Enquiry Concerning Human Understanding* (1748)

Hindsight, reinforced by charts and stories that make history appear more inevitable than it ever was at the time, induces us to recall (and expect) unrealistically successful market timing decisions. This in turn may encourage excessive allocations to tactical risk. Empirical evidence is perhaps the best antidote to such biases, and in this note we provide some evidence that contrarian or value-oriented market timing is particularly hard. We also propose a simple enhancement that may help to mitigate the difficulty: combining contrarian valuation and momentum timing signals.

Even those investors who *can* successfully time markets or strategies should recognize that tilting towards preferred investments tends to involve risk concentration. We quantify the impact of "forgone diversification" in tactical tilts using a simple allocation model and show that the required "hit-rate" for successful tactical allocation is higher for larger tilts and for tilts between more diversifying assets.

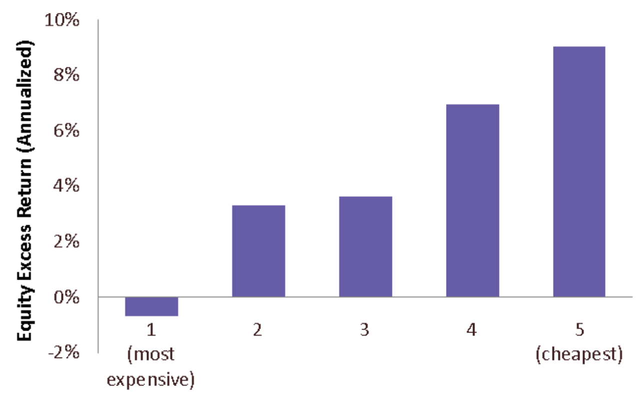
Timing Is Harder Than It Seems

Just one or two successful market-timing decisions in a given decade can transform investment performance from mediocre to extraordinary. This creates a tantalizing holy grail for investors, especially when, as we show below, there seems to be persuasive evidence that simple valuation measures can predict subsequent market performance.[1]

Many investors recognize that market timing is an intrinsically narrow strategy where a moderate edge is less useful than it would be in a strategy with a broader opportunity set.[2] But it gets more challenging: realistic backtests suggest that it is difficult to translate the predictive relations into any kind of outperformance. This is a puzzling result that requires explanation. An understanding of the fundamental challenges of market timing may encourage investors to approach tactical decisions with humility and scale them appropriately. In the below analysis we use U.S. equity returns and Shiller P/E ratios[3] since 1900, but we and others have studied timing strategies in many different markets and time periods and with many different indicators.

Exhibit 1 shows the average rate of excess return for U.S. equities for quarterly five-year periods sorted by starting valuation, as measured by the Shiller P/E ratio, using over a century of data. The evidence for higher valuations predicting lower subsequent returns (and vice versa) does indeed appear strong.

Exhibit 1 | *U.S. Equity Five-Year Returns Sorted by Starting CAPE Valuation, 1900-2014*



Source: Robert Shiller and AQR. Average annualized geometric rates of return excess of cash, based on quarterly data. Past performance is not a guarantee of future performance.

There are several reasons to suspect that real-life market timing strategies will not deliver as strong results as Exhibit 1 suggests. First, the chart involves an important hindsight bias: we define the quintiles using the full history. In other words, each quarter we evaluate the market relative to both past and

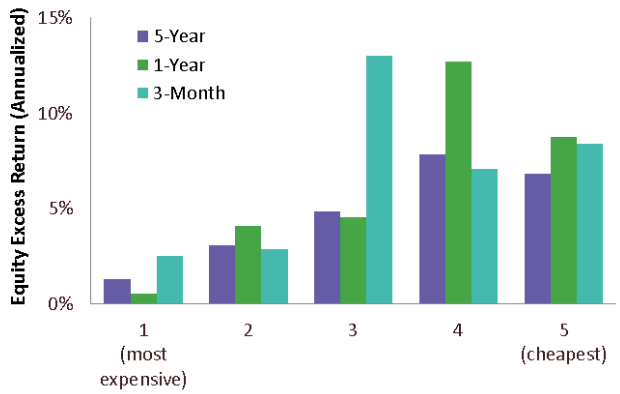
[1] See for example, chapter 8.6 in Ilmanen (2011): *Expected Returns* as well as Asness (2012): *An old friend, the stock market's Shiller PE*. The latter article advocated a cautious interpretation of the evidence, for similar reasons to those we illustrate here.

