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A New Core Equity Paradigm

Using Value, Momentum, and Quality to Outperform Markets

Market exposure has historically rewarded long-term investors, but market risk is only one exposure among several that can deliver robust long-term returns. Most notably, tilts toward value, momentum, and quality have provided more attractive risk-reward trade-offs than the market alone, but most equity investors do not have easy access or adequate exposure to these styles.

This paper describes a new core investment strategy for equity investors, which uses value, momentum, and quality themes to identify stocks expected to significantly outperform the market. By combining these three themes into one core strategy, investors have the potential to receive similar market equity risk exposure, but with substantially higher returns.¹ We first discuss the motivation for this strategy and the intuition behind why value, momentum, and quality have outperformed the market historically and why we expect them to continue to outperform. Next, we detail how to implement a strategy that maximizes a long-only investor's exposure to these styles. In particular, there are large diversification benefits from combining these three styles into one portfolio that has the ability to reduce risk substantially while still offering high average returns above the market. Two large potential benefits, relative to a core benchmark, are revealed by combining these themes: 1) a much higher reward per unit of risk and 2) a significant reduction in extreme risk/losses. Hence, not only does the combined portfolio provide higher returns relative to a traditional core benchmark in normal times, it also reduces risk and losses during extreme times, making it a very valuable investment strategy.

In short, we seek to present a "new core" strategy by combining these three themes in an intuitive and transparent approach that delivers compelling net returns, reduces severe risk/losses, and effectively captures opportunities beyond the market. For those using a traditional passive equity index as a core strategy, we believe this new blend of three proven investment themes offers a much better risk-reward profile that can serve as a new core strategy. And, for those who may already be tilted toward value or momentum or quality, this new core blend provides a more efficient and effective way of achieving those tilts simultaneously and is much better than tilting toward only one of these themes.

¹ Throughout this paper, we will interchangeably use the terms "quality" and "profitability", also references to returns, risks, out-performance, etc. are based on a hypothetical analysis and not an actual portfolio or account. Any statement about returns is also subject to the caveat that past performance is not a guarantee of future returns. Please see below for additional details on this analysis and important disclosures at the end of this paper.

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Introduction

The benefits of style tilts, specifically value, momentum, and quality, have been known for some time and (as we detail below) are backed by long-standing empirical evidence.² Yet, it has been difficult for most long-only equity investors to access these sources of return efficiently in a single portfolio. Historically, these styles have often been bundled with active and opaque products that charge high fees. We take a different approach, by designing a systematic and structured strategy that provides access to these styles in a single portfolio for long-only investors. While the approach is transparent and systematic, minimizing the costs and managing the risks requires careful portfolio construction and implementation. The disciplined and structured approach we advocate involves dynamically rebalancing well-diversified portfolios to capture and maintain desired exposures to these styles, but it is not designed to make idiosyncratic, “active bets” on individual stocks. In this sense, our approach is “active” in implementation, while remaining passive or systematic in theme and specific stock selection.

To achieve this goal, we use an integrated, straightforward methodology for capturing value, momentum, and quality, which combines these themes endogenously into one portfolio. This integrated framework takes advantage of natural synergies among these styles, which can significantly reduce the volatility of the portfolio, and has the ability to be more efficient in terms of lowering taxes and trading costs. We capture each style using multiple transparent and intuitive measures which leads to a more robust and reliable strategy. In addition, we combine these themes in order to maximize the benefits and interactions between them. In the end, we hold a diversified, fully invested, long-only portfolio of individual stocks that efficiently provides exposure to these three classic themes.

Finally, using algorithmic trading and smart rebalancing techniques, we seek to minimize the costs of implementing these styles. All of these features allow us to better translate the high Sharpe ratio opportunities provided by these systematic styles into higher realized returns and, at the same time, lower tracking error.

In short, to capture and harvest the long-term returns, while controlling risks and costs, of these classic styles requires craftsmanship and a well-structured approach.

² Note, there are other well-known styles, including the “size” and “low-beta” effects. In this paper, we focus on value, momentum, and profitability, since these styles are the most applicable for long-only investors seeking to outperform core benchmarks. Throughout the paper, references to “core benchmarks” shall mean the Russell 1000 for U.S. large cap, Russell 2000 for U.S. small cap and MSCI World Ex U.S. for International large cap.

Motivation

Value and momentum remain the two strongest findings of academic and practitioner research of the last 30 years.³ While academics continually identify new “market anomalies,” which purport to offer significant risk-adjusted excess returns, and the Street routinely spins new stories to sell them, value and momentum stand head-and-shoulders above the rest—no other styles have performed so well, for so long, and in so many places. Both value and momentum have long histories of providing attractive returns, have performed well across markets and across asset classes, and have persisted for decades after their discoveries. Importantly, the two strategies perform even better when combined.⁴

The idea of value and quality investing dates back to at least Benjamin Graham. Graham believed investors should “...apply a set of standards to each [stock] purchase, to make sure that he obtains (1) a minimum of quality in the past performance and current financial position of the company, and also (2) a minimum of quantity in terms of earnings and assets per dollar of price.”⁵ These rules were designed to help investors identify undervalued stocks and avoid overvalued ones. Descriptions of momentum strategies go back even further; for example, in 1838 James Grant’s The Great Metropolis described a simple momentum rule attributed to eighteenth century British economist and investor David Ricardo.⁶ We begin with value investing, which refers to item (2) of Graham’s philosophy above, then describe momentum and finally return to item (1) above when talking about quality.

1. Value: Over the last 30 years academics have repeatedly shown the successful performance of value strategies.⁷ This research has generally complied with the second set of standards Graham believed should be met when selecting stocks: the price criteria, which requires that investors obtain a minimum *quantity* of assets for each dollar paid. Put differently, these value strategies buy cheap stocks. The implementation is relatively straightforward. Take a set of stocks and rank them by some fundamental-to-price measure, which takes some measure of a company’s fundamental value,

³ Fama and French (1996, 2008, 2012), Jegadeesh and Titman (1993), Asness (1994), Asness, Moskowitz, and Pedersen (2012), Israel and Moskowitz (2013).

⁴ See Asness, Moskowitz, and Pedersen (2012), among others.

⁵ Graham (1973).

⁶ Grant (1838): “...when a member possessed a stock, and prices were rising, he ought not to sell until prices had reached their highest ...”

⁷ Most prominently Fama and French in a series of papers: Fama and French (1992), Fama and French (1993), Fama and French (1996), Fama and French (2004), Fama and French (2008), Fama and French (2012).

such as earnings or book equity, and scales it by its market price. On average, the stocks that have high fundamental values relative to their price significantly outperform the market going forward. The idea is to buy “value” in the form of paying a cheaper price for each unit of earnings or cash flow a firm generates.

2. Momentum: Momentum investing is an almost equally well-known strategy, supported by evidence that is as robust and pervasive as the evidence behind value investing. Momentum is the tendency of stocks to exhibit persistence in their relative performance.⁸ Since its initial documentation in academia in the early 1990s among U.S. equities, momentum has been studied extensively, and shown to be a pervasive phenomenon across markets and asset classes. The typical approach to momentum investing is to buy winners (for example, to hold stocks that have outperformed their peers over the last year.) On average, these winners have significantly outperformed the market going forward.

