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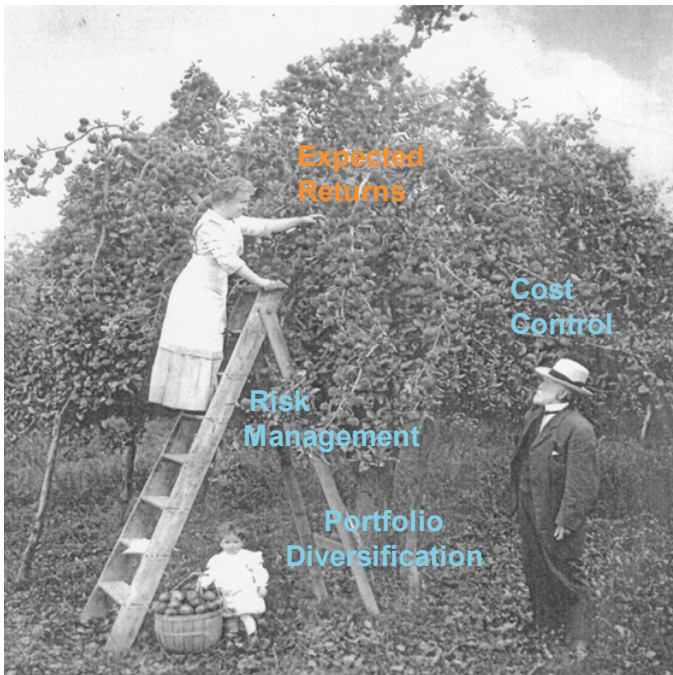
AQR Capital Management (Europe) LLP

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Alpha Beyond Expected Returns



Source: Penrose, Colorado Chamber of Commerce. <http://www.penrosechamber.com/LocalInformation/History.aspx>

Executive Summary

Many institutional investors focus primarily on one source of alpha: expected returns, perhaps relative to a benchmark. There are many drawbacks to this approach, including manager search costs, limited performance persistence, and (potentially) high fees. We argue that “alpha” can be more reliably captured in virtually every other stage of the investment process. In this article, we suggest seven sources of value-added beyond the traditional view of “alpha”, grouped under three themes:

1. **Portfolio Construction** – diversification, that “only free lunch,” can be applied in aggressive and innovative ways
2. **Risk Management** – practices that generate a smoother ride enable investors to stick to their game plan in bad times
3. **Cost Control** – cost-effective execution and fair fees gain importance in a world of low expected returns

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Please read important disclosures at the end of this paper.

Introduction

Investors spend much of their time on selecting active investments or active managers, which is ultimately a zero-sum game (at best). While doing so, they underutilize diversification, risk management and effective implementation. We call these less glamorous activities collectively as sources of “alpha beyond expected returns” where alpha is loosely defined as improved risk-adjusted returns. In today’s low-rate environment, it is even more important that investors do not let any source of alpha go to waste.

If investing were compared to apple harvesting, the picture on the cover page illustrates the classic mistakes made when reaching for the top while missing the low-hanging fruit. Look at the poor quality of diversification – all apples in one basket. What should we say about risk management when the poor girl is standing under the ladder? And cost control is hardly impressive when we see one overseer and one active worker. **Do not let your investment process be like this harvesting effort!**

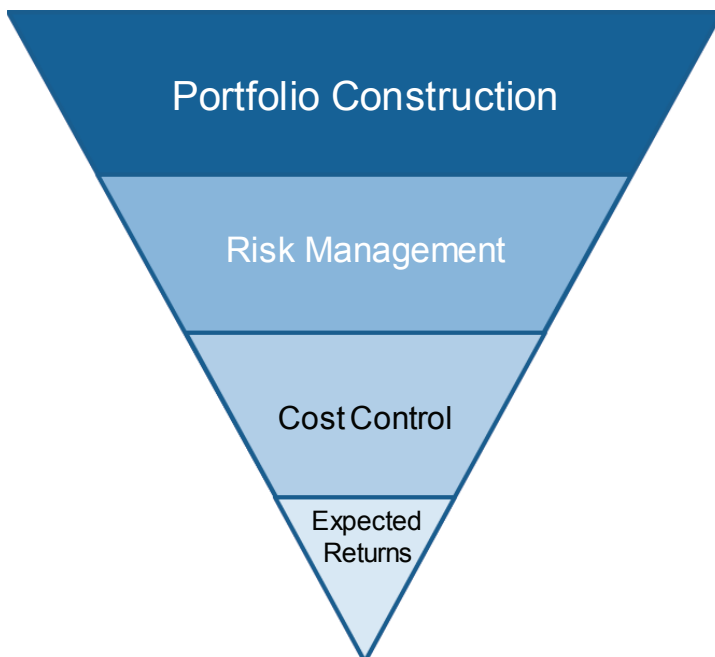
More seriously, investors should strive to create value-added in every step of the investment process: expected return generation, portfolio construction, risk management, and cost-effective execution. In this article, we list eight key sources of alpha in the investment process. The underlying ideas are general but the examples are based on simulations related to actual investment

products (naturally, if we believe in these ideas so much that we recommend them to others, we also apply them ourselves).

In many examples that follow, we associate alpha with improvement in Sharpe ratios (volatility-adjusted excess returns over cash). Some investors stress that they cannot consume risk-adjusted returns; we counter that the risk reduction benefits can be capitalized (converted into higher expected returns) through careful use of leverage. In fact, not using leverage may force most investors to accept another form of risk – concentration risk. We elaborate on this point in Concluding Thoughts.

To visually highlight the importance of alpha sources beyond expected returns, the next chart flips a pyramid on its head. The chart shows eight sources of alpha grouped under four themes: Portfolio Construction (1-3); Risk Management (4-6); Cost Control (7); and Expected Returns (8). That is, only the last source directly involves expected returns.