[2] See Grinold (1989): *The Fundamental Law of Active Management*.

[3] The 'Shiller P/E ratio', also called the cyclically adjusted P/E ('CAPE') ratio, uses average earnings per share over the past decade in the denominator to smooth cyclical variations in earnings. Both P and E are adjusted for inflation. Professor Robert Shiller popularized this idea and updates the series regularly in his website. We sometimes invert this measure and use it as a proxy for the real long-term equity market return.

future valuations. Real-time investors do not know how future valuations may evolve and change the definition of what constitutes high or low valuations. **Exhibit 2** removes this bias by defining quintiles using a rolling 60-year window of past data.[4] It also adds one-year and three-month returns, to see if the pattern holds at shorter horizons. With an out-of-sample approach, the five-year pattern weakens somewhat. Moving to shorter horizons, the pattern weakens further.

Exhibit 2 | *U.S. Equity Returns Sorted by Starting Valuation Based on Rolling 60-Year Window, 1900-2014*

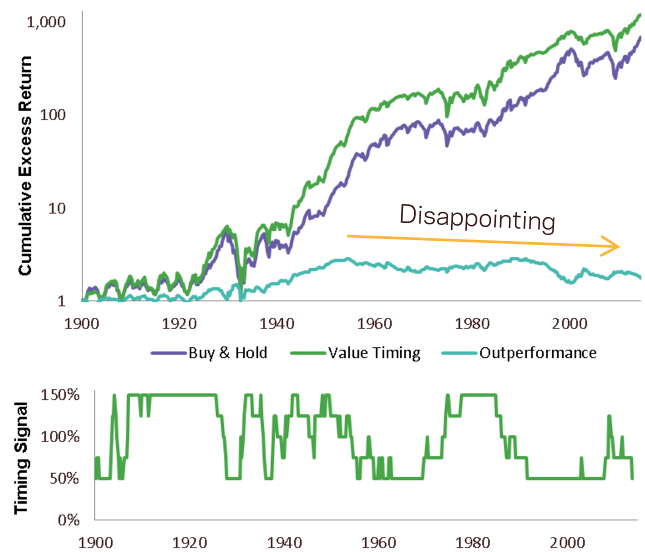


Source: Robert Shiller and AQR. Average annualized geometric rates of return excess of cash, based on quarterly data. Past performance is not a guarantee of future performance.

So is valuation a useful market timing signal, or not? We construct a simple timing strategy that scales its equity investment in the range 50% to 150% (effectively adding a tactical overlay to a buy-and-hold portfolio) and then compare this strategy to a fully invested buy-and-hold approach. Specifically, the timing strategy applies weights of 50%, 75%, 100%, 125% and 150% for valuations in the five out-of-sample quintiles respectively, rebalancing quarterly and borrowing or lending cash with the rest of the portfolio. **Exhibit 3** shows performance statistics and cumulative returns, as well as the underlying signal. The results are disappointing. The timing strategy has a slightly lower Sharpe ratio than buy-and-hold over both the full 115-year sample and the latter half of it (this starts in 1957). During this (perhaps more relevant) latter period, it has earned lower returns than buy-and-hold.[5]

Exhibit 3 | *Performance of Buy-and-Hold and Simple Timing Strategies in U.S. Equities, 1900-2014*

	1900-2014		1957-2014	
	Buy & Hold	Value Timing	Buy & Hold	Value Timing
Excess Return	5.9%	6.4%	5.2%	4.6%
Volatility	19.0%	22.6%	15.3%	14.0%
Sharpe Ratio	0.31	0.28	0.34	0.32



Source: AQR. Hypothetical performance excess of cash, gross of transaction costs and fees, based on quarterly rebalancing. Geometric rates of returns and Sharpe ratios. Hypothetical results have certain inherent limitations, some of which are disclosed in the back. Past performance is not a guarantee of future performance. This analysis has been provided for illustrative purposes only and is not based on an actual portfolio AQR manages.