3. Quality: More recent research has emerged that strategies based on a stock’s *quality*—Graham’s first criteria—are just as successful as those based on traditional value measures (e.g., price measures following Graham’s second criteria). The term “quality” refers to the company’s assets. On average, stocks of profitable, stable, and growing companies tend to significantly outperform the market going forward.⁹ The idea is that for the same price, firms with more productive assets will produce greater returns. Frazzini, Kabiller, and Pedersen (2012) show that the performance of the publically-traded companies held by Berkshire Hathaway, the primary investment vehicle of Warren Buffett, Graham’s most famous student and perhaps the most successful value investor of all time, can largely be explained by his commitment to buying stocks of high-quality companies.¹⁰

In this paper, we focus on one measure of the quality of a firm’s assets: profitability. Profitability investing captures another dimension of value. All value strategies endeavor to acquire productive capacity cheaply. Traditional value strategies do this by buying assets at bargain prices. However, profitability strategies do this by buying uncommonly-productive assets. Buying high-quality, profitable assets without paying premium prices is just as valuable as buying average-quality assets at discount prices. Strategies based on either of Graham’s criteria generate significant excess returns,

but the real benefits of value investing accrue to investors that make decisions based on both price *and* profitability. Profitability measures help traditional value investors distinguish bargain stocks (those that are undervalued) from value traps (those that are cheap for good reasons). Price measures help quality investors avoid good firms that are already fully priced. Combining both measures brings the double benefit of increasing expected returns while simultaneously decreasing volatility and reducing the frequency and magnitude of periods of underperformance. Cheap, profitable firms tend to outperform firms that are just cheap or just profitable.¹¹ Profitability tends to deliver solid performance when traditional value suffers large drawdowns, and vice versa, so strategies that trade on both measures also tend to generate steadier returns than do strategies that trade on profits or price alone. This illustrates why an integrated approach is so valuable. Importantly, profitability is not an anti-value “growth” strategy, but is used in conjunction with value to identify better value stocks and therefore essentially a better value strategy. This is what Graham had in mind, and it is supported by extensive empirical evidence.

Combining momentum with value and profitability can help identify even better investments. A stock that is both cheap and profitable and exhibiting signs of positive momentum tends to be a better investment than one showing signs of negative momentum. Conversely, a hot momentum stock with high profitability that is selling cheap tends to be a better buy than one with low profitability that looks expensive. In essence, the combination of all three themes identifies stocks producing large profits at relatively cheap prices already exhibiting an upward swing. Hence, we believe the combination of all three styles simultaneously provides a cleaner measure of the best stocks to purchase (as well as those to avoid), delivering a more efficient and more successful investment strategy.¹²

¹¹ Novy-Marx (2012a) shows that incorporating profitability measures yields dramatic improvements to the performance of value strategies based on book-to-price.

¹² Of course, any single stock may not be attractive on all criteria; it is the characteristics of the portfolio that we ultimately care about.

⁸ Berger, Israel, and Moskowitz (2009).

⁹ Novy-Marx (2012a, 2012b) and Asness, Frazzini, and Pedersen (2013).

¹⁰ Frazzini, Kabiller, and Pedersen (2012).

Economic Intuition

So why do value, profitability, and momentum deliver superior performance over the market? The justification for their excess returns is grounded in sound and intuitive economic theory and is supported by some of the most robust and studied empirical research in economics, which we describe below.

1. Value: If two firms with similar assets, cash flows, and growth prospects are priced differently, it must be because investors require a higher expected return or discount rate to hold the firm with the lower share price. Firms for which investors require high rates of return are priced lower, and consequently should have higher fundamental-to-market ratios (e.g., book equity-to-price, earnings-to-price, etc.), than firms for which investors require lower returns. Because valuation ratios help identify variation in expected returns, value firms generate higher average returns than growth firms.¹³ While this argument is certainly consistent with risk-based pricing, it works just as well if variation in expected returns is driven by behavioral forces, too.¹⁴ For example, low book-to-price stocks may be on average overpriced (possibly because investors over-extrapolate the growth prospects of these companies), while the opposite is true for high book-to-price stocks. This means that buying value stocks and selling growth stocks can represent a crude (but effective) method for exploiting relative misvaluations across stocks. We believe both explanations have merit (perhaps varying over time in importance) and certainly won't settle here the ongoing academic debate of which explanations matter most.

2. Quality: Similar arguments suggest that highly-profitable firms with productive assets should yield higher average returns than unprofitable firms with less-productive assets. If two firms are priced similarly, but one firm is more profitable than the other, it must be that investors require a higher expected return to hold the more profitable one. Variation in productivity consequently helps identify variation in investors' required rates of return. Because productivity helps identify this variation, with higher profitability indicating higher required rates, profitable firms generate higher average returns than do unprofitable firms. Again, the argument is consistent with both rational, risk-based pricing and behavioral forces. The higher required return for more profitable firms could come from those firms being more exposed to macroeconomic

risks and investors demanding compensation for that risk, or from those firms being mispriced by the market due to behavioral factors such as investors' mis-reaction to information.

3. Momentum: Explaining the performance of momentum strategies follows a similar line of logic, though the most appealing theories relate to behavioral biases, where several basic psychological forces help explain the phenomenon.¹⁵ We remain open to risk-based explanations of course, but these have received less prominence in the literature.

First, slow diffusion of new information may explain why high-momentum stocks have high required returns. For example, investors may be slow to react to new information because different investors (for example, a trader versus a casual investor) receive news from different sources, and react to news over different time horizons and in different ways. In addition, investors may update their views only partially when faced with new information due to anchoring and adjustment (a well-known behavioral phenomenon). There is ample evidence supporting slow-reaction-to-information theories, ranging from market response to earnings and dividend announcements to analysts' reluctance to update their forecasts.¹⁶

Second, investors are prone to what behavioral economists and experimental psychologists call the disposition effect, or the tendency to sell winning investments prematurely to lock in gains, and to hold on to losing investments too long in the hope of breaking even. The disposition effect creates an artificial headwind in markets: when good news is announced, the price of an asset does not immediately rise to fully reflect its value because of premature selling, and when bad news is announced prices fall too slowly because investors are reluctant to sell.¹⁷

Third, investors may be susceptible to "bandwagon" and herding effects, which can result in delayed market over-reaction. Short-term traders may use recent performance as a measure to buy or sell. Longer-term investors look to recent performance to confirm their convictions. The interaction between these two types of investors can create price run-ups

¹⁵ Many of these explanations are based on the Nobel-prize winning work of Daniel Kahneman and Amos Tversky. See, for example, Kahneman and Tversky (1979).

¹⁶ Bernard (1992), Michaely, Thaler, and Womack (1995), and Chan, Jegadeesh, and Lakonishok (1997).

¹⁷ Research in behavioral finance shows a strong tendency for retail investors, and even mutual fund managers, to exhibit the disposition effect. See Odean (1998) and Grinblatt and Han (2005) for retail investors and Frazzini (2006) for fund managers.

¹³ Ball (1978), Berk (1995).

¹⁴ Lakonishok, Shleifer, and Vishny (1994).

Exhibit 1: Composite Style Measures

Measures	Value	Profitability	Momentum
	Book-to-price	Total profits over assets	Prior 1-year return (skipping last month)
	Earnings-to-price	Gross margins	Return around earnings announcements over prior year
	Forecasted earnings-to-price	Free cash flow over assets	
	Cash flow-to-enterprise value		
	Sales-to-enterprise value		

Source: AQR.

(or run-downs) that can persist for many months before they are eventually corrected.¹⁸ Notable extreme examples include the technology bubble of the late 1990s and the energy rally of 2007-2008. As Fama and French (2007) point out, all investors need not have this bias. As long as a subset of investors are biased that don't cancel each other out, betting against them is risky.

While lively debate continues over which of these psychological biases is most responsible for generating momentum (and it may be all three, and perhaps some risk component as well), there is no debate on momentum's existence. Clear evidence, from a range of markets, asset classes, and time periods (most of which are out-of-sample relative to the original findings), supports the argument that momentum is not a random occurrence, and that it is sufficiently strong to survive after accounting for the impact of transaction costs.¹⁹

Likewise, healthy debate over the right explanation for value and profitability persists, but the evidence for these styles is also unquestioned—strong returns exist over a range of markets, asset classes, and time periods, and those returns exceed real-world transaction costs.

Implementing the Styles

To provide empirical evidence of these styles, we create long-only strategies exposed to value, momentum, and quality. These strategies use what we believe are pure measures of each style. In general, our design choices favor simplicity and transparency. However, we emphasize the merits of using multiple measures for each style in generating reliable and stable value, momentum, and quality exposures.²⁰ For example, this procedure mitigates the impact of large,

uninformative changes in any one of the measures, which can arise from measurement error, or from changes in accounting rules or regulations.