Key sources of alpha



- and how to catch them

1. Harvest many return sources
2. Allocate risk, not dollars
3. Seek negative/low correlations
4. Limit risk concentrations with well-chosen constraints
5. Target constant volatility over time
6. Use dynamic overlays to control drawdowns
7. Keep trading costs low and pay fair fees
8. Identify investments with superior Sharpe ratios

Source: AQR. For illustrative purposes only.

1-3. Portfolio construction: Diversify, Diversify, Diversify!

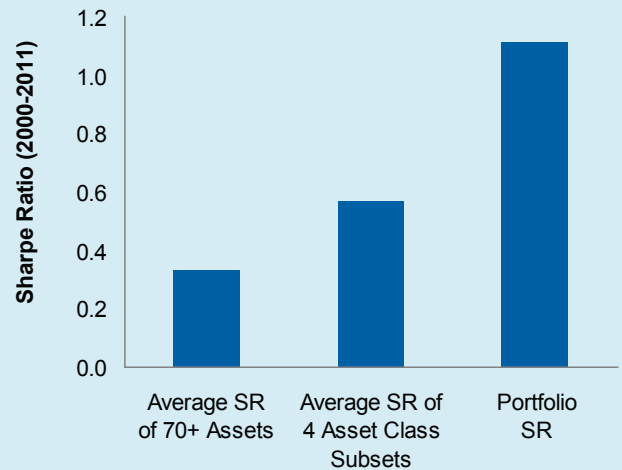
1. Harvesting rewards from many return sources is essential

A portfolio's risk-adjusted return (Sharpe ratio, SR) depends crucially on its breadth or diversification.¹ While diversification is famously called the only free lunch that markets offer, some observers consider diversification a sign of ignorance or lack of guts. We firmly believe that diversification is smart in being realistically humble about investors' forecasting ability. In contrast, risk concentrations often signal overconfidence.

Diversification can be achieved along many dimensions, such as by geography, asset class, risk factor, strategy style, or indicator. In our first example, we study a portfolio which is aggressively diversified across more than 70 long-only market premiums from four broad subsets (global stocks, nominal government bonds, real assets and credit instruments). In simulations between 2000 and 2011, the average SR among the single assets is about 0.3. Each subset contains 12-26 positively correlated assets; combining them roughly halves the portfolio volatility and thus doubles the average SR to 0.6. Combining the four subsets, which have low correlations with each other, further halves the portfolio's volatility and gives it a SR well above 1. The magic of breadth works similarly whenever investors combine truly diverse return sources.

¹ The so-called "fundamental law of active management", coined by Richard Grinold, states that under certain conditions, an active portfolio's Sharpe ratio is a function of investor skill per investment (forecasting ability) as well as portfolio breadth (number of uncorrelated constituents, which proxies for the degree of effective diversification). For example, combining four uncorrelated return sources doubles the portfolio SR. Of course, it may not be easy to find truly uncorrelated return sources with positive SRs.

Aggressive Diversification Reduces Portfolio Volatility and Boosts Its Sharpe Ratio



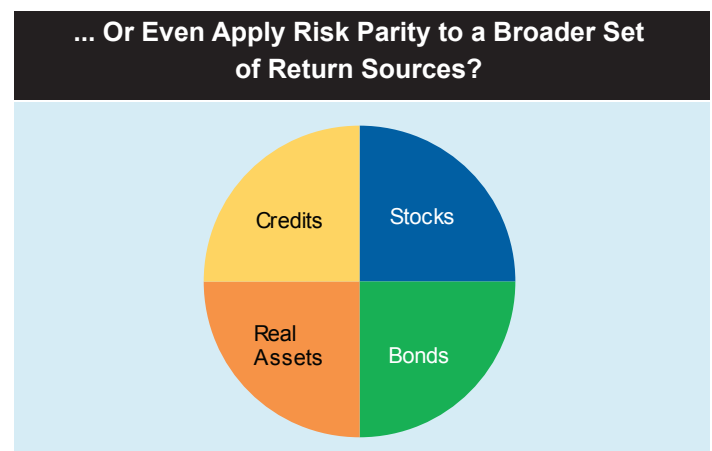
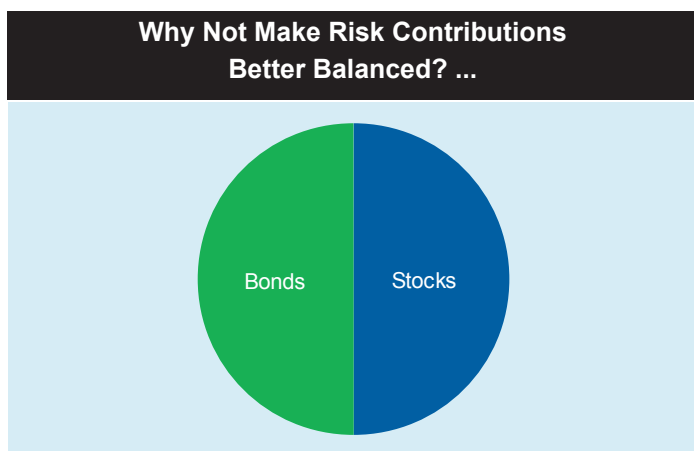
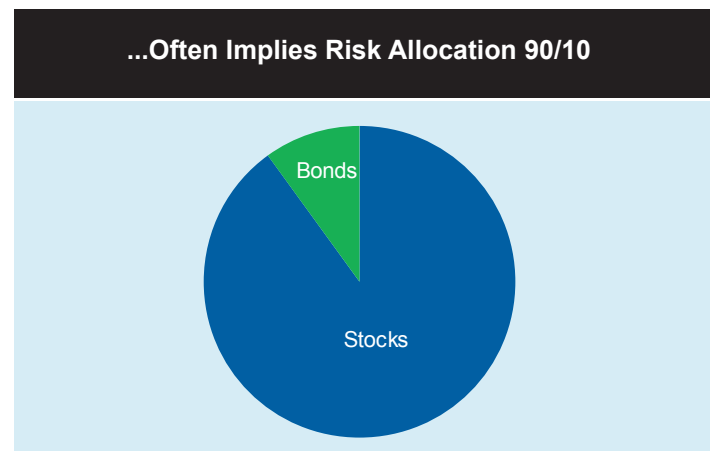
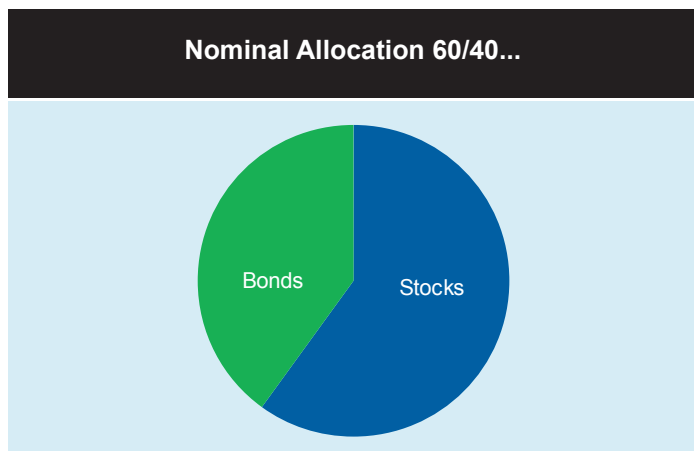
Source: AQR. Sharpe Ratios are based on backtested returns of a Global Risk Parity strategy, net of trading costs and gross of management fees.