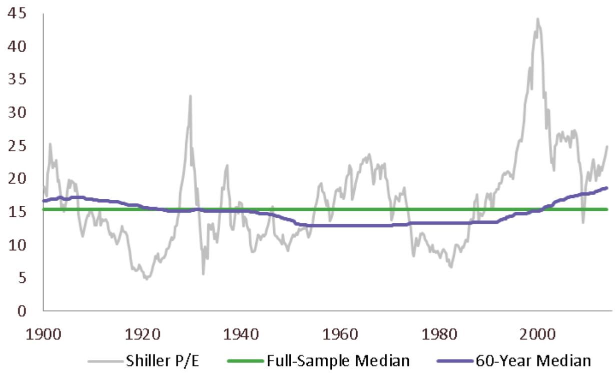
An important reason for the unsatisfactory performance in recent decades is shown in **Exhibit 4.** While the Shiller P/E ratio trends *lower* during the early 1900s, it generally trends *higher* for the last 60 years. This upward trend means the timing strategy gets a disproportionate number of "underweight" signals in recent decades and is therefore underinvested on average (average position 80%). If contrarian timing signals were accurate enough, they

[4] In the early decades of the 1900s, the window is expanding using data since 1881.

[5] In the Appendix we show that the promising pattern of five-year returns in Exhibit 2 persists even in this latter period.

might overcome the return drag from the forfeited equity premium, but this has not been the case.

Exhibit 4 | *Shiller P/E Ratio, U.S. Equities 1900–2014*



Source: Robert Shiller and AQR. Past performance is not a guarantee of future performance.

This is clearly a sample-specific result and probably a particularly bad draw for the timing strategy, with the CAPE in the most expensive quintile at the end of the sample: it doesn't prove that contrarian timing strategies won't work in the future. But it does illustrate a fundamental difficulty faced by such strategies: valuations can drift higher or lower for years or decades, making it difficult to categorize the current market confidently as "cheap" or "expensive" without hindsight calibration. Only part of the dataset (the past) is available to us.[6]

One stark illustration of the challenges contrarian investors face is that in the 1990s the timing strategy gets an "overvalued" signal (Shiller P/E reaches the richest quintile) not in 1999 or even 1996, but at the end of 1991: a painful case of "early equals wrong."[7]

Several additional factors contribute to the disappointing results. The full-sample Sharpe ratio, for example, is reduced by the tendency of low valuations to predict not only higher returns but also higher volatility.[8]

There are of course many variants of, and potential enhancements to, the simple value strategy we analyze above (some are described in the Appendix). But more comprehensive studies (for example, Goyal and Welch (2008) and Dimson, Marsh and Staunton (2013)) find similarly disappointing results for out-of-sample contrarian market timing strategies.[9] Regardless of the design details, the main challenge remains: drifting contrarian indicators make it difficult to evaluate the current market in real time and give profitable time-varying exposure to the equity premium.

More generally, whether studying other indicators, time periods or markets (or even style premia[10]), the broad story seems to be the same: we find that tactical timing is difficult and merits modest allocations of risk. In addition, we nearly always find better historical results from momentum than contrarian timing (see Appendix for evidence on the benefits of combining contrarian and momentum signals). Indeed, one reason for the disappointing performance of contrarian strategies is that they face an uphill battle against shorter-term momentum.

Some institutional investors instinctively prefer contrarian to momentum market timing. For an investor with a long horizon and correspondingly

[6] In other words, we don't know for sure that we are at a peak or trough until afterwards. Importantly, security selection or relative value strategies bypass most of this difficulty. A cheap stock can certainly get cheaper, and the attractiveness of a relative value opportunity must also be judged against the past, but we can at least confidently say that, by our chosen measure, one stock is currently cheaper than another.

[7] In fact, this result (and the timing performance in general) has been softened by yet another source of hindsight bias: the choice of Shiller P/E. Dividend yield was the most popular valuation signal in the early 1990s, later replaced due to the structural change of firms increasingly using buybacks instead of dividends. Dividend yield would have given an even more premature sell signal. Permanent structural changes arguably present the worst outcomes for contrarian strategies: not only is the timing of the expected normalization difficult to judge — it may never happen.

[8] Another contributing factor is that without a hindsight bias the strategy tends to linger on extreme signals — the two out-of-sample extreme "quintiles" actually account for more than two fifths of all observations. This exacerbates the tendency of time-varying risk to produce higher full-sample volatility and lower Sharpe ratios. See for example Kritzman (2000) and Hallerbach (2012).