1. Value: While stocks selected using the traditional academic measure of value, the ratio of a company's book value to its market price (B/P), perform well in empirical studies, there is no theory that says book-to-price is the best measure for value. Other measures can be used and applied simultaneously to form a more robust and reliable view of a stock's value. For example, investors can look at a variety of other reasonable fundamentals, including earnings, cash flows, and sales. We use five measures for value: book-to-price, earnings-to-price, forecasted earnings-to-price, cash flow-to-enterprise value (an adjusted measure of price), and sales-to-enterprise value.²¹

2. Quality: Similarly, we use multiple quality or profitability measures – total profits over assets, gross margins, and free cash flow over assets – to capture different aspects of a firm's profitability and improve the reliability and performance of the profitability measure relative to using a single measure.²²

3. Momentum: Finally, accounting for multiple momentum measures can also significantly improve the performance and reliability of momentum strategies. While recent stock performance over the past year (specifically, the total return from 12 months ago until a month ago) is a powerful predictor of future stock performance, measures of fundamental momentum and returns around earnings announcements help form more reliable and profitable momentum measures.²³ In our final implementation we use two measures: prior year returns and the average 3-day returns around earnings announcements over the prior year.

²¹ All of our value measures scale a measure of firm fundamentals by a measure of the share price using the most up-to-date market information, which significantly improves the performance of value strategies that are combined with momentum portfolios. See Asness and Frazzini (2011) and Appendix B for details.

²² See Novy-Marx (2012a) and Asness, Frazzini, and Pedersen (2013).

²³ See Chan, Jegadeesh, and Lakonishok (1997) which also documents earnings announcement-based momentum and post-earnings announcements drift.

¹⁸ Although these market corrections can lead to short-term losses for momentum, our research suggests that equity momentum strategies do not have larger or more frequent periods of underperformance than other equity styles (value, growth, and the market).

¹⁹ Frazzini, Israel, and Moskowitz (2012).

²⁰ See Israel and Moskowitz (2013).

Exhibit 1 summarizes the different measures used for each style. While conscious of the perils of data mining, we believe our specific improvements are unlikely to be the result of simply over-fitting or random chance. First, our criteria for value, momentum, and profitability are restricted to well-known and economically-intuitive measures. Second, incorporating multiple measures of momentum, value, and profitability and always taking an average of those measures rather than choosing the “best” measure that worked in-sample helps mitigate these concerns. Third, many of these measures have been thoroughly tested and reviewed in the academic literature. Finally, these measures, which were first tested in U.S. equity data, have subsequently been shown to be effective outside of the U.S., with strong support in global equity data, as well as in other non-equity asset classes, and have been shown to be robust to time periods beyond their original testing period. These findings put them, in our opinion, beyond any reasonable data-mining critique.

Armed with these measures of value, momentum, and profitability, we test the performance of these styles both individually and in combination across three different universes: U.S. large cap, U.S. small cap, and International large cap equities. The universe for U.S. large cap is defined as approximately the top 1,000 stocks in the U.S. by market capitalization. U.S. small cap includes approximately the next 2,000 stocks by market capitalization. Finally, the International large cap universe includes approximately the top 85% of stocks by market capitalization of the twenty global, developed markets excluding the U.S., resulting in approximately 1,000 stocks internationally.²⁴

To build portfolios in a straightforward, transparent way, we rank stocks based on each measure and compute a composite rank by averaging the individual ranks. Within value, momentum, and profitability we average each individual measure. We compute a composite rank by applying a 40% weight to value, 40% to momentum, and 20% to profitability. This weighting scheme reflects the fact that value and momentum have longer histories of proven out-of-sample performance as well as evidence for a wider set of asset classes.²⁵ We then select the top 25% of stocks with the

highest combined ranking and weight the stocks in the resulting portfolio via a 50/50 combination of each stock’s market capitalization and standardized combined rank. We rebalance these portfolios quarterly, which reflects the tradeoff between using the most relevant and up-to-date measures and limiting the turnover and transaction costs of trading. This tradeoff results in higher net returns.²⁶

Our integrated methodology for capturing value, momentum, and profitability combines these strategies at the signal or portfolio level—meaning we also take into account the interactions between value, momentum, and profitability. This approach provides a direct and transparent way of getting exposure to these styles simultaneously and accounts for their interactions, which add significant value. In contrast, a popular approach screens on one style first and then, based on another or multiple measures, determines how much or when to trade. For example, a strategy that first identifies desired stocks with a low price-to-book, may then time the buy or sell decisions of those stocks (or their amounts) based on momentum, using how those stocks have performed in the recent past. Empirically, these types of screens or overlays are an inefficient way to combine themes. In the case of value and momentum, for example, it results in too much exposure to value and not enough exposure to momentum, and it misses out on the significant interactions between the two. For example, by using momentum with value, we are able to distinguish cheap stocks that are becoming expensive versus cheap stocks that are becoming even cheaper, which can improve portfolio performance significantly. In addition, a medium-value stock with great momentum would be ignored using only momentum screens, but would be captured by combining at the portfolio level as we do. **Appendix B** entitled “Momentum Screens” provides further discussion and empirical evidence on the use of screens. We focus on momentum screens to illustrate the inefficiency of using screens, but the same rationale applies to value or profitability screens. As the appendix details, we believe an integrated portfolio-level combination maximizes the diversification benefits and return interactions between all three themes, resulting in a much more efficient portfolio.

Our analysis covers the period 1980-2012 in the U.S. and 1990-2012 internationally. The academic literature using simpler tests has found evidence of these themes much further back. In fact, the original value and momentum studies used data that ended in the 1980s to early 1990s, which is the starting point of our analysis, making, we believe, our tests essentially an out-of-sample exercise from the original studies, which helps alleviate data-mining concerns.

²⁴ The universe of countries include: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Hong Kong, Italy, Israel, Japan, Netherlands, Norway, Portugal, Singapore, Spain, Sweden, Switzerland and United Kingdom. In addition, stocks from all markets (including the U.S.) must meet certain other criteria based on company type (e.g., which excludes REITS, ETFs, closed end funds, LPs, SPACS), liquidity (e.g., minimum liquidity requirement of three month median daily trading volume of at least \$0.1 MM.), exclusion of firms with less than 12 months of public trading, and exclusion of firms announced as a current takeover or merger target.

²⁵ Note as well regarding the weighting scheme, our version of value uses current price as in Asness and Frazzini (2011) and thus is actually somewhat more

value/contrarian than the standard versions that use lagged prices (see Appendix B for a more detailed discussion).

²⁶ Appendix A details the benefits of our approach.

Exhibit 2: Performance of Value, Momentum, Profitability Strategies

	U.S. Large Cap, 1980 - 2012					U.S. Small Cap, 1980 - 2012					International, 1990 - 2012				
	Simple value	Value	Momentum	Profitability	VMP	Simple value	Value	Momentum	Profitability	VMP	Simple value	Value	Momentum	Profitability	VMP
Return	12.6%	16.7%	15.2%	14.7%	17.3%	16.1%	18.8%	17.6%	17.5%	20.7%	8.5%	11.9%	7.7%	8.4%	11.2%
Volatility	17.2%	18.1%	20.6%	16.8%	16.6%	20.2%	21.7%	23.9%	21.5%	19.9%	18.4%	18.7%	17.5%	15.8%	15.7%
Sharpe Ratio	0.45	0.65	0.50	0.58	0.74	0.55	0.64	0.53	0.58	0.79	0.28	0.46	0.25	0.32	0.50
Excess Return	0.6%	4.7%	3.2%	2.7%	5.3%	4.0%	6.8%	5.5%	5.5%	8.6%	2.4%	5.8%	1.6%	2.3%	5.1%
Tracking Error	8.0%	8.4%	10.3%	5.4%	5.8%	8.2%	10.3%	8.7%	5.2%	5.2%	7.4%	7.9%	7.9%	4.7%	7.0%
Information Ratio	0.08	0.56	0.31	0.51	0.91	0.49	0.65	0.63	1.06	1.67	0.32	0.74	0.20	0.49	0.72

Source: AQR. Returns are gross of transaction costs and fees. Performance is hypothetical, and is not based on an actual portfolio or account. See important disclosures relating to hypothetical results at the end of this paper.

