Who Is On the Other Side?

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Principal

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A Confession:
Coming here is a pre-commitment vehicle to help fulfil my promise to Bill Sharpe in Q 2012. “Other side” has been a slow project with colleagues, but it will eventually turn into a paper.
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Introduction
Motivating the Question “Who is on the other side?“

Originally, academic literature asked this question regarding any transaction
• A marketmaker should quote different prices to liquidity/noise traders than to informed traders

Here, the question is asked in the context of systematic strategies, not on specific trades
• If you expect to earn a positive long-run reward on a given strategy (e.g., long value style), you should consider who is going to “pay” it by long-run underperformance
• You should also ask why other smart investors do not arbitrage away the perceived opportunity

Opposite question arises from systematic losses, evidence that investors’ aggregate dollar-weighted returns lag time-weighted returns in many contexts: Who benefited from poor active decisions?

Many ways to address these questions
Outline
Rephrasing: Do Historically Successful Strategies Have a Sustainable Other Side?

Introduction
• I will focus on long-run rewarded systematic factors (style premia), trying to address the question: How to convince ourselves there is a sustainable other side?
• I argue that no single approach can address this question, but four sub-questions together give a framework for doing it

Drill into four sub-questions
• Is the empirical return edge persistent, pervasive, and robust?
  – Raising the bar on historical return evidence
• Why does the opportunity exist in the first place, and why is it not arbitraged away?
  – Economic intuition
• Can positioning histories identify a well-defined group on the other side (or limited arb flows)?
  – Flows/Holdings evidence
• Has the historical opportunity been arbitraged away?
  – Evolving market pricing

(If time, I will briefly discuss the flipside question for apparent systematic laggards)
Four Ways to Address the “Other Side” Question
In the Context of Successful Systematic Strategies

1. **Empirical return edge.** Long-run evidence of a strategy’s positive return is suggestive of an “other side“. To raise the bar, evidence should be persistent over subperiods; pervasive across regions and asset classes; and robust across specifications. *But: Still worry about sustainability, need more.*

2. **Economic intuition.** Any long-run rewarded opportunity should be backed by a theory or story on what caused the opportunity in the first place (as well as an explanation why it does not get arbitraged away). The main candidates are risk-based explanations and behavioral explanations. *But: Many theories exist from both sides for any empirical regularity.*

3. **Flows/Holdings evidence.** It is best if we have empirical evidence of a well-defined large investor group “taking the other side“ of a rewarded opportunity and losing money as a result. Ideal evidence is directly linked to the economic theory above. *But: Data limitations and adding-up constraint.*

4. **Evolving market pricing.** Forward-looking valuations should show that the past success is not due to one-off richening (arb’ing away) and that current starting levels are broadly in line with past norms. *But: Contemporaneous and predictive relations between valuations and returns can be weak.*
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Related Concepts

Only the cap-weighted market portfolio is “macro-consistent” in the sense that all investors can hold the same portfolio in equilibrium

- For any active strategy, such as value investing, greater popularity should reduce long-run reward
- Even within CAPM, practical use of the market portfolio embeds assumptions on which parts of the market are “investable” (worse in FI) and on investor demand accommodating any net issuance

“For every buyer, there is a seller” is true, by definition

- Or, “the average investor must hold the market portfolio”
- Limits the usefulness of any empirical analysis of ‘aggregate’ or ‘net’ investor flows or holdings
  - Who is the unmeasured other side of the investor universe you study (say, 13F or custody data)?

* As far as I know, this term was first used in writing in Professor’s Sharpe’s Masters interview for the Journal of Investment Consulting in 2005, but the concept was applied already in Perold-Sharpe (1988). A slide in the Appendix provides some excerpts on these concepts.
Empirical Return Edge Needing the Other Side
- Systematic Return Sources: Equity Premium
- Example Cases with All Boxes Ticked
- Four Major Style Premia as a Broad Lens
Systematic Long-Run Return Edges: Equity Premium and More

Return Evidence Is Good, But May Not Be Enough

Long-run evidence of a strategy’s positive average return may point to a sustainable other side
• To raise the bar on empirical evidence, we emphasize persistence, pervasiveness, and robustness
• We will focus on four style premia – value, momentum, carry, defensive – which satisfy these criteria
• Even with the best historical evidence, we may worry about sustainability, so the non-return considerations matter