[9] Another well-known and apparently promising pattern, long-term mean-reversion in equity returns (Zakamulin 2013) is just as difficult to translate into a successful timing strategy and susceptible to sample-specific outcomes.

[10] Four investment "styles" — Value, Momentum, Carry and Defensive — have emerged as compelling sources of alternative returns, backed by economic theory and decades of data across geographies and asset groups. When applied as long/short strategies, these styles have delivered positive long-term returns across multiple asset groups and markets, with low correlations to other investments.

high tolerance of short-term losses, Warren Buffett's advice to be "fearful when others are greedy and greedy when others are fearful" rings true. The even snappier "buy cheap assets" is a persuasive and pleasingly concise maxim. Conversely, momentum investing may feel too much like jumping on a bandwagon. We too are value investors in many contexts, but the evidence challenges the idea that valuation signals *alone* can be used to time markets or inform asset allocation decisions. When others seem greedy, they may still get greedier for many years to come ("longer than you can remain solvent"). Even if the investor has the patience to stay the course, boards or capital providers, seeing persistent underperformance, may not.

Tactical Tilts Forgo Diversification

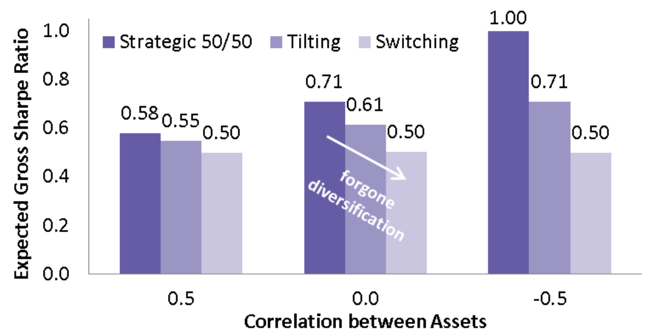
A related application of tactical views is in dynamically allocating capital or risk across multiple assets or strategies. Tactical allocators often face higher turnover and transaction costs than their strategic counterparts, and must overcome this hurdle if they are to outperform. And tactical tilts based on valuation signals encounter the timing challenges we have just described.

However, tactical allocators face another hurdle: over the long term, they are forgoing diversification compared to a well-balanced strategic portfolio. In other words, tactical tilts tend to involve risk concentration. Such tactical actions effectively incur a performance penalty over and above the penalty of additional transaction costs. The simple intuition of "no skill equals no gain but no harm" is false.

Consider a simple hypothetical portfolio of two uncorrelated assets with expected volatilities of 10% and expected Sharpe ratios of 0.5. The expected Sharpe ratio of an equally weighted strategic portfolio of these assets is around 0.7, due to diversification. A tactical investor switching between the two assets (and so giving up all the diversification) will have to be very skillful to match this improvement.

The amount of diversification forgone by a tactical allocation strategy depends on the correlations between the assets, and the size of the tactical tilts. **Exhibit 5** extends the previous simple example, showing expected Sharpe ratios for strategic portfolios and two dynamic strategies, assuming the tilts are applied randomly, without skill or predictive power. The "tilting" strategy applies tilts with an average of +/-25% (maximum of +/-50%), while the "switching" strategy illustrates the extreme case of switching capital entirely from one asset to the other. In this latter case there is no diversification and the portfolio has the same expected Sharpe ratio as the single assets, regardless of correlation.

Exhibit 5 | *Expected Sharpe Ratios for a Two-Asset Portfolio Under Three Allocation Regimes*



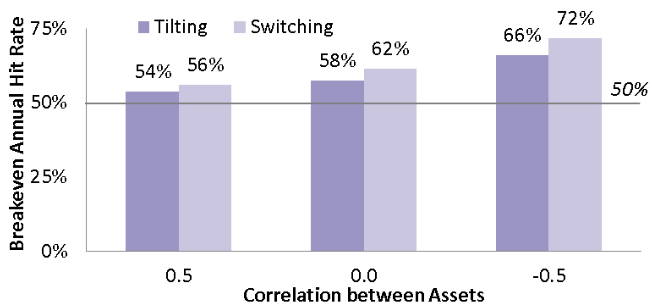
Source: AQR. Theoretical arithmetic Sharpe ratios gross of costs and fees, assuming asset volatilities of 10% and Sharpe ratios of 0.5. For illustrative purposes only. Past performance is not a guarantee of future performance.