2. Return sources should be combined in a balanced way (allocate risk, not dollars)

Holding a large number of return sources does not provide true breadth if one return source contributes much more to portfolio risk than others. In practice, the most volatile constituents often dominate portfolio risk. Investors tend to achieve a better balanced portfolio if they make allocations in volatility units, not in dollars. That is, they should think about risk budgets instead of (or in addition to) capital allocations. The best-known example is the 60/40 stock/bond portfolio, which may sound like a balanced capital allocation but actually implies highly-concentrated equity market exposure in the risk budget (we estimate approximately 90%). This realization has inspired many investors to shift their portfolios toward risk parity (see lower pair of charts below).²

If we simulate monthly returns between 1990 and 2011, a global 60/40 stock/bond portfolio achieved a SR of 0.5. A risk parity portfolio of global stocks, nominal government bonds, real assets (commodities and inflation-linked bonds), and credit-sensitive

assets achieved a SR of 1.1. A risk parity portfolio of only stocks and bonds fared even better (SR 1.3) because falling yields during these two decades made bonds the best performer among the four subsets.³ Although windfall gains in bonds accentuated the profits of a risk parity portfolio over this period, the edge over a 60/40 portfolio holds over longer and more neutral periods. The primary reason is more effective diversification, and the secondary one is the tendency of lower-risk investments to offer higher long-run SRs.⁴



Source: AQR Capital Management. Stylized examples of 60/40 portfolios and risk parity portfolios with two or four subsets.

² For more information, please request "Understanding Risk Parity," AQR Capital Management.

³ Sharpe ratios based on backtested returns of a Global Risk Parity strategy, net of trading costs and gross of management fees.

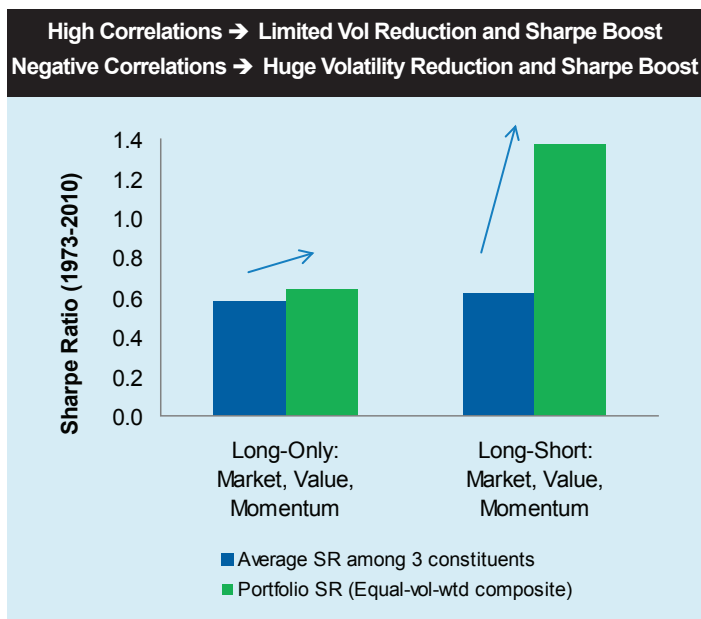
⁴ See Asness-Frazzini-Pedersen (2012).

3. Low to negative correlations are superb diversifiers, when available

For a given number of return sources and balanced volatilities, diversification will be better when the correlations between the sources are lower. Style/factor diversification can be more effective than asset class diversification (which we looked at in the preceding section) because long-short style/factor portfolios⁵ often have lower or even negative correlations with one another and with the equity market than do most traditional asset portfolios. Long-only funds tend to have high positive correlations due to the common market-directional element.

Investors often look for diversification from illiquid assets, but such diversification is partly an illusion, reflecting stale prices and return-smoothing effects. Both private equity and hedge funds tend to be highly market directional; among hedge fund styles, only managed futures and global macro managers tend to be nearly uncorrelated with the market.

The next chart shows an example of how high correlations limit diversification and how negative correlations enhance it. It compares the long-run performance of an equal-volatility weighted combination of three stock portfolios – global market-cap, value and momentum portfolios – in long-only and long-short contexts. The long-only value and momentum portfolios involve regularly rebalancing into the top 30% of the equity universe when stocks are



Note: Asness, Moskowitz, and Pedersen (2011) based on monthly returns of global stocks between 1973 and 2010.