Let’s first briefly consider the most important traditional risk premium:
1. Equity premium is supported by persistent and pervasive empirical evidence (e.g., Dimson, Marsh, Staunton 2016)
2. It has the most compelling economic intuition for a long-run premium (CAPM, covariance with bad times, etc.)
3. Other side can be seen as either equity issuers or more risk averse investors
4. Forward-looking signals (e.g., Shiller E/P) indicate lower expected reward than historically, but still clearly positive

Before turning to the style premia, let’s discuss a few anecdotal cases where we can tick all the boxes
• These cases involve better links between empirical evidence, theory, and flows/holdings evidence than styles can
### Examples With All Boxes Ticked and Linked (1)
Selling Index Puts, Favoring Defensive Stocks

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<td>End-investors tend to have a long net position in S&amp;P500 index options, esp. in deep OTM puts. (Garleanu-Pedersen-Poteshman 2009)</td>
<td>No downtrend in the ex-ante gap between implied and realized vol (same for skew).</td>
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| Betting against beta | Low-beta stocks have offered higher risk-adjusted returns than high-beta stocks. (Frazzini-Pedersen 2014) | Leverage aversion can explain common investor preference for riskier stocks. Lottery preferences may contribute. | Mutual funds tend to favor high-beta stocks; their portfolio holdings average realized beta near 1.1. (Frazzini-Pedersen 2014) | Value spreads of market-neutral "bet-against-beta" portfolios vary over time, with richer levels since 2008. |

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# Examples With All Boxes Ticked and Linked (2)

## Price Pressure in Commodity Index Roll, Fallen Angel Corporate Bonds

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<td>Price pressure from a large synchronous flow on regular GSCI index roll days (prespecified window).</td>
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| Fallen angels in corporate bonds | Corporate bonds that were recently downgraded from IG to SG rating outpaced peers by 6.6% in two years after the downgrade. (Ng-Phelps 2010, Ben Dor-Dynkin-Hyman-Phelps 2012) | Forced selling by investors regulations constrain to hold only IG debt and by inflexibly index-matching investors. | Higher turnover of bonds despite higher t-costs after downgrade is consistent with forced selling. (Ben Dor et al. 2012) | The effect has weakened since 2010 publications. (Ben Dor and Xu 2015) |

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Raising the Bar on Return Evidence
What Are the Major Style Premia?

Research has identified four styles that have historically generated positive long-run returns in- and out-of-sample (persistent), across a variety of asset groups (pervasive), using many specifications (robust).

Four Market-Neutral Styles

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<td><strong>Value</strong></td>
<td>The tendency for relatively cheap assets to outperform relatively expensive ones</td>
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<td><strong>Momentum</strong></td>
<td>The tendency for an asset’s recent relative performance to continue in the near future</td>
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<tr>
<td><strong>Carry</strong></td>
<td>The tendency for higher-yielding assets to provide higher returns than lower-yielding assets</td>
</tr>
<tr>
<td><strong>Defensive / Quality</strong></td>
<td>The tendency for lower risk and higher-quality assets to generate higher risk-adjusted returns</td>
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More directional “cousins” of momentum and carry include **trend-following** and **volatility selling**

Another group would be variants of **illiquidity premia** in public and private assets

**Style Premia Evidence Across Many Asset Groups**

Single Long/Short Style Premia and Diversified Composites

**Hypothetical Gross Sharpe Ratios of Long/Short Style Components Across Asset Groups**

January 1990 - December 2015

Source: AQR; Iimanen, Israel, and Moskowitz (2012). Above analysis reflects a backtest of theoretical long/short style components based on AQR definitions across identified asset groups, and is for illustrative purposes only and not based on an actual portfolio AQR manages. The results shown do not include advisory fees or transaction costs; if such fees and expenses were deducted the Sharpe ratios would be lower; returns are excess of cash. Please read performance disclosures in the Appendix for a description of the investment universe and the allocation methodology used to construct the backtest and composites. Hypothetical data has inherent limitations, some of which are disclosed in the Appendix.
Economic Intuition
- Risk-Based and Behavioral Explanations
- Other, incl. Limits of Arbitrage
Economic Intuition: Risk-Based or Behavioral?