The middle group of bars shows our initial example of uncorrelated assets, which could be likened to a stock-bond allocation strategy. The left-hand group of bars represents positively correlated assets, and can be likened to a stock selection strategy. In this case, the amount of forgone diversification is smaller and an investor with reliable return forecasts is more likely to be able to improve the portfolio Sharpe ratio (gross of costs) by making tactical bets. The right-hand group of bars, representing strongly diversifying assets, can be likened to a portfolio of market-neutral value and momentum style premia. Here the diversification benefit is the largest, representing a significant hurdle for tactical tilts to improve on a diversified strategic allocation. [11]

[11] Are we just saying a tactical strategy has less diversified allocations on average? Partly, yes. When the tilting strategy is applying its average tilt

Of course, tactical view-takers would argue their tilts are positive return strategies, not random noise. How good do these strategies have to be to get a tactical investor back on terms with his strategic counterpart? Each tactical portfolio is just the sum of the strategic portfolio and a long/short tactical overlay, and it is straightforward to calculate breakeven information ratios or "hit-rates" for the tactical element in each of our strategies, as shown in **Exhibit 6**. The required hit-rate is higher for more aggressive tilts and for tilts between more diversifying assets.[12] For uncorrelated assets, the tactical investor must make profitable tilts in about 60% of years just to break even.

Exhibit 6 | *Breakeven Annual Hit-Rates for Two-Asset Tactical Strategies*



Source: AQR. Based on breakeven theoretical arithmetic information ratios gross of costs and fees, and normally distributed serially uncorrelated returns. For illustrative purposes only. Past performance is not a guarantee of future performance.

Tactically minded investors might further argue that diversification does not itself generate returns. Admittedly, its most significant potential benefit is to reduce portfolio risk, and thus raise expected *risk-adjusted* returns. This advantage may be enough to convince many risk-conscious investors. But a better-diversified, less risky portfolio may also generate higher long-run absolute returns: it is less likely to trigger costly interventions during tough times, and the investor may be able to raise strategic allocations by reducing cash holdings or employing prudent (direct or delegated) leverage.

Finally, it should be noted that a diversified strategic portfolio is not a buy and hold portfolio: it needs to be rebalanced to maintain strategic weights. Indeed, rebalancing to constant notional or risk weights is one of the only active allocation strategies that systematically maintains, rather than forgoes diversification.

A Time and a Place for Tactical

Tactical decisions are made at many stages and levels of the investment process, from the top-level allocation policies of investing institutions, to the allocation decisions of smaller units within those institutions, down to the sub-strategies of individual active managers. The challenges, biases and hurdles described in this article occur and should be considered at all these levels.

We do believe that valuations are useful for setting long-term expectations. We also believe investors and managers are right to continue researching potential indicators of time-varying expected returns of assets, style premia and other investment strategies — we certainly do ourselves — but these should be approached with humility and sized and used appropriately. Attractive predictive correlations do not always translate to successful timing, and tactical tilts incur a mechanical Sharpe ratio penalty which is larger for portfolios of more diversified assets or strategies.

Contrarians may be characterized as bravely or wisely standing up to herd-like market behavior. But while individual contrarian trades may indeed be uncomfortable to the point of heroism, the concept of "buying cheap" is so comforting and appealing — and hindsighted contrarian narratives are so misleadingly compelling — that it may be over-represented in tactical timing decisions. For every

of 25%, its allocations to the two assets are 75% and 25%. But the expected Sharpe ratio of this strategy is in fact slightly lower than that of a static 75%/25% allocation. This is because time-varying volatility does not average in the same way as time-varying allocations. This extra penalty, which may be described as forgone diversification through time, is also suffered by market timing strategies (see footnote 8 and AQR investor note "Tactical Tilts and Forgone Diversification"). It is generally smaller than the effect of forgone cross-sectional diversification.

[12] For investors familiar with mean-variance optimization, this result should come as no surprise. Differences in expected returns imply smaller differences in optimal portfolio weights when components are more diversifying. Here we describe the same effect, encouraging tactical investors to account for (forgone) diversification when applying tilts.

peak or trough there will be investors who called it right, and subsequently attract publicity and praise. Many more call it wrong and fade into obscurity.