Exhibit 2 presents the performance results of simulations of the stand-alone long-only strategies for value, momentum, and profitability, separately. The results are grouped into three panels for U.S. large cap stocks, U.S. small cap stocks, and international equities. For a baseline comparison, we also report in each market the performance results of a simple value strategy that only uses one measure (book-to-price) and weights securities by their market capitalization. In this way, we show in each market how starting from a simple value strategy can be vastly improved and made more consistent by adding multiple measures of value, diversifying beyond pure cap weighting, and then further improved by adding momentum and profitability.

The first three rows of each panel report the average return, volatility, and Sharpe ratio of the raw returns of each strategy. The next three rows report the excess portions of each strategy's returns, which are the mean excess return of each strategy relative to the market (Russell 1000 for U.S. large cap, Russell 2000 for U.S. small cap, and MSCI World Ex U.S. for International large cap), tracking error to the market, and the information ratio of each strategy.²⁷ First, we see that even simple value exposure adds some value over the market. The excess return to simple value over the market among U.S. large caps is 0.6% and the information ratio is 0.08.²⁸ Comparing the first two columns of each panel, we see that using our measure of value that uses multiple valuation ratios improves performance significantly. The excess returns to value jump to 4.7% with a tracking error of 8.4% among U.S. large caps and the information ratio rises to 0.56. Similar improvements are apparent for U.S. small caps and international stocks. Using multiple measures of value also makes a value strategy more consistent and stable, as

²⁷ The information ratio is defined as excess returns divided by tracking error.

²⁸ It may come as a surprise to some that in U.S. large cap, simple cap-weighted book-to-price value, delivers only small, positive outperformance, but this is consistent with other data studies (see Israel and Moskowitz 2013) and underscores the need for more themes, more diversified measures and a slightly more aggressive weighting scheme than cap weighting.

evidenced by the more consistent information ratios across the large cap, small cap, and international universes compared to the far less stable returns for the simple value strategy. Momentum and profitability also each generate significant excess returns over the market. In U.S. large cap, the excess returns are 3.2% and 2.7% per year for momentum and profitability, respectively. Tracking errors are 10.3% and 5.4% per year, and information ratios are 0.31 and 0.51, respectively.

For U.S. small cap we see even bigger excess returns for value, momentum, and profitability that range from 5.5% to 6.8% per year and even larger information ratios that range from 0.63 to 1.06. The international evidence in the last panel also confirms the existence of excess positive returns to each strategy and significantly positive information ratios. Hence, across all three universes—U.S. large and small cap and international equities—there is substantial and consistent evidence of excess returns to each of value, momentum, and profitability. Moreover, across all three markets, the excess returns generated from these three themes dominate those from a simple value tilt.

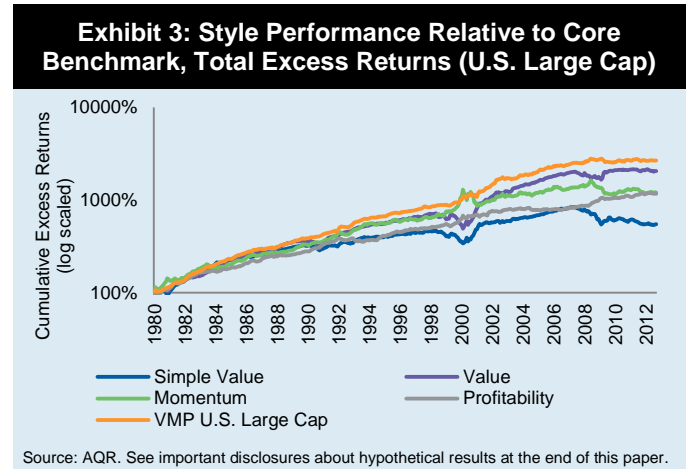
While each style meaningfully outperforms its benchmark in every market, the most impressive results come when we combine these individual styles into an integrated portfolio, which we label VMP (Value, Momentum and Profitability). The highlighted fifth column in each panel of Exhibit 2 presents the performance results of long-only strategies that integrate value, momentum, and profitability styles into one combined portfolio. As the exhibit highlights, the VMP portfolio produces even better performance, consistently providing higher returns, at lower volatility and tracking error, and therefore generating much higher Sharpe ratios and information ratios. The magnitudes of the differences are impressive. In addition to comparing to core benchmarks, compared to a simple value strategy, the combined VMP portfolio offers substantially higher returns at similar (or even

lower) risk and tracking error. For instance, among U.S. large cap stocks, a simple value strategy offers a 0.6% excess return above the market with 8.0% tracking error, while the VMP strategy yields a 5.3% excess return at a lower tracking error. Hence, for less risk, a simple-value investor could potentially improve his/her returns by almost 5% per year using VMP instead. The information ratio for the investor would jump from 0.08 to 0.91. Similar-sized improvements are found for small cap and international equities as well.

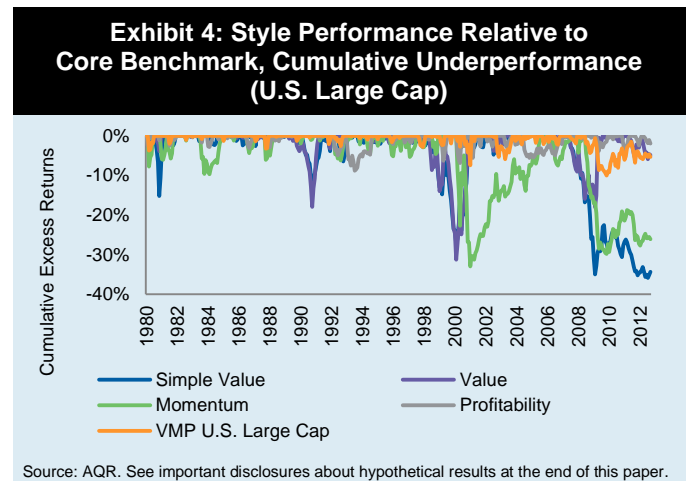
Furthermore, note that the excess returns to the combined portfolio are generally higher than any of the individual styles (with the exception of value in international markets, though that is entirely driven by the extreme performance of value in Japan over this sample period).²⁹ Thus, “the whole is greater than the sum of its parts.” This may seem strange or “too good to be true.” Shouldn’t the combined portfolio just be a weighted average of the individual styles? The answer is no, and the reason is that we don’t combine individual portfolios. Instead, we build a single portfolio that blends value, momentum, and profitability at the stock level. This approach takes into account important interactions between the measures, such as a value stock that is beginning to exhibit momentum and has high profitability versus a value stock that has mild or negative momentum and low profitability. As Exhibit 2 shows, this matters significantly and can add as much as 1-2% per year above the simple averaging of these strategies. However, the extra return and higher information ratio to a combined VMP portfolio are only part of the story. In addition, a combination of value, momentum, and profitability may reduce extreme downside market-relative risk substantially.

Exhibit 3 compares the historical performance of U.S. large cap simple value, our composite value, momentum, profitability, and the VMP strategy relative to the core benchmark. As the graph shows, the VMP strategy outperforms both the core benchmark and each of the individual strategies. In addition, the VMP portfolio also significantly reduces and effectively eliminates the extreme negative returns that occasionally plague a simple value strategy. Take the technology “bubble” episode, for instance, of the late 1990s and early 2000s when simple value did extremely poorly. A value, momentum, and profitability combination would have not only offset this downturn, but also offered positive excess returns during this period.

²⁹ Asness (2011).



Or, take a more recent example during the 2008 financial crisis, where the same diversification benefits from combining all three themes would have produced positive, rather than extreme negative, excess returns.



Looking more closely at downside risk, Exhibit 4 plots the cumulative underperformance of U.S. large cap simple value, our composite value, momentum, profitability, and the VMP strategy relative to the core benchmark. As the figure highlights, the integrated VMP strategy has less frequent and smaller periods of underperforming the benchmark, compared to value alone. Hence, in addition to offering higher returns, the VMP combination is able to offer lower risk and significantly better downside protection. For a simple-value investor whose memory of these episodes is likely still painful, the relatively lower magnitude of periods of underperformance of the VMP strategy compared to value could have been welcome relief.