Two Main Types of Explanations Debated

Any long-run return source should be backed by a theory or logic of what caused the opportunity in the first place – as well as a story of why it is not arbitrated away.

The main candidate explanations are risk-based (rational) and behavioral (irrational)

- Many observers consider only risk-based explanations sustainable
  - However, limits of arbitrage and slow learning can also sustain behavioral anomalies
- Perhaps the bar should be raised on risk-based explanations: Risk should hurt and be systematic

This requirement is hardly binding because academics have by now provided an abundance of explanations (of both varieties) for each major premium.
Economic Logic: Beyond the Two Main Explanations
Data Mining or Frictions / Limits of Arbitrage

Beyond the two main explanations, any historical premium may be explained by:

• **Data mining** and other selection biases: spurious in-sample results

• **Frictions / Limits of Arbitrage** (especially needed to make behavioral stories sustainable)
  o Trading costs
  o Short-selling constraints
  o Leverage aversion (or leverage constraints), perhaps the most important LoA force
    o Even the “unconstrained” arbitrageur is limited from exploiting all the available opportunities, especially assets/strategies with low natural volatility or highly diversified composites
Focus on Key Style Premia: VMCD
Who Is Their Other Side?

Value: A long debate among academics between risk-based and behavioral explanations
• Each story implies its own other side
• Same for Momentum, Carry, Defensive – more on the next slide

Value and Momentum are opposing ideas (sell or buy into strength) and thus provide “other sides” to each other. But they work at different horizons and thus complement each other.
• Ideal investments are multi-year cheap and have improved in recent quarters.
• We also need the other side for the V&M combo, who willingly buys the rich and declining assets
  – Many investors “act like momentum investors at reversal horizons”, chasing 3-5yr returns
  – Likewise, too-fast rebalancing fails to “let the momentum play out”
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More broadly, who is the other side for the VMCD combo or other diversified factor portfolios?
- Not just one but a collection of other sides
  - Many L/S opportunities with SR 0.2 can be diversified into a SR 1 portfolio, and then – maybe – levered up
- The bigger question is why such diversified L/S portfolios do not get arbitraged away
  - Leverage aversion and other LoA forces sustain all kinds of opportunities
# My List of Selected Explanations (You May Have Yours…)

## Four Style Premia as Umbrella Concepts for Many Strategies

<table>
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<td>VALUE + Rebalancing Contrarian Timing LT Reversals</td>
<td>Over-extrapolation of past growth Delayed overreaction to price trends Discomfort with ‘dogs’/distress Generic risk premium (1/P) Rational: distress risk, dynamic betas</td>
<td>Over-extrapolators of multi-year growth LT overreactors (chasing returns at 3-5yr horizons when reversals dominate) Managers attracted to glamor or “story stocks”</td>
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<td>MOMENTUM + Trend Following Fundamental Mom.</td>
<td>Underreaction to (non-salient) public news Overreaction to price trends Procyclic risk tolerance or risk management Disposition effect</td>
<td>Inattentioned, conservative, overconfident Contrarians resisting the herd Investors without stop-loss rules Those hanging on to losers (avoid loss realization)</td>
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<tr>
<td>CARRY + Volatility Selling Illiquidity Premia</td>
<td>Skew/tail preferences, volatility/jump premia Overconfident expectations of capital losses (mkt moves) that would offset the carry edge Non-profit-driven flows supporting high carry Generic risk premium (1/P) Liquidity needs (lower t-costs), price pressure</td>
<td>Tail insurance buyers, skewness lovers, crash protection seekers Overconfident holders of salient (UIP; PEH,…) macro views Non-profit-driven actors (e.g., central banks) Impatient/short-horizon investors, those needing immediacy in trading</td>
</tr>
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<td>DEFENSIVE (BAB / Low Risk) + Quality Risk Parity</td>
<td>Leverage aversion Lottery seeking Relative risk preferences, conventionality Active managers seeking maximal bang for the (unlevered) buck Underreaction to quality</td>
<td>Constrained investors who avoid leveraging up low-risk opportunities with better SRs and instead choose concentrated high-risk exposures Investors who prefer lotteries and positive skewness Benchmarked managers who care more about tracking error than total portfolio risk Overconfident-and-constrained active managers Inattentioned, “story-oriented” analysts/investors</td>
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Flows/Holdings Evidence
- Direct Positioning Data (13F, etc.) vs. Inferred from Return Regressions
- Review of Key Academic Studies
- Own Evidence on 13F Holdings
- Own Evidence on Return Regressions
Flows/Holdings Evidence
Main Focus on 13F data on U.S. Equity Holdings