Furthermore, the mathematics of diversification implies that tactical bets should be modestly sized unless confidence in tactical forecasts is extremely high. For a portfolio of diverse investments with low correlations to each other, balanced strategic allocations are particularly hard to beat.

Appendix

Momentum: The Missing Ingredient?

Markets have been shown to exhibit trends or time series momentum at multi-month horizons,[13] and any contrarian timing strategy is fighting against this headwind. Combining value and momentum has been shown to be effective in stock selection and cross-sectional strategies,[14] and the combined signal intuitively represents "value with a catalyst," or *patient* contrarian investing, with a supportive momentum signal potentially reducing the risk of value traps or premature signals. Does the evidence agree that a dose of momentum can resuscitate contrarian market timing?

Exhibit A1 adds the performance of a simple one-year momentum timing strategy, and a combined value and momentum (VM) strategy. The momentum strategy overweights (underweights) the market for the next quarter if the market return exceeded (lagged) cash during the past year. The combined strategy achieves modestly higher gross returns and Sharpe ratios than buy-and-hold or pure value timing over both samples.[15] Evidence and intuition both suggest that adding a momentum signal — whether based purely on price as above, or on macro fundamental indicators[16] — helps to address the challenges of contrarian timing. This is consistent with AQR's broader findings that momentum tends to work "everywhere," that timing is still hard even with the best of models, and especially so when applied on a single market without diversification.

Exhibit A1 | *Performance of Buy-and-Hold and Simple Timing Strategies in U.S. Equities*

1900-2014	Buy & Hold	Value Timing	Mom Timing	VM Timing
Excess Return	5.9%	6.4%	7.1%	6.9%
Volatility	19.0%	22.6%	18.4%	19.7%
Sharpe Ratio	0.31	0.28	0.39	0.35

1957-2014	Buy & Hold	Value Timing	Mom Timing	VM Timing
Excess Return	5.2%	4.6%	5.7%	5.2%
Volatility	15.3%	14.0%	16.2%	14.5%
Sharpe Ratio	0.34	0.32	0.35	0.36

Source: AQR. Hypothetical performance excess of cash, gross of transaction costs and fees, based on quarterly rebalancing. Geometric rates of returns and Sharpe ratios. Momentum signal is 133% after a positive one-year return and 67% after a negative return (numbers chosen to give an expected standard deviation similar to that of the value signal). Note momentum strategy is approximately 110% invested on average due to positive long-term equity returns. Combined signal is simple average of value and momentum signals. Hypothetical results have certain inherent limitations, some of which are disclosed in the back. Past performance is not a guarantee of future performance. This analysis has been provided for illustrative purposes only and is not based on an actual portfolio AQR manages.

Strategy Variants and Additional Charts

Exhibit A2 shows hypothetical performance for buy-and hold, the simple out-of-sample strategy that we describe in the main article ("Rolling 60-year Window"), and several variants. Each variant changes one parameter and keeps the others unchanged:

- "Rolling 60-year Window" calculates quintile boundaries using data from 1881, with an expanding window until 1941 and then a rolling 60-year window. It holds 50/75/100/125/150% positions in the five quintiles.
- "In-Sample Quintiles" uses fixed quintile boundaries based on the full 1900-2014 sample as shown in Exhibit 1, and therefore includes a hindsight bias.
- "Expanding Window" uses an expanding data window from 1881 to calculate quintile boundaries.
- "Rolling 30-year Value" uses data from 1881, with an expanding window until 1911 and then a rolling 30-year window.
- "Continuous Signal" applies a smoothly varying signal in the range 50% to 150% based on the valuation percentile, rather than five discrete signal levels.
- "Extremes Only" applies 50% and 150% signals in the bottom and top quintiles respectively (otherwise 100%).

[13] See Moskowitz, Ooi and Pedersen (2012) and Hurst, Ooi and Pedersen (2012). The latter paper notes that momentum exhibits attractive empirical tail-hedging behavior as well as positive returns. Note that trend-following strategies usually combine time series momentum strategies on many different assets, which is a much more diversified approach than the single-market timing strategy that we examine here.
[14] Asness, Moskowitz and Pedersen (2013).
[15] Alternative ways to avoid fighting momentum included simply rebalancing less frequently, or "slowing down" the value signal, by using a multi-year moving average. The latter method avoids the problem of rebalancing to an arbitrary schedule and is equivalent to making a sequence of overlapping value bets that are each "locked in" for a fixed period. Results for these variants are shown in Exhibit A2.
[16] See Brooks et al (2014). Potential macro momentum indicators include growth and inflation surprises and forecast revisions.