⁵ Popular examples of long-short style factors are value – say, buying stocks with high book-to-market ratios while selling stocks with low book-to-market ratios – and momentum – say, buying stocks that performed well over the past year while selling past year's laggards.

sorted by the book-to-market ratio and by past-year (excluding the most recent month) return, respectively. The pairwise correlations between these three stock portfolios range from +0.71 to +0.90. As a result of the common market-directional core, diversification among these three portfolios only reduces portfolio volatility by a tenth or so, and has correspondingly limited impact on the SR. In contrast, the long-short versions have negative correlations among constituents (Value-Market -0.04, Momentum-Market -0.09, Value-Momentum -0.53), which means that diversification more than doubles the portfolio SR. This example illustrates why the large negative correlation between value and momentum styles justifies giving this pair a central role in many systematic trading models.⁶

This example is given from total return perspective. For active long-only managers, relative performance against the benchmark is crucial, and their excess returns will resemble the long-short returns above. Thus, from active return perspective (alpha and tracking error versus a benchmark), value and momentum tilts retain the negative correlation, and can still be of great value when relative returns are the goals or the worry. This qualifier applies also to the next paragraphs.

Style tilts achieved through long-only investing can be viewed as a tie-in sale that includes a small slice of the style tilt and a large slice of the market exposure. Style diversification is most effective when the tie-in sale is unbundled by short-selling other stocks – or at least by selling index futures – to remove the directional exposure. The resulting directionality-hedged portfolio has a lower volatility and may require leverage to achieve higher volatility targets. Many investors are unable or unwilling to use leverage, and we believe this leverage aversion sustains all style premiums by preventing investors from utilizing them most effectively.

In summary, separation of alpha from beta – and separation of alternative beta from either – requires the application of derivatives, short-selling, and/or leverage. We sometimes call these “the three dirty words in finance”; they have their problems but they also help investors escape from the excessively equity-centric portfolio.

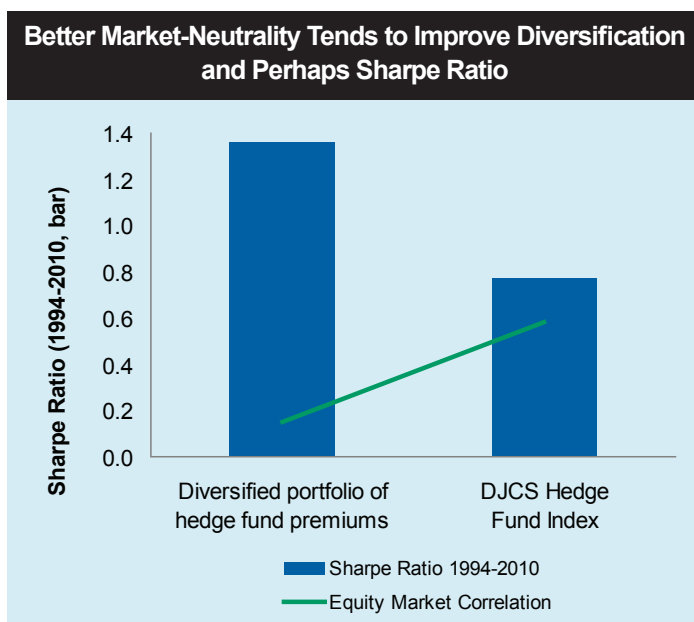
⁶ Even in this example, we created an equal-volatility weighted combination of the three constituents, thereby *underutilizing the information in correlations*. If we assume equal Sharpe ratios among constituents, a mean-variance optimizer would assign larger (smaller) weights to better (worse) diversifiers. An asset's contribution to portfolio risk reflects both the standalone volatility and various correlations. Equal-volatility weighting is a heuristic and surprisingly robust approach which captures a good part of diversification benefits when constituents with low correlations are combined. The reason why we sometimes ignore specific in-sample correlations is their instability over time. Low correlations across factors or across asset classes can exhibit significant sampling variation and sign changes – even if they are much more persistent and predictable than returns. Conservative use of in-sample estimated correlations can give further benefits in portfolio construction, while naïve use can lead to overfitting and unhelpful turnover. Prudent approaches balance these considerations.

4-6. Risk management (mitigate risk concentrations and deep drawdowns)

4. Well-chosen constraints can limit market directionality and other risk concentrations

Because concentrated equity market exposure is typically the main culprit preventing institutional portfolios from being well-diversified and risk-balanced, targeting market-neutrality can significantly improve a portfolio's efficiency. This is more easily said than done, since many assets are positively related to equity markets.

The preceding examples (namely 2 and 3) present evidence on the Sharpe ratio benefits from reducing this key risk concentration. The next chart gives one more example from hedge funds and hedge fund premiums. All major hedge fund indices exhibit high correlations with equity markets. For example, the Dow Jones Credit Suisse hedge fund index has a 0.60 correlation with global equity markets since inception (and 0.77 during the past decade), even when we ignore positive correlations with lagged market returns (likely related to stale pricing or return smoothing). Hard work is needed to maintain a low beta exposure. In the example below, a portfolio of diverse hedge fund premiums includes individual strategies designed to be low to moderately market-directional with a further equity hedge to the total portfolio. This portfolio has achieved a 0.17 correlation with global equities since 1994.⁷



Source: AQR. Sharpe Ratios are based on backtested returns of a Hedge Fund Risk Premiums strategy, net of trading costs and 2% management fees. Correlations are against the MSCI World Index.

⁷ For more information, please request "Building a Better Alternatives Portfolio," AQR Capital Management.