Exhibit 5: Performance of Integrated Value, Momentum, and Profitability (VMP) Strategies

	U.S. Large Cap, 1980 - 2012 VMP	U.S. Small Cap, 1980 - 2012 VMP	International, 1990 - 2012 VMP
Return	17.3%	20.7%	11.2%
Volatility	16.6%	19.9%	15.7%
Sharpe Ratio	0.74	0.79	0.50
Excess Return	5.3%	8.6%	5.1%
Tracking Error	5.8%	5.2%	7.0%
Information Ratio	0.91	1.67	0.72
Net Returns	15.6%	18.3%	10.3%
Net Sharpe Ratio	0.64	0.67	0.44
Total Trading Costs	1.7%	2.4%	0.9%
Turnover (1-sided)	136%	102%	125%
Beta	1.0	1.0	0.8
Worst Cumulative Underperformance	-11%	-13%	-17%
% of Rolling 3-year Underperformance	4.7%	4.7%	13.2%
% of Rolling 5-year Underperformance	0.0%	0.0%	2.9%
% of Rolling 10-year Underperformance	0.0%	0.0%	0.0%

Source: AQR. Net returns are after estimated transaction costs but gross of fees. Performance is hypothetical and is not based on an actual portfolio or account. See important disclosures relating to hypothetical results at the end of this paper.

This reduced risk from combining styles is the product of the correlation structure of the different themes. Because these strategies perform particularly well when value performs poorly, integrating momentum and profitability provides an additional, powerful hedge to value.

Exhibit 5 reports more summary statistics on the VMP combined portfolio that summarizes its two key attributes. The first six rows highlight the additional performance the VMP combination provides by repeating the basic performance statistics from **Exhibit 2** for the VMP portfolios.

The next three rows of **Exhibit 5** report a measure of the *net* returns to each strategy by subtracting a measure of trading costs based on the turnover of each strategy and an estimate of trading costs for each stock. We use a very conservative estimate of trading costs here that typically overstates costs. Live trading data and costs typically yield much lower estimates for these strategies as shown in Frazzini, Israel, and Moskowitz (2013). Trading costs reduce returns by at most 2.4% (for small cap), leaving plenty of net excess positive returns across all markets.

The next six rows then add statistics on the turnover, betas, and the worst cumulative underperformance of the strategies as well as measures of the frequency of market underperformance of the portfolio over three-, five-, and 10-year horizons. The volatility and frequency of underperformance of the integrated portfolio are quite low and substantially reduced relative to the individual styles. Hence, another important feature of the combined VMP portfolio—that risks and extreme risks are significantly

reduced—is a consequence of the important interactions among the styles and their offsetting risks when combined into one investment strategy.

To understand why the integrated portfolio performs so well, and why risks are significantly reduced relative to simple tilts toward one theme only (e.g., simple value), we can look closer at the interaction of the three styles. **Exhibit 6** shows the correlations of the strategies' excess returns (relative to the market), where value and momentum are negatively correlated (ranging from -0.09 to -0.56), value and profitability are less negatively correlated (ranging from -0.39 to 0.14), and momentum and profitability are positively correlated (ranging from 0.45 to 0.18).³⁰

Exhibit 6: Correlation of Monthly Excess Returns of Value, Momentum, and Profitability Strategies

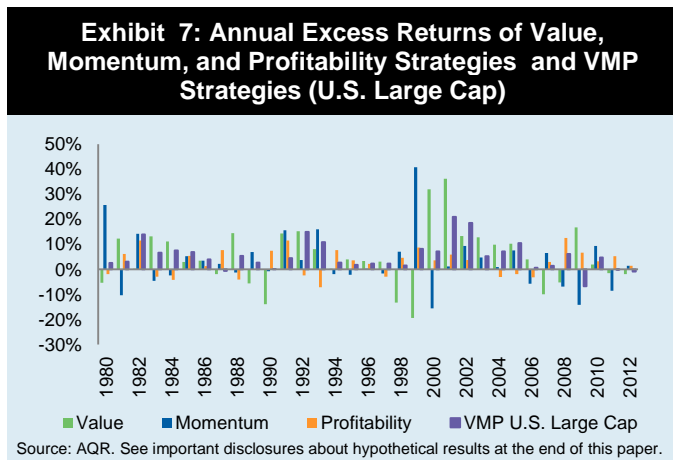
	U.S. Large Cap		U.S. Small Cap		International	
	Momentum	Profitability	Momentum	Profitability	Momentum	Profitability
Value	-0.48	-0.39	-0.56	0.14	-0.09	-0.16
Momentum		0.38		0.18		0.45

Source: AQR. See important disclosures about hypothetical results at the end of this paper.

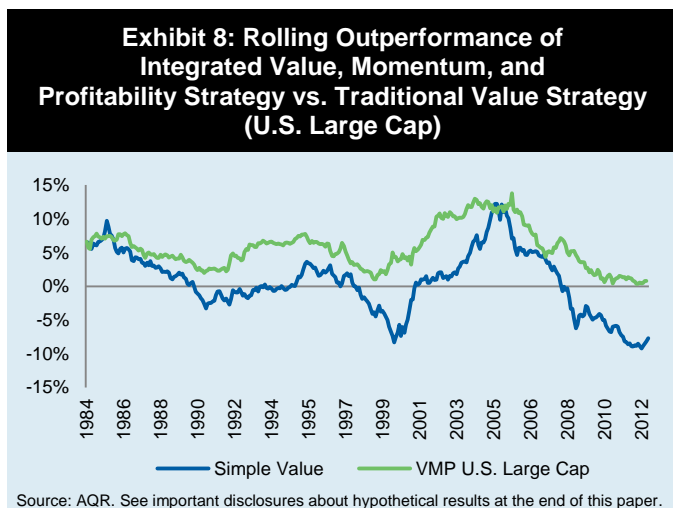
Because momentum and value are negatively correlated, value and profitability exhibit low correlation to each other, and momentum and profitability are less than 0.5 correlated, their idiosyncratic movements have the ability to offset and reduce overall risk. Since each strategy generates large excess returns on its own, using these styles in combination has the ability to improve returns while simultaneously reducing risk

³⁰ Note that some of the relatively lower (negative) correlation between value and momentum in our international sample is due to the fact that we are allowing country over-weights and under-weights. Keeping the portfolio country neutral relative to the core benchmark increases the magnitude of the negative correlation.

significantly. The extent to which the different styles act as a hedge and provide insurance for each other can be seen in **Exhibit 7**, which plots each style's annual return in excess of the market. The occasional underperformance of any one style is mitigated, and often eliminated, by the other two. Hence, combining all three themes into one portfolio, VMP, which is also plotted in the figure, results in a more stable stream of positive returns.



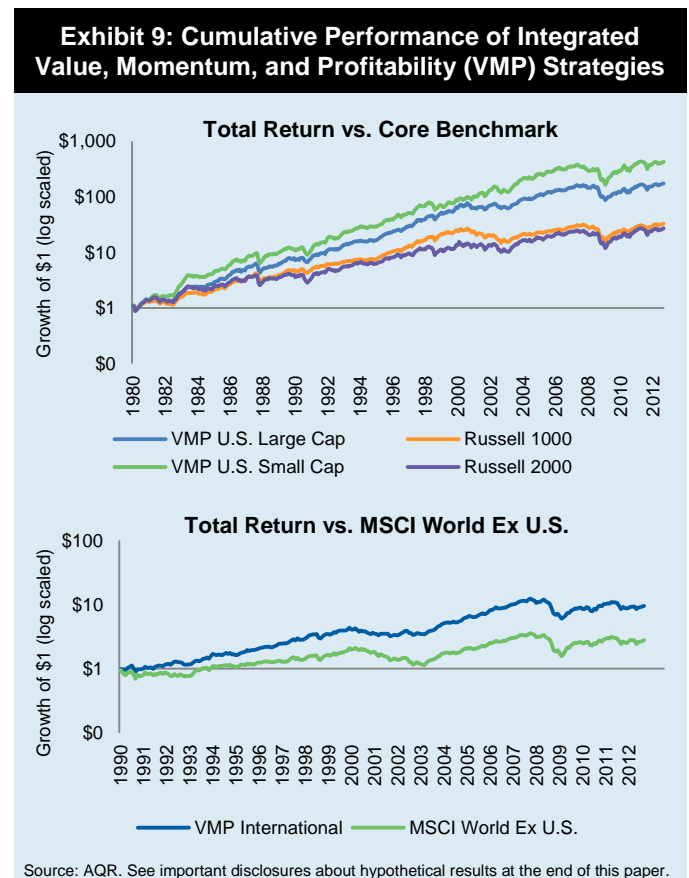
The diversification benefits of combining momentum and profitability with value are even more evident over longer investment horizons. **Exhibit 8** shows the 5-year annualized rolling excess returns of the integrated VMP portfolio over the market portfolio compared to the excess returns of a simple value portfolio. For brevity, we show results for U.S. large cap only, but the results for U.S. small cap and international are similar. The graph shows that an integrated portfolio of value, momentum, and profitability increases performance over every five year period relative to its core benchmark and by a much wider margin than a simple value portfolio alone.