- "Extremes w Mom Filter" applies the extreme-quintile signals only when the one-year momentum signal is of the agreeing sign.
- "Annual Rebalance" rebalances annually at year-end instead of quarterly.
- "10-Year Lock-in" uses a 10-year moving average of the signal, which is equivalent to investing 1/40th of assets based on the latest signal each quarter, locked in for 10 years. This strategy performs strongly in the more recent sample, by locking in overweights during the 1980s and delaying the premature underweight in the 1990s. It is much less helpful during the pre-war period, where a simple annual rebalance gives better results. This highlights the sample-specific nature of contrarian timing performance.
- "Value and Momentum" is the combined strategy shown in Exhibit A1.

Exhibit A2 | *Performance of Value Timing Signals in U.S. Equities, 1900-2014*

1900-2014	Avg Position	Excess Return	Volatility	Sharpe Ratio
Buy and Hold	100%	5.9%	19.0%	0.31
Rolling 60-year Window	98%	6.4%	22.6%	0.28
In-Sample Quintiles	100%	7.1%	22.9%	0.31
Expanding Window	98%	6.6%	22.7%	0.29
Rolling 30-year Window	96%	6.4%	22.0%	0.29
Continuous Signal	98%	6.4%	21.9%	0.29
Extremes Only	98%	6.2%	22.7%	0.28
Extremes w Mom Filter	103%	6.6%	19.3%	0.34
Annual Rebalance	98%	6.9%	22.6%	0.30
10-year Lock-in	97%	5.8%	21.5%	0.27
Value and Momentum	104%	6.9%	19.7%	0.35

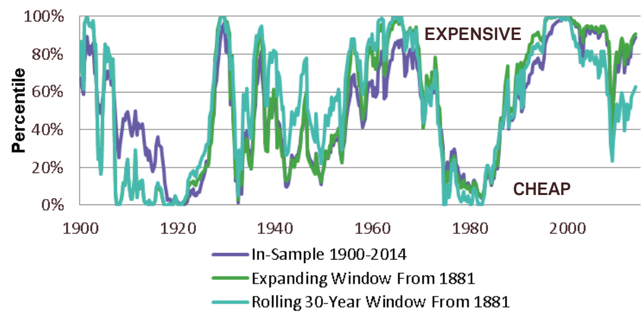
1957-2014	Avg Position	Excess Return	Volatility	Sharpe Ratio
Buy and Hold	100%	5.2%	15.3%	0.34
Rolling 60-year Window	80%	4.6%	14.0%	0.32
In-Sample Quintiles	86%	5.4%	14.8%	0.36
Expanding Window	80%	4.7%	14.1%	0.33
Rolling 30-year Window	86%	4.8%	15.0%	0.32
Continuous Signal	82%	4.9%	13.9%	0.35
Extremes Only	84%	4.8%	14.6%	0.33
Extremes w Mom Filter	99%	5.3%	15.0%	0.36
Annual Rebalance	81%	5.0%	14.0%	0.36
10-year Lock-in	83%	5.3%	13.1%	0.40
Value and Momentum	96%	5.2%	14.5%	0.36

Source: AQR. Hypothetical performance excess of cash, gross of transaction costs and fees. Geometric rates of returns and Sharpe ratios. Hypothetical results have certain inherent limitations, some of which are disclosed in the back. Past performance is not a guarantee of future performance. This analysis has been provided for illustrative purposes only and is not based on an actual portfolio AQR manages.

The first column shows the average position for each strategy. For the second half of the sample, all purely contrarian strategies are underinvested on average due to the upward trend in valuations. It is worth noting that even the most promising strategies — the combinations of value and momentum — confer only a small advantage over buy-and-hold, and that implementation costs would reduce this further. This result supports our view that strategic allocation decisions are more likely to drive long-term performance than tactical decisions.

Exhibit A3 shows how market valuation depends on available data. Compared to the full history, 2014 is top-quintile expensive, whereas compared to a 30-year window, 2014 scores only just above the middle quintile. Thus, by using a shorter window instead of the full history, we partly account for the trend increase in market valuations.