Less market-directionality is one reason that this portfolio of hedge fund premiums may have a higher Sharpe ratio than a hedge fund index. Concentrated directional risk hurts diversification, which in turn lowers the portfolio Sharpe ratio unless the reward for equity market risk is so much higher than the rewards for other risk factors that the risk concentration is warranted.⁸

Other top-down constraints, apart from market-neutrality, can be imposed to mitigate poorly rewarded or unintended risk exposures. The best-known example is to impose industry neutrality, which long-short hedge funds often use in their stock portfolios. In contrast, academic studies and many style indices rarely impose this constraint and thus may allow large sector bets, such as long Financials. Overlaying an industry neutrality constraint on stock selection strategies often reduces volatility while keeping long-run returns broadly unaffected, which implies higher portfolio Sharpe ratios.⁹

The topic of investment constraints is vital to limiting excessive risk concentrations in portfolios. We turn next to other ideas which result in more modest SR increments than gains from diversification – but they are still worth pursuing; every little bit counts. Indeed, some of the improvements that follow are hard to quantify without large amounts of data. The direction of the gains is correct, however, and consistent with first principles.

⁸ This idea is discussed in Asness-Frazzini-Pedersen (2012). Empirically, equities have not had a significantly higher long-run SR, which would be required to justify their dominant role in most portfolio risk budgets.

⁹ It is important to find the right balance when using constraints in portfolio construction. Constraints can help if they reduce excessive risk concentrations or if they enable a cleaner separation between directional, country or industry, and firm-specific active views. Intrusive constraints can certainly hamper performance by reducing the opportunity set, but country or industry neutrality can improve effective portfolio breadth by replacing a handful of large country or industry bets with hundreds of small single-stock bets. Also see "Avoiding Unintended Country Bets in Global Equity Portfolios," AQR Capital Management.

5. Volatility targeting improves risk accuracy and may improve the Sharpe ratio

Investors commonly let their portfolio volatility fluctuate with market volatility, and the resulting ride can be a wild one. There is another option. Adjusting nominal position sizes dynamically over time to offset changing market volatility levels helps investors achieve reasonably steady portfolio volatility over time. The chart below shows that even in 2008 it was possible to maintain portfolio volatility near its target level, resulting in more accurate risk measures.

Moreover, targeting a constant near-term volatility using recent volatilities may improve the Sharpe ratio for single assets and across assets because, for many assets, higher volatility does not appear to empirically predict higher return in the near term.¹⁰

In one empirical study of more than 70 liquid investments in several asset classes between 2000 and 2011, we analyzed how constant volatility targeting (using rolling 21-day volatilities) changed risk and performance statistics compared to constant nominal holdings. Kurtosis – roughly, the volatility of volatility – declined in about 80% of the cases. (Kurtosis is formally the fourth moment of a return distribution – a measure of its “fat-tailedness.”)¹¹ Additionally, the SR increased in about 70% of the cases, with the average SR across all assets rising from 0.32 to 0.40. We should not overstate the importance of one study, as results can differ depending on asset class, sample period, future holding period, historical window length and sampling frequency for volatility, but we believe that volatility targeting can be a source of value-added.

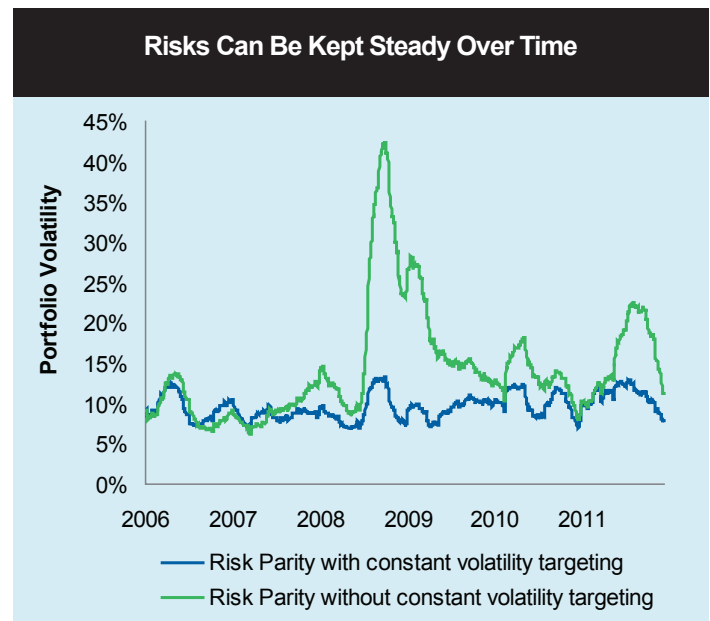
We stress that any SR improvement from volatility targeting should be seen as “icing on the cake.” The main benefit – the cake – is more stable portfolio volatility (and with it, slimmer tails). Less-dramatic surprises make it more likely that investors will stick to their game plan and not capitulate in bad times.

¹⁰ Even static volatility targeting using long-run volatilities may boost the Sharpe ratio because it makes the portfolio more effectively diversified (item #2 above). Here we deal with more dynamic targeting of constant volatility.

¹¹ The impact on worst drawdowns was less uniform. One reason is technical: constant-volatility targeting tends to increase average nominal position sizes due to the nonlinearity in the ratio (fixed volatility target / recent volatility). Larger nominal positions in turn raise the realized volatility and related tail risk measures. (In our exercise, the realized volatility across volatility-targeted assets averaged 22%, 13% more than the 20% realized volatility across constant nominal holdings.)

One could view such volatility targeting as “diversification through time” in the sense that it helps investors avoid risk concentrations over time by not letting abnormally volatile periods dominate the portfolio’s long-run performance. Investors should judge for themselves when to take large risks instead of letting the market (with its time-varying volatility) impose it on them.¹²

¹² For more information on volatility targeting in a diversified portfolio, please request “Risk Parity, Risk Management, and the Real World,” AQR Capital Management.



Source: AQR. For illustrative purposes only. Sample Risk Parity Portfolios created using Equities (S&P 500 Index), Bonds (Barclays Capital Aggregate Bond Index) and Commodities (Goldman Sachs Commodities Index). Notional exposures for static portfolio are set at inception. Notional exposures for dynamic portfolio are adjusted based on a volatility forecasting model.

6. Dynamic overlays beyond volatility targeting may reduce drawdowns, and boost Sharpe ratios

Although long-run performance mainly depends on static long-run allocations, dynamic overlays may be used to gain an additional edge and provide downside protection.