Four studies summarized below (Lewellen 2011, Edelen 2015, Akbas et al. 2015, Calluzzo et al. 2015) and much of academic literature, as well as our own empirical analysis, use 13F data of U.S. equity investors’ quarterly holdings from the Thomson-Reuters 13F database.

There are several issues to note:

• Only investors with at least $100mio AUM need to file 13F reports. Thus, 13F reflects large institutions and "the other side" of net active 13F positions is seen to include retail and other small investors.  
  – However, there may be filing exemptions and underlying filed data may have problems

• Only cash equity longs are reported in 13F filings. Including active short and derivative positions could change inferences (there are some datasets on these but less comprehensive). Even for long-only managers, we do not know benchmarks.

• Capturing all investors would face the adding-up constraint (netting to zero active tilts)

• Splitting the 13F universe into investor subsets may be as relevant as for "other side" analyses as the net/aggregate results (recall the adding-up constraint), but the classifications are problematic  
  – The largest group of investment advisors is sometimes split into subsets
Other comparable data sources to 13F filings include flow/holding data from custodians like State Street (e.g., Froot-Teo 2008), derivatives data from the CFTC or exchanges (e.g., Gorton et al. 2007), large consultant databases involving voluntary reporting by end-investors (e.g., Gerakos et al. 2015)

- All of these raise similar questions as the 13F database
- In some countries, regulations enable a virtually comprehensive picture of all trading activity

We may also infer certain investor group’s active tilts by running returns-based regressions with factors (e.g., style premia) as explanatory variables

- Such estimates can only reveal average exposures and linear relations, but the upside is that returns reflect all investor positions (not just cash longs but also shorts and derivatives)
Main Academic Studies Using 13F Data (1)
Lewellen 2011, Edelen et al. 2015, Akbas et al. 2015 in JFE ...

- 13F data 1980-2007 shows that institutional investors as a group largely hold the market portfolio, with only minor tilts away from the market on a dozen major anomalies.
- Quintile weights in the net 13F institutional portfolio are compared to the market portfolio. Most weights are within 2%; the max gap is large size quintile where investors hold 77% vs Mkt 73%.
- Unlike the studies below which focus on changing positions, Lewellen focuses on levels (average tilts).

- Institutional investors typically are on the wrong side of major anomalies (except for momentum) during a 1yr period when the anomaly portfolio was constructed. In particular, institutions often buy apparently overvalued stocks instead of shorting them.
- This wrong sign is inconsistent with limits of arbitrage constraining them from smart arb activities. At 12-18 month horizons, correlations between institutional flows and strategy returns are negative.

- Authors identify hedge funds as smart money and mutual funds as dumb money. They then show that aggregate inflows to mutual funds exacerbate cross-sectional mispricings, while hedge fund inflows attenuate them. In both cases, the main impact of inflows is on overvalued stocks.
- Focus on the impact of aggregate inflows complements the Frazzini-Lamont (2008) evidence.
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- Quintile weights in the net 13F institutional portfolio are compared to the market portfolio. Most weights are within 2%; the max gap is large size quintile where investors hold 77% vs Mkt 73%.
- Unlike the studies below which focus on changing positions, Lewellen focuses on levels (average tilts)

- Institutional investors typically are on the wrong side of major anomalies (except for momentum) during a 1yr period when the anomaly portfolio was constructed. In particular, institutions often buy apparently overvalued stocks instead of shorting them.
- This wrong sign is inconsistent with limits of arbitrage constraining them from smart arb activities. At 12-18 month horizons, correlations between institutional flows and strategy returns are negative.

- Authors identify hedge funds as smart money and mutual funds as dumb money. They then show that aggregate inflows to mutual funds exacerbate cross-sectional mispricings, while hedge fund inflows attenuate them. In both cases, the main impact of inflows is on overvalued stocks.
- Focus on the impact of aggregate inflows complements the Frazzini-Lamont (2008) evidence
Main Academic Studies Using 13F Data (1)
Lewellen 2011, Edelen et al. 2015, Akbas et al. 2015 in JFE ... 