Moreover, a simple value portfolio experiences significant 5-year periods of underperformance, while the VMP portfolio effectively eliminates any such episodes, outperforming the market in every 5-year period historically.

Summarizing all of these results, **Exhibit 9** plots the growth of \$1 invested in the integrated VMP portfolio relative to the market portfolio in each universe. The exhibit shows that a combined portfolio delivering simultaneous exposure to value, momentum, and profitability significantly outperforms a passive investment in the corresponding core benchmark and also hedges the extreme downturns that occasionally plague the traditional core benchmark.

For deeper insight into the value-added from our specific portfolio design choices, **Appendix A** shows the incremental value added going from a simple value-tilted portfolio to using multiple measures of value, combining with momentum, and combining with profitability. In addition, the incremental value added from various portfolio construction choices are shown, which we discuss in a later section. The cumulative sum of these improvements produces a portfolio with a far better risk-reward tradeoff and significantly reduced downside risk.



Appendix C also highlights the exposure of the VMP portfolio to commonly used factors in the academic literature (e.g., Fama and French (1996, 2008, 2012)) for those inclined to sort through the details. The punch-line is that the VMP portfolio achieved simultaneous positive exposure to all of the factors and excess returns above the Fama and French factors. The alphas are remarkable given the fact that we are evaluating a long-only portfolio composed of tradable stocks (VMP) against long/short benchmarks comprised of all stocks in the universe (Fama and French factors).

Misconceptions

While value, momentum, and profitability are robust, powerful styles, implementing strategies that reap their maximal benefits while controlling costs and managing risks requires judgment and expertise.

Momentum strategies have higher turnover than other passive indices (e.g., value and growth), so tax and trading costs are especially important considerations. Both value and momentum occasionally experience periods of underperformance, making it especially important to try to maximize their natural negative correlations. Potential pitfalls associated with these issues can be avoided, or at least strongly mitigated, but doing so requires skillful portfolio construction and cost-effective execution.

There is a myth, widely believed in academia, which holds that the costs associated with trading on momentum are prohibitively high.³¹ However, these claims were made based on models and aggregated trade and quote data that grossly overestimated these costs. Frazzini, Israel, and Moskowitz (2012) using live trading data and real trading costs from executed trades show that actual trading costs for these strategies are less than one tenth as large as previously estimated and hence not even close to being prohibitively expensive for trading momentum. The same misconception was once also held for small cap strategies. Academic studies claiming small caps were too costly to trade were also subsequently proven to be false from live trading data.³² Trading costs are important, but can be managed through transaction costs optimization and improved trading systems (e.g., decimalization and direct market access trading). Another misconception is that high turnover results in high taxes. Momentum strategies provide a counterexample. While

turnover for momentum can be high, the nature of turnover for a momentum strategy can generate tax advantages rather than disadvantages because momentum strategies tend to keep winners and sell losers, usually generating long-term gains and short-term losses, which is very efficient from a tax perspective. In fact, the tax rates, which we will present below, incurred on well-designed momentum strategies are about as low as those incurred on much lower turnover strategies like value.³³

Another fallacy regarding momentum is that it requires shorting to work. This is partly due to the myth that momentum is stronger among losers. In reality, the returns from positive and negative momentum have similar magnitudes. This enables long-only investors to capture momentum returns by buying winners, just as long-only investors can capture the value premium by buying stocks with low valuations.³⁴

Yet another common misconception is that value, quality, and momentum styles are driven completely by small cap stocks. In fact, momentum and value strategies have worked historically in virtually every asset class, and value and momentum combinations can be even more powerful in many markets.³⁵ Adding profitability to value is especially beneficial among the largest stocks.³⁶

While concerns regarding implementation of the strategies (especially momentum) are not unreasonable, they are generally ultimately untrue. Historical performance of value, momentum, and profitability has been strong enough to survive implementation costs. Additionally, craftsmanship and skillful implementation can add significant value by reducing these costs and increasing returns.

Benefits of Integration

Our basic strategy design, which trades value, momentum, and profitability in an integrated manner, yields multiple benefits. First, obtaining the styles by explicitly weighting the measures used in the stock selection procedure provides us with a level of control over our exposures to each style that we think is superior to other approaches such as screens or using independent measures. Because we do not require that a stock look extraordinarily good on any one dimension, as a “screening” process does, we can buy stocks that look good on

³¹ See, for example, Lesmond, Schill, and Zhou (2003) or Korajczyk and Sadka (2004).

³² See Keim (1999).

³³ Israel and Moskowitz (2012).

³⁴ Israel, and Moskowitz (2012), Fama and French (2012).

³⁵ Asness, Moskowitz and Pedersen (2012) and Israel and Moskowitz (2012).

³⁶ Novy-Marx (2012a).

multiple dimensions, increasing both the size and reliability of the exposures that we can get on every dimension. (See Appendices B and C for further evidence.)

This allows us to translate the higher risk-adjusted returns into higher actual returns, and not just lower risk. Strategies that manage these styles independently and then combine separate styles by averaging them into one portfolio do not achieve the same level of exposure.³⁷ The integrated framework is also more cost efficient. While well-designed value, momentum, and profitability strategies already survive transaction costs and taxes on their own,³⁸ integrating the strategies at the style level yields a significant reduction in turnover. Since the styles are negatively correlated, the value measure frequently suggests buying (or selling) a stock at the same time that the momentum measure suggests selling (or buying) or the profitability measure suggests selling (or buying). In an integrated strategy, these offsetting positions net out, reducing turnover and therefore trading costs relative to a combination of independent value, momentum, and profitability styles.

While multiple aspects of our design reduce turnover, maintaining optimal exposures still entails a moderate level of trading activity. When portfolios are built, they take into account forecasted trading costs, and are traded in an efficient and patient manner that simultaneously minimizes transaction costs without having to take unwanted tracking error relative to the benchmark. In order to minimize the associated costs, we execute these trades using our own automated trading algorithms. These algorithms were designed, using the experience we have developed while executing nearly a trillion dollars' worth of live trades over the last decade, to provide rather than demand liquidity. This procedure dramatically reduces transaction costs. In fact, over our history we have realized transaction costs, even accounting for implementation shortfalls, which average about one-tenth of typical academic estimates of trading costs.³⁹

For the taxable investor, we can also further improve the performance realized by investors through tax optimization, efficiently delaying the recognition of gains and actively realizing short term losses, and again do it more efficiently in one integrated portfolio.⁴⁰

³⁷ Thus, running the integrated strategy at higher tracking errors is another added benefit that can be extraordinarily valuable to investors. For example, at higher tracking error an investor essentially pays lower fees per unit of style exposure and per unit of excess returns they expect to receive.

³⁸ Israel and Moskowitz (2012) and Frazzini, Israel, and Moskowitz (2012).

³⁹ Frazzini, Israel, and Moskowitz (2012) discuss trading costs in value, momentum, and other equity strategies.

⁴⁰ Israel and Moskowitz (2012).