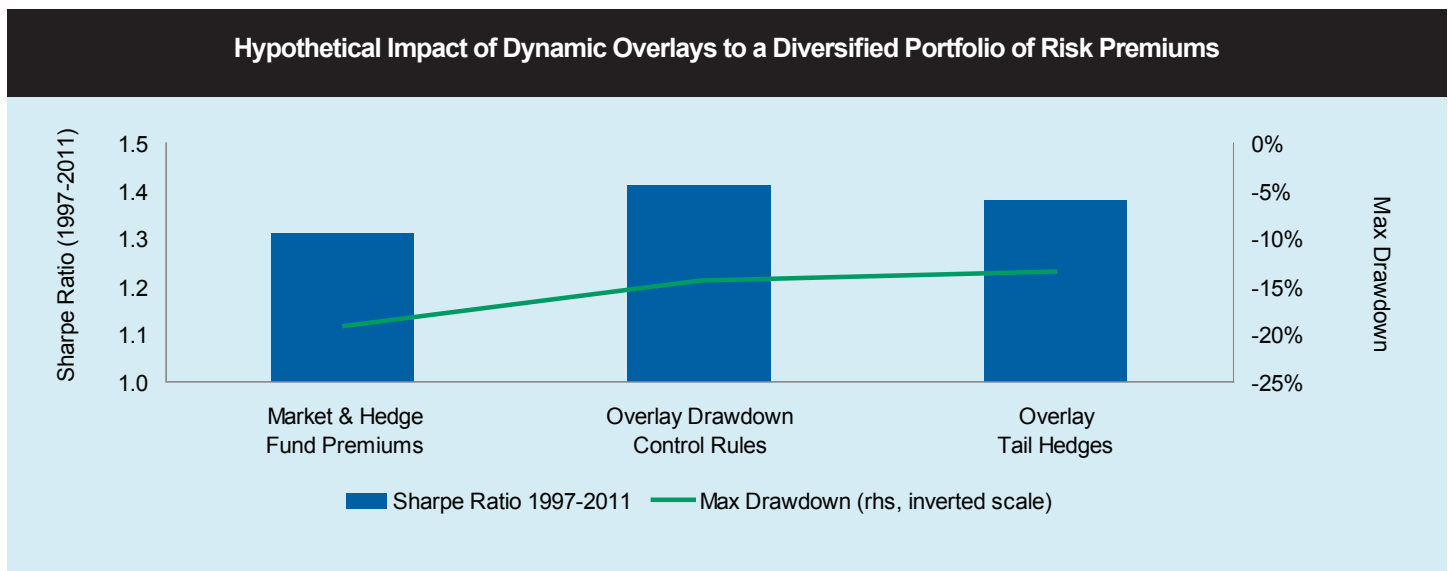
- Mechanical drawdown rules may shift capital from risky investments to cash if pre-specified loss levels are reached (and dial risk exposures back up when performance recovers).
- Tail hedges may improve fund performance in the worst of times (but option-based tail insurance is so expensive that we prefer statistical hedges with better performance in normal times, such as trend-following strategies and defensive equity strategies).¹³

These overlay features may or may not add value in the long run but by preventing larger losses, they should ensure that the investor survives to fight another day. They might even enable investors to take advantage of exceptional bargains at times of distress. In our simulations, overlaying either of these features on a 70/30 risk-weighted combination of market risk premiums and hedge fund risk premiums improved the portfolio Sharpe ratio and reduced the worst drawdowns over a 15-year period (see chart).

¹³ For more information, please request "Chasing Your Own Tail (Risk)," AQR Capital Management.

We admit that such a fortuitous outcome can be sample-specific. In particular, the higher Sharpe ratios may not be repeated in the future. Containing worst drawdowns is, in any case, the more important benefit because it reduces the danger of investors capitulating procyclically near the market bottom. Of course we cannot backtest the added value of being able to stick with a good long-term strategy, but even casual analysis of the last decade suggests that this ability is very valuable.¹⁴

¹⁴ For a broader review of ideas to help investors take advantage of their long horizon, please see "Seven Thoughts for Running Big Money for the Long Term," AQR Capital Management. That report also discusses another form of dynamic overlay – contrarian tactical allocation tilts, not covered here.



Source: AQR Capital Management. Hypothetical returns based on backtests of market risk premiums and hedge fund risk premiums, and are net of estimated trading costs and 1.5% management fees. The base portfolio is a 70/30 risk-weighted combination, drawdown control rules are systematic and respond to increasing losses by reducing position sizes and raising position sizes quickly after losses are recouped, the tail hedge overlay involves 10% risk allocation to a backtested portfolio of statistical tail hedges.

7. Cost effectiveness: Mitigating trading costs and fees helps the bottom line

Trading costs and fees eat into the bottom line. In a world of low expected returns, cost savings gain in importance. For example, harvesting alternative betas is very much a matter of technology and implementation efficiency, with some gains available to only the most cost-effective traders.¹⁵

Trading Costs: By making a significant investment into building an in-house, state-of-the-art algorithmic trading platform, AQR has minimized execution costs tremendously. AQR pioneered algorithmic trading in most asset classes globally, which gives a significant competitive advantage in minimizing execution costs and seeking to preserve more alpha for its investors.

- By reducing the need for an intermediary, AQR both minimizes the fees and commissions paid to brokers and also avoids information leakage to brokers' proprietary desks through their internalization mechanisms (i.e. "dark pools").
- AQR is able to tailor its algorithms to its various investment strategies rather than using "one size fits all" broker solutions. For example, for longer term investment time horizons, AQR has built a trading algorithm that minimizes trading costs by using a patient trading style designed to minimize the risk and adverse selection in country, market, and sector specific risk at entire basket level during the relatively longer execution horizon. The patient trading style allows AQR to be a liquidity *provider* (rather than a liquidity *taker*), often capturing bid-ask spreads and creating lower market impact.
- By aggregating various liquidity sources electronically, AQR is able to access more depth of liquidity at lower spreads, which further minimizes execution costs. For example, AQR aggregates FX liquidity electronically from more than 15 dealer desks and electronic communication networks (ECNs), which improves spreads by about 75% in developed market currencies and by 40% in emerging market currencies.
- AQR stores all relevant executions and tick level market data into a database to allow for transaction cost analysis and systematic improvements in our trading algorithms. The transaction cost curves across various asset classes and markets are applied to the portfolio optimization process, creating a feedback loop for continued improvement.