• 13F data 1980-2007 shows that institutional investors as a group largely hold the market portfolio, with only minor tilts away from the market on a dozen major anomalies.
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• Focus on the impact of aggregate inflows complements the Frazzini-Lamont (2008) evidence.
Main Academic Studies Using 13F Data (2)

... and Calluzzo et al. (2015) Seems Especially Relevant


• More positive results for institutional arbitrage activity than Lewellen (2011) or Edelen et al. (2015), especially around periods when anomalies are published

• Higher anomaly-based trading among institutional investors, mainly hedge funds and “transient institutions” (with high turnover, broad diversification) is found following the publication of research on anomalies. Higher trading seems in turn to explain the decay in post-publication anomaly returns.
  – Authors posit that institutions can act as arbitrageurs and correct anomaly mispricing, but they need to know about the anomaly and have the incentives to act on the information

• Different results in Edelen et al. (2015) reflect their use of a long window (>12mo., before ranking). Calluzzo et al. use a much shorter two-quarter window surrounding the anomaly ranking date.
  – Thus, results here highlight the responsive, rather than anticipatory, behavior of institutions wrt. publicly available information

• Consistent with McLean-Pontiff (2015), authors find a sizable reduction in the anomaly returns post-publication. Greater arb activity post-publication reduces profits especially on the long side.
German Data Covering All Transactions
Evidence on Momentum Traders and Their Other Side

“Who Trades on Momentum?”, Baltzer-Jank-Smajlbegovic (2014), Deutsche Bundesbank:
• The new Securities Holdings Statistics, which cover virtually the entire holdings structure of the German stock market, enables studying the investment decisions of various investor types (2005-12)
• Mutual funds and foreign investors (generally institutional) are clearly momentum traders and have benefited from it over the sample period
• Private households are the contrarian “other side” (especially the less sophisticated households, as proxied by lower wealth and greater home bias). In line with earlier evidence on disposition effect.

“Cyclical Investment Behavior Across Financial Institutions”, Timmer (2016), Deutsche Bundesbank:
• Uses the same database (2005-14) but focuses on debt securities and different institution types
• Banks and investment funds are momentum traders in bond markets, while insurance companies and pension funds act in a contrarian fashion
AQR’s Own 13F Analysis (Xie, Pomorski, et al.)
Better Identification/Split of Investor Groups, Better Measure of Active Tilts

- Data from Thomson Reuters institutional investor holdings database (13F). Russell 3000 stock universe.
- Institution types are based on Thomson Reuters classification and on additional AQR research.
- Thomson Reuters identifies general institution types (e.g., investment advisor, bank and trust, etc.).
- **We map out the institution types even further, for example by identifying institutions that only run mutual funds, institutions that only run hedge funds, etc..**
- Non 13F investor holdings are identified by the difference between Russell 3000 holdings and total 13F report holdings.

Evolving Shares: Institutions Are Increasingly Important Equity Holders

*By focusing on Russell 3000, we capture about 97% of the value-weighted U.S. equity market.*
Which Strategies/Tilts to Study?
Focus Here on Broad and Well-Known Stock Selection Styles

Value
- Key signal: book-to-price ex cash (B/P)

Momentum
- Key signal: P212

Defensive, with its two component sub-styles
- Quality, key signal: gross profitability (GPOA)
- Low Risk, key signal: beta (BAB)

Size
- Key signal: market cap
How to Measure Active Tilts For Each Investor Group?
Measuring Investor Subsets’ Role in a Given Strategy (13F: Long cash holdings)

Each quarter:

1. For each institution group, compute the weight of each stock in the aggregate portfolio

2. For each stock, compute that stock’s percentile ranking on the key signal
   - E.g., for value, the most expensive stocks (the lowest B/P) is 0%

3. Compute the weighted average of each stock’s percentile

   E.g., BAB for hedge funds: the key signal is beta, so \( \text{measure}^{HF} = \sum_{i=1}^{N} w_i^{HF} \text{perc}(\beta)_i \)
   where \( w_i^{HF} \) is the weight of stock \( i \) in the overall hedge fund portfolio and \( \text{perc}(\beta)_i \) is the percentile of stock \( i \)’s beta. As the BAB factor favors low beta, the highest-beta stocks are in the 0% percentile.