Exhibit 10 shows the impact of both trading costs and taxes on the net excess returns delivered by the VMP strategies when optimized for trading costs and taxes, and compares them to single stand-alone tilts toward each of the themes by themselves. As indicated, there are substantial interaction effects from combining all three themes into one portfolio that can reduce both turnover and tax exposures, providing even better net-of-trading-cost and after-tax returns to investors. As the table shows, the returns to an integrated value, momentum, and profitability strategy remain large even after trading costs and taxes are taken into account, outperforming both the core benchmark as well as a portfolio based on simple value on an after-tax basis.⁴¹

Exhibit 10: Effects of Trading Costs and Taxes For Value, Momentum, and Profitability (VMP) Strategies

	Excess Returns				
	Gross	After Trading Costs	After Trading Costs and Taxes	Turn-over (1-sided)	Effective Tax Rate
U.S. Large Cap, 1980-2012	4.1%	3.6%	2.1%	64%	9.5%
U.S. Small Cap, 1980-2012	6.7%	6.0%	3.9%	54%	11.4%
International, 1990-2012	4.6%	4.1%	3.1%	70%	10.0%

Source: AQR. See important disclosures about hypothetical results at the end of this paper.

Conclusion

Value, momentum, and profitability have each provided a better risk/reward tradeoff than the market, yet these sources of significant long-run returns have remained largely inaccessible to most investors.

Our integrated approach using all three themes yields a diversified, fully invested, long-only portfolio of individual stocks with well-constructed exposures to value, momentum, and profitability, which provide excess returns that are both larger and cleaner than those that can be achieved by pursuing the styles separately, or by using investment screens. Our experience and proprietary algorithmic trading helps control costs and manage risks. The resulting portfolios exhibit risk-return profiles superior to those of traditional core strategies and yet provide the equity risk exposure most investors desire for their core holdings. We believe a core strategy combining value, momentum, and profitability will reward investors in the long-term better than passive equity indices and other existing core strategies (that are often too narrow for their

⁴¹ Israel and Moskowitz (2012) and Frazzini, Israel, and Moskowitz (2012). See Israel and Moskowitz (2012) for a discussion of effective tax rate computations.

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investors' own good), providing a new source of higher positive returns at the same or lower risk.

We hope this helps the multitude of investors that currently lack a well-structured, transparent way to obtain exposures to value, momentum, and profitability. Investors could benefit greatly by reducing their over-reliance on the market to drive long term performance, and instead move toward a new core investment strategy that reaps the benefits available from value, momentum, and profitability.

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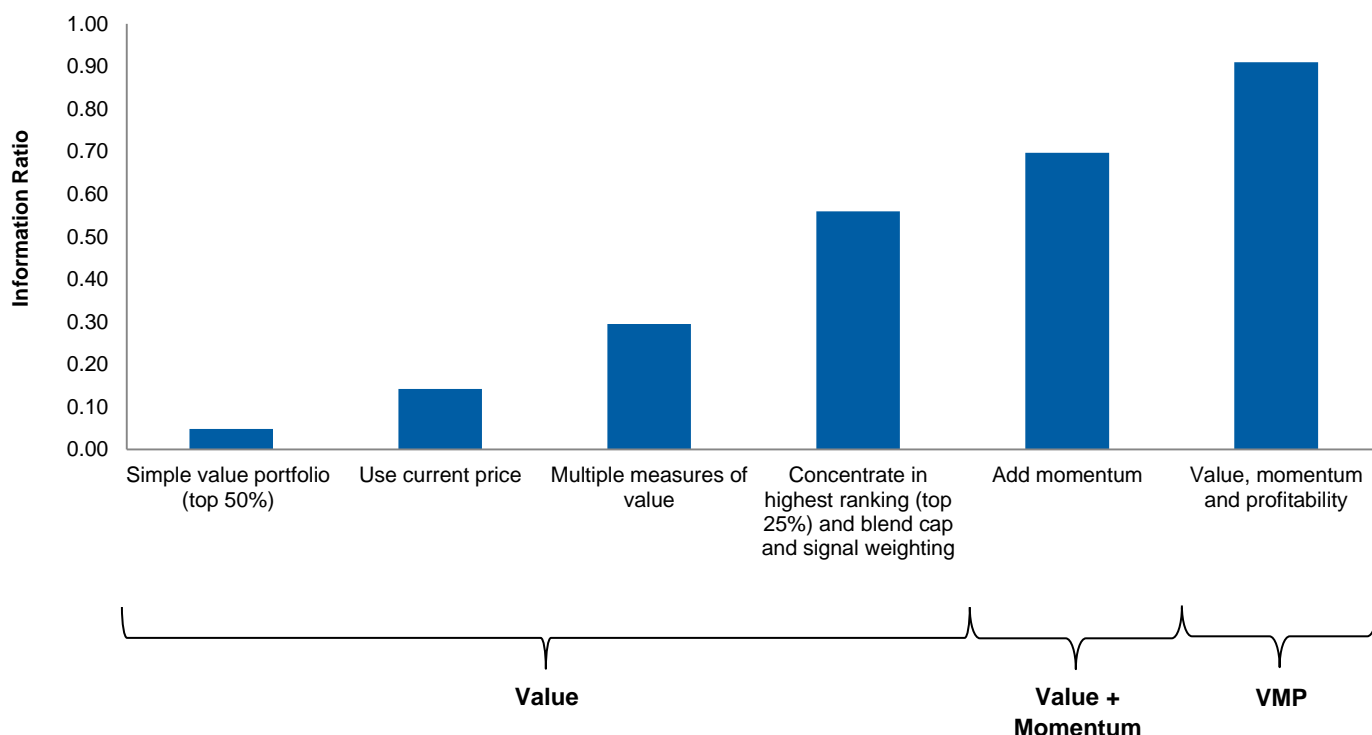
Appendix A: Impact of Specific Design Choices

Each choice we make when implementing the combined VMP strategy is designed to improve the portfolio’s performance. In this section we start with a simple value portfolio and show the value added from individual improvements in portfolio construction as well as from adding exposure to momentum and profitability. We focus on U.S. large cap for brevity, but the results for U.S. small cap and international are analogous.⁴¹

Exhibit A1 shows the marginal gains each individual improvement yields over a simple value strategy.

Exhibit A1: Impact of Specific Design Choices					
Portfolio	Description	Excess Return	Tracking Error	Information Ratio	Worst Rolling 5-year Underperformance
(1)	Simple value portfolio (top 50%)	0.3%	5.3%	0.05	-47.3%
(2)	(1) + use current price	0.8%	5.9%	0.14	-34.1%
(3)	(2) + use multiple measures of value	1.7%	5.8%	0.29	-18.3%
(4)	(3) + concentrate (top 25%) and blend of cap-signal weighting	4.7%	8.4%	0.56	-11.1%
(5)	(4) + add momentum	4.4%	6.3%	0.70	-18.3%
(6) - VMP	(5) + add momentum and profitability	5.3%	5.8%	0.91	0.0%

Source: AQR. See important disclosures about hypothetical results at the end of this paper.



Our starting point is portfolio (1), based on book-to-price, and with price lagged between 6 to 18 months as in Fama and French (1996, 2008, and 2012). Every quarter we rank stocks based on book-to-price, take the top 50% of stocks with the highest book-to-price and weight the stocks in the resulting portfolio by their market capitalization. All portfolios are rebalanced quarterly.

Portfolio (2) replaces the 6 to 18 month lagged price in portfolio (1) with the current price as in Asness and Frazzini (2011), thus computing valuation ratios that use more updated information.

⁴¹ Note that the “simple value” portfolio in Exhibit A1 is based on the top 50% of stocks with the highest book-to-price while the exhibits in the main text use the top 25% of stocks. In Exhibit A1 we start with the top 50% to demonstrate the benefits of concentrating and using a more aggressive weighting scheme in portfolio (4).

In portfolio (3) we replace book-to-price with our composite value measure, using a full set of valuation ratios.

In portfolio (4) we increase the portfolio exposure to stocks with the high composite rank by weighting the stocks in the resulting portfolio via a 50/50 combination of each stock's market capitalization and standardized combined rank.

Finally in portfolios (5) and (6) we add the momentum and profitability composites. These portfolios are composites of multiple measures and are constructed as described in the paper by taking the top 25% of the composite rank (with a 50-50 blending of signal and capitalization weights). Portfolio (5) adds momentum to a weight of 50%, and portfolio (6) (which is our VMP composite) adds the profitability composite, which is a 40-40-20% weighting on value, momentum, and profitability, respectively.