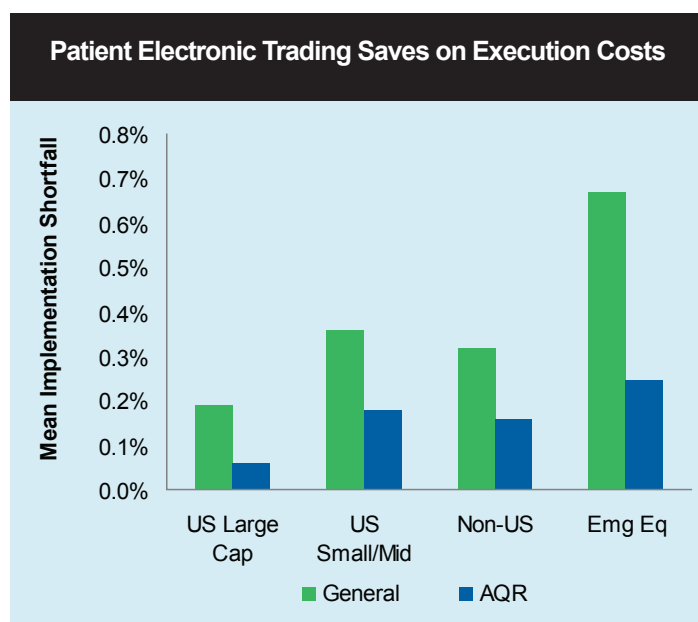
We estimate that our algorithmic trading platform and our systematic approach to trading leads to significant overall execution cost savings. For example, the chart to the right shows

¹⁵ As costs and fees vary across managers, the specific examples below relate to AQR, but can be a source of alpha for any investor.

stock trading cost estimates in several contexts; also see Frazzini-Israel-Moskowitz (forthcoming).

Management Fees: AQR has long argued that fees should be commensurate to costs, complexity, and capacity of the return source. Alpha, defined more narrowly as unique, predictive skill (not broadly like we do in most of this article), undoubtedly deserves the highest fees. Market risk premiums should have very low fees, though dynamic, diversified funds warrant higher fees than plain-vanilla index funds. Alternative beta premiums (hedge fund premiums, style premiums) are between pure alpha and traditional beta, and justify fees between them.

We think investors should be cost-conscious but not necessarily cost-minimizing (cash with negative real yields has the lowest costs). For example, the core portfolio should be cheaply sourced market and alternative premiums. The costliest approach is to pay active management fees for the whole portfolio if it resembles an index fund minus higher fees (closet indexing among single funds, diversification impact among many constituents).



Source: AQR and State Street Global Markets. AQR data is an average of actual trading execution (implementation shortfall) across relevant AQR funds from 2007 to 2011. The General execution cost data is an estimated average implementation shortfall in 2010 per market sector. Different sample periods and potentially different trading sizes may impact figures, but we believe the results are directionally representative.

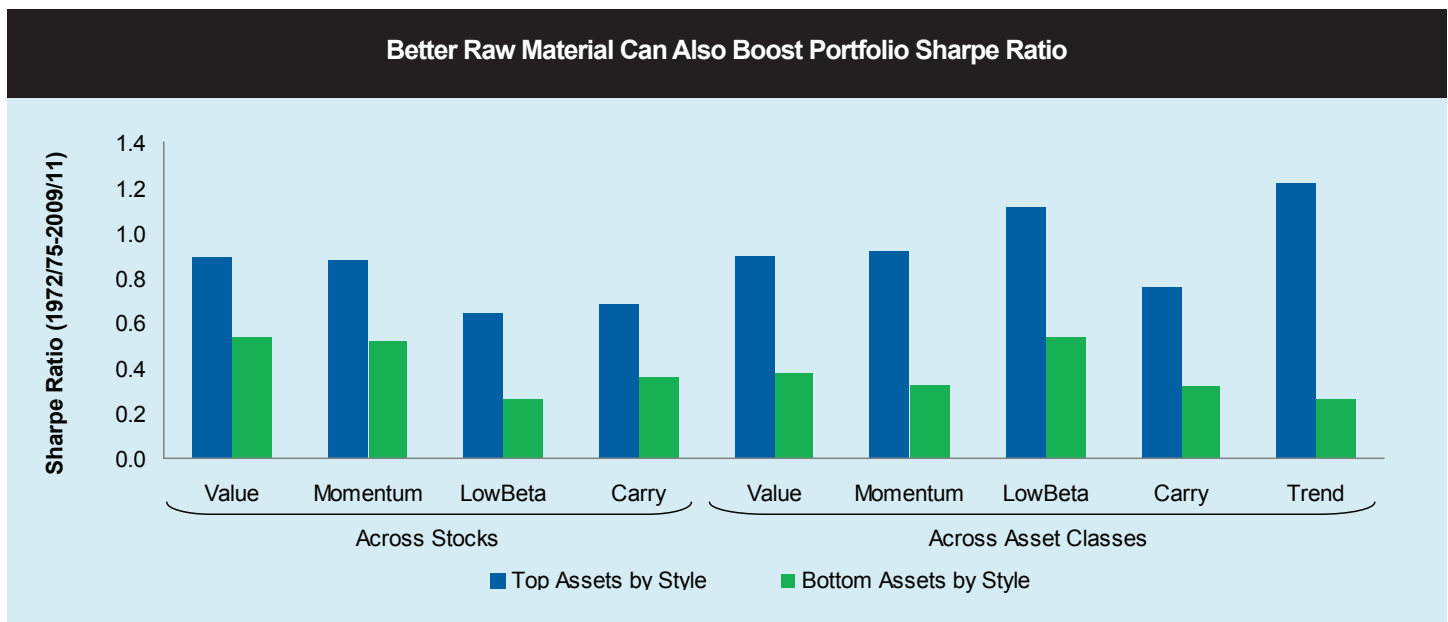
8. Expected returns: Return sources with superior Sharpe ratios are attractive

Even though we stress that the role of expected returns is overstated, we should not go overboard: They too are a source of alpha, of course.