Exhibit A3 | *Shiller P/E Percentiles Using In-Sample and Out-of-Sample Methods*



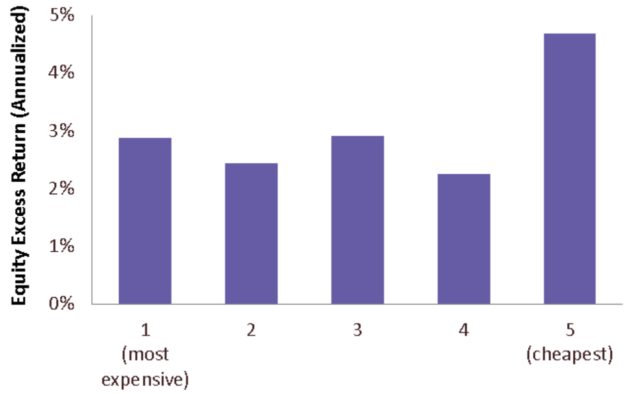
Source: Robert Shiller and AQR. Shiller P/E data begins in 1881. Past performance is not a guarantee of future performance.

Exhibit A4 shows the out-of-sample quintile pattern for the second half of the sample, since 1957. The pattern is weaker than for the full sample, but low valuations clearly still predict higher returns than high valuations. Despite this pattern, the simple out-of-sample value timing strategy performs poorly during this period for the reasons described in the main article.

Exhibit A5 shows that the dispersion of subsequent return outcomes (annualized) is comparable for different valuations and for different horizons.

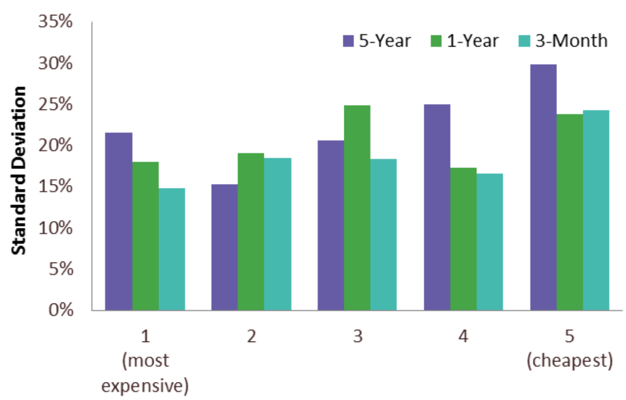
Finally, **Exhibit A6** shows separately the impact of underweight and overweight value signals. In the analysis, shifting partly to cash when valuations are unattractive ("underweights only") slightly raises the Sharpe ratio, but at the cost of lower returns. Levering up when the market looks cheap ("overweights only") raises returns but at the cost of a lower Sharpe ratio. Investors hoping to raise both return and Sharpe ratio by contrarian timing would be disappointed with this strategy and many other variants.

Exhibit A4 | *U.S. Equity Returns Sorted by Starting Valuation Based on Rolling 60-Year Window, 1957-2014*



Source: Robert Shiller and AQR. Average annualized geometric rates of return excess of cash, based on quarterly data.

Exhibit A5 | *Annualized Standard Deviation of Return Outcomes Sorted By Starting Valuation, Rolling 60-Year Window, 1900-2014*



Source: Robert Shiller and AQR. Based on quarterly data.

Exhibit A6 | *Performance of Underweight and Overweight Value Timing Signals, 1900-2014*

	Excess Return	Sharpe Ratio
Buy and Hold	5.9%	0.31
Underweights only	5.5%	0.32
Overweights only	6.8%	0.28
Full Value Timing	6.4%	0.28

Source: AQR. Hypothetical performance gross of transaction costs and fees, based on geometric returns excess of cash. Value quintiles based on a rolling 60-year window. "Underweights only" applies a weight of 50% in the first (most expensive) quintile, 75% in the second and 100% otherwise. "Overweights only" applies a weight of 150% in the fifth (cheapest) quintile, 125% in the fourth and 100% otherwise. Hypothetical results have certain inherent limitations, some of which are disclosed in the back. This analysis has been provided for illustrative purposes only and is not based on an actual portfolio AQR manages.

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The white papers discussed herein can be provided upon request.

AQR Capital Management, LLC
Two Greenwich Plaza, Greenwich, CT 06830
p: +1.203.742.3600 I f: +1.203.742.3100 I w: aqr.com