4. Finally, compute a similar measure for the overall market and subtract it from each measure to give the active tilt compared to the value-weighted market portfolio
Intuition of Our Measure for Active Tilts
And Comparison with Other Studies

• **Our measure has an appealing interpretation**
  – For example, for BAB (low beta), the market-adjusted value for hedge funds is -0.08
  → HF s tend to hold stocks with betas 8 percentile ranks higher than the overall market

• Existing papers focus on: % shares held by institutions (e.g., Lewellen); Change in % shares held by an institution type (e.g., Calluzzo et al.); # institutions buying/selling (e.g., Edelen et al.)
  – These measures are then applied to particular long/short anomaly portfolios

• Instead, we study the entire market and compare the characteristics of stocks held by each group
  – We do not take a stand on how they acquire style exposure (maybe no extreme L/S portfolios)
  – Like Lewellen, we do not take a strong stance on when institutions should trade to qualify

• None of these measures controls for interactions across factors (cf. multi-variate regressions)

• **This measure does not account for the relative size of each institution type**
  – Appendix shows weight-adjusted measures which add up to zero across investor groups
Average Factor Tilts for Various Groups Since 1999

Strong “Other Side” Evidence for Size, Beta, and Momentum

- Mutual fund managers have significant tilts to momentum, profitability, and high beta
- HF managers have significant tilts to small cap, unprofitable, high beta, and momentum
- Asset managers offering both HFs and MFs have active tilts between pure HF and pure MF
- Non-13F investors have significant tilts to anti-momentum, low beta, large cap
- Size will not be discussed further, but we note that HFs have a small-cap tilt, while non-13F investors (as well as banks and pension funds‘ internal management) are on the other side

<table>
<thead>
<tr>
<th>Average Tilt (1999Q1-2016Q1)</th>
<th>Market Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value B/P</td>
<td>Momentum P212</td>
</tr>
<tr>
<td>-----------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Mutual Fund</td>
<td>0.0003</td>
</tr>
<tr>
<td>Mutual Fund/Hedge Fund</td>
<td>0.0002</td>
</tr>
<tr>
<td>Hedge Fund</td>
<td>0.0012</td>
</tr>
<tr>
<td>Other Investment Advisor</td>
<td>-0.0032</td>
</tr>
<tr>
<td>Pension Fund (Internal)</td>
<td>0.0098**</td>
</tr>
<tr>
<td>Investment Bank</td>
<td>-0.0014</td>
</tr>
<tr>
<td>Bank and Trust</td>
<td>-0.0140**</td>
</tr>
<tr>
<td>All 13F Investors</td>
<td>-0.0001</td>
</tr>
<tr>
<td>Non-13F Investors</td>
<td>0.0010</td>
</tr>
</tbody>
</table>

Asterisks * (**) denote statistical significance at 95% (99.9%) confidence level (based on t-statistics of quarterly active tilts over time, using Newey-West with 4 lags).

All 13F investors include about 1% of smaller groups, besides those listed above.

Source: Thomson Reuters, Compustat, Barra, AQR.
P212 is price momentum over 2-12 months. GPOA is gross profit over total assets. BAB (Betting Against Beta) is a levered beta-neutral portfolio that is long low beta stocks and short high beta stocks with the stock universe roughly the Russell 1000. M-CAP is market capitalization.
Evolving Value and Momentum Tilts By Three Investor Groups
Small Non-13F Investors Are One Other Side for 1yr Momentum

VALUE (B/P): A Time-Varying Picture

MOMENTUM (P212): HF&MFs Pro, vs. Non-13F

2YR smoothed percentile difference versus the market
SEE WEIGHTED TILT MEASURES IN THE APPENDIX

Source: Thomson Reuters, Compustat, Barra, AQR.
Detour: Average Momentum Tilts for Different Lags

Mutual Funds May Be the Other Side for Multi-Year Reversals

- Mutual fund and MF/HF managers chase returns at all lags based on coefficient signs. They appear to be on the wrong side of