Since we analyze volatility-targeted positions, we prefer candidates with high Sharpe ratios.¹⁶ Investors are most familiar with expected returns from asset classes, such as the equity premium, term premium and credit premium. However, investors often underutilize opportunities in style investing, which may provide consistently good risk-adjusted returns (as well as diversification benefits). In particular, style tilts based on Value, Carry, Momentum/Trend and Low-Beta investing have delivered positive long-run SRs in virtually every context researchers have studied them (stock selection in different regions; asset allocation across equity markets, bond markets, currencies and commodities; etc.). The next chart summarizes the evidence using more than 30 years of data for each style. Even more compelling are bar charts showing the ubiquitous positive long-run SRs for each style across numerous individual assets and markets, that emphasize the out-of-sample robustness of these styles.

This example focuses on long-run (static) expected returns from systematic sources. It is worth noting that time-varying expected returns may provide additional tactical opportunities. Some active investors try to exploit such opportunities on a systematic basis, perhaps using the above style indicators in a time series context: letting long-run value or short-term momentum signals guide their timing decisions. Other investors – the majority – rely on their discretionary judgments.

We repeat that this last item is the only one out of eight that is directly related to expected returns. The rest are less eagerly pursued but hugely important for long-run investment success.



Source: AQR. Sharpe ratios based on hypothetical performance.

Value strategies favor assets with low (cheap) valuations and dislike assets with high valuations. Momentum strategies favor last-year's outperforming assets and dislike the laggards (while Trend-following trades each asset individually based on past-year performance). Low Beta strategies favor low-beta assets and dislike high-beta assets. Carry strategies favor high-yielding assets and dislike low-yielding assets. Carry across stocks refers to stock selection based on dividend yield, with data from Kenneth French's website.

Blue bars show the SR of a portfolio of "long" assets – corresponding to top-30% or top-50% when an asset universe is sorted on a relevant style indicator – that are aggregated across various contexts. Green bars correspond to comparable asset portfolios, bottom-30% or bottom-50% of each asset universe that might be "shorted." All series start in the 1970s and end in 2009 or 2011, gross of trading costs and fees.

¹⁶ While the Sharpe ratio may be the best summary measure of an investment's attractiveness, it tells nothing about its higher moments of return distribution, diversification ability, liquidity or capacity.

Concluding Thoughts

The greatest challenge for investors today may be the market-directional exposure in their portfolios. Since the Global Financial Crisis, correlations between assets have been elevated and even underlying risk factors seem to move synchronously. Diversification has its limits in such an environment.¹⁷ Yet, we strongly believe that it remains the best approach, especially now that other means of risk reduction are so unappealing: sovereign debt troubles underscore the absence of truly riskless assets and option-based tail risk insurance has become very expensive.

Our ideal portfolios aggressively exploit breadth; this almost always improves risk-adjusted returns. If the resulting level of portfolio volatility is deemed too low, investors can potentially

¹⁷ We argue elsewhere that the criticism against diversification is overstated. See Asness-Israelov-Liew (2011), Asness-Frazzini-Pedersen (2012) and Ilmanen-Kizer (2012).

convert diversification gains into higher raw returns through the use of some amount of leverage.¹⁸ The challenge is compounded for the many institutions that still ambitiously target 4-5% long-run real returns in today's low-rate environment. Without leverage, investors seeking high returns must resort to high dependence on the equity premium (concentrated risk budget), holding the often overpriced high-volatility segments within each asset class, buying products with costly embedded leverage and questionable liquidity, or succumbing to the dream-sellers. We believe an approach of harvesting multiple return sources, balancing them by risk, and executing cost-effectively, while managing leverage and other risks, offers by far the most reliable basis for achieving ambitious real return targets.

¹⁸ Asness-Kabiller-Mendelson (2010) discuss the challenges with leverage but argue that leverage risk is a lesser and more manageable risk than concentration risk. Moreover, risks associated with leverage are mitigated by using highly liquid, exchange-traded, and low-volatility assets, which are unlikely to lead to forced delevering.

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Disclosures

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Drawdown Control rules will not always be successful at controlling a portfolio's risk or limiting portfolio losses.

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Gross performance results do not reflect the deduction of investment advisory fees, which would reduce an investor's actual return. For example, assume that \$1 million is invested in an account with the Firm, and this account achieves a 10% compounded annualized return, gross of fees, for five years. At the end of five years that account would grow to \$1,610,510 before the deduction of management fees. Assuming management fees of 1.00% per year are deducted monthly from the account, the value of the account at the end of five years would be \$1,532,886 and the annualized rate of return would be 8.92%. For a ten-year period, the ending dollar values before and after fees would be \$2,593,742 and \$2,349,739, respectively. AQR's asset based fees may range up to 2.85% of assets under management, and are generally billed monthly or quarterly at the commencement of the calendar month or quarter during which AQR will perform the services to which the fees relate. Performance fees, if applicable, are generally equal to 20% of net realized and unrealized profits each year, after restoration of any losses carried forward from prior years. In addition, AQR funds incur expenses (including start-up, legal, accounting, audit, administrative and regulatory expenses) and may have redemption or withdrawal charges up to 2% based on gross redemption or withdrawal proceeds. Please refer to AQR's ADV Part 2A for more information on fees.

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