Results in Exhibit A1 show a clear pattern: using composite measures, increasing exposure to and increasing the weight in stocks with a high composite ranking, and most of all, combining value exposure with momentum and profitability all show significant performance improvements. Sharpe ratios and information ratios all rise monotonically from left to right as we add layers in the portfolio construction. The benefits to investors are significant: for example moving from a simple cap-weighted value portfolio to a full value composite raises the information ratio from 0.05 to 0.56. Adding momentum and the combination of momentum and profitability produces large further improvements, bringing the overall information ratio to 0.70 and 0.91, respectively.

Appendix B: Momentum Screens

In this section we provide some evidence that using screens is an inefficient way to get exposure to momentum. We focus on price momentum but an analogous analysis can be performed on profitability screens or on multiple screens on value and profitability.

Exhibit B1: Performance of Momentum Screens, 1980 – 2012

Portfolio	Description	Return	Volatility	Sharpe Ratio	Excess Return	Tracking Error	Info. Ratio	Turnover (1-sided)	HML Loading	UMD Loading
(1)	Simple value portfolio (top 25%)	12.5%	17.2%	0.44	0.6%	8.0%	0.07	63%	0.65	-0.10
(2)	(1) + momentum screen	12.8%	16.8%	0.47	0.9%	7.1%	0.12	58%	0.61	0.05
(3)	(1) + current price + some momentum	13.1%	16.8%	0.49	1.2%	7.1%	0.17	56%	0.65	0.06
(4)	(1) + current price + momentum	14.2%	16.8%	0.56	2.3%	6.1%	0.38	57%	0.31	0.25

Source: AQR. See important disclosures about hypothetical results at the end of this paper.

There are two forms of momentum screens that are commonly used by practitioners. One is using lagged prices when forming a valuation measure by aligning prices and book at fiscal year-end as in Fama and French (1992). While the original intent was to match the information on book values from accounting statements (typically available with a six month lag) with market values, this choice of lagging prices also provides some indirect exposure to momentum, since the strategy avoids underweighting recent winners and overweighting recent losers when it ignores the price changes of stocks over the last six to 18 months. The second form of momentum screening is more direct and involves selecting value stocks first and then using momentum to time buy or sell decisions. While we believe both of these methods are helpful versus ignoring momentum, they provide inefficient forms of momentum exposure and therefore inefficient diversification benefits from combining value with momentum. A more efficient approach is the integration of separate value and momentum measures that we advocate.

First, using lagged prices makes the value measure in a valuation ratio less accurate since a stock is really only cheap if you can buy it at a good price *today*, not if you could have bought it at a good price a year (or more) ago. The economic logic for valuation ratios simply makes more sense when the ratios are calculated using current prices. Using lagged prices throws away all of the useful information contained in the current price. Therefore, strategies that trade value based on current price in conjunction with momentum significantly outperform strategies that trade value based on lagged prices in conjunction with momentum.⁴² The joint strategies that employ current prices obtain a cleaner exposure to value, because value is measured more accurately, and they achieve a cleaner exposure to momentum, because they get this exposure directly from momentum, not using a crude screen. Because the exposures to both sources of excess returns are cleaner, they tend to perform better and can be managed better to more easily capture desired exposure to both value and momentum, as well as more efficient risk, tax, and trading cost management.

Similarly, selecting value stocks first and then applying a trade timing decision based on momentum (another form of momentum screening) is also suboptimal. To show this empirically we create a simulated return series that applies a simple, intuitive momentum screen (and in combination with value measures that use both current and lagged prices).

For brevity we focus the analysis on U.S. large cap only (results for U.S. small cap and international are similar). Also to avoid confounding effects, we start with a simple measure of value (book-to-lagged-price, portfolio (1) in Exhibit A1) and consider a portfolio that adds simple price momentum to it.

We start by creating a value portfolio that selects the top quartile of stocks in the universe with the highest book-to-price ratios. We restrict ourselves to a single value measure for simplicity (and subsequently do the same for momentum). We then categorize sells and buys into securities with high/low momentum, defined as stocks ranking in the top/bottom quartiles of the universe based on momentum scores (past 12-month return excluding the most recent month). We delay selling stocks with high momentum in order of

⁴² Asness and Frazzini (2011).

descending momentum rank and do the same for delayed buying of stocks with low momentum, until the total delayed sells match the total delayed buys by dollar amount. We then trade the remaining (non-delayed) securities as a value strategy.

In the table above we present results for various simulations to test out how effective the screens are. In the first column we show the performance of a simple value measure (book-to-price) using a lagged price. In the second column, we combine that simple value measure with a momentum screen that times trades as described above. In the third column, we present the results of an integrated combination of simple value using up-to-date price and price momentum as we described in the main body of the paper, setting the weight on momentum to be 25% (and value to be 75%) such that the resulting loading on UMD is equal to the loading obtained from the “momentum screen” presented in row (2), constraining the turnover such that the realized turnover is about the same as that presented in row (2). Comparing rows (2) and (3), the integrated approach with current price achieves higher returns, a higher Sharpe ratio, and a higher information ratio, and because we are equating turnover, the assumed transaction costs for both should be about the same. In row (4), we show what would happen if we used a 50/50 weighting between value and momentum, and again keep the turnover constant for comparison across strategies. Moving from row (3) to row (4), the returns continue to go up by almost a full percent and the information ratio more than doubles.

To summarize, the data supports the notion that injecting some momentum into a value portfolio by either lagging the price used in constructing value or by using a buy/sell timing screen, while improving the portfolio, is somewhat, but only marginally helpful, and leads to an inefficient and suboptimal amount of exposure to momentum. An investor desiring momentum in his portfolio for better returns and lower risk would be better served by using a value measure using current prices, and combining it with a separate momentum measure in an integrated fashion, where the weight on both value and momentum is roughly equal. That integrated combination maximizes the diversification benefits between value and momentum, generating the most efficient performance.

Appendix C: Academic (Fama and French) Factor Exposures

In this section we examine the exposure of simple value and the VMP portfolio to commonly used factors in the academic literature (e.g., Fama and French (1996, 2008, 2012)). We show t-statistics below the coefficient estimates. The VMP portfolio achieves simultaneous positive exposure to all of the factors. Furthermore, it delivers consistently positive (in all three samples) and significant (in two out of three samples) alphas or excess return above the Fama and French factors. The alphas are remarkable given the fact we are evaluating a long-only portfolio composed of tradable stocks (VMP) against long/short benchmarks comprised of all stocks in the universe (SMB, HML, and UMD). In general, since we are comparing long-only portfolios on a restricted universe to their long/short, unconstrained counterparts on a broader universe, one would expect negative alphas. Note that in Exhibit C1, HML is constructed using lagged prices which itself is a combination of a “pure” HML constructed using current prices and UMD (see Asness and Frazzini (2011)). Consistent with Asness and Frazzini (2011) using HML constructed from current prices tends to raise the UMD loadings and lower the alphas in Exhibit C1.

Exhibit C1: Factor Exposures of Simple Value and VMP Portfolios

	<u>U.S. Large Cap, 1980 - 2012</u>		<u>U.S. Small Cap, 1980 - 2012</u>		<u>International, 1990 - 2012</u>	
	<u>Simple value</u>	<u>VMP</u>	<u>Simple value</u>	<u>VMP</u>	<u>Simple value</u>	<u>VMP</u>
Alpha	-1.38% (-1.75)	2.68% (3.64)	1.06% (1.21)	5.56% (6.07)	0.65% (0.48)	1.78% (1.51)
MKT	1.07 (71.3)	1.04 (74.3)	1.05 (63.1)	1.04 (59.8)	0.91 (41.1)	0.87 (44.8)
SMB	0.02 (0.8)	0.12 (5.9)	0.81 (33.6)	0.83 (32.9)	-0.16 (-3.30)	-0.11 (-2.48)
HML	0.65 (28.2)	0.22 (10.1)	0.75 (29.6)	0.42 (15.7)	0.63 (11.2)	0.45 (9.3)
UMD	-0.10 (-7.52)	0.20 (15.4)	-0.18 (-11.70)	0.01 (0.8)	-0.16 (-5.37)	0.20 (7.6)
R2	94%	94%	94%	94%	89%	89%

Source: AQR. See important disclosures about hypothetical results at the end of this paper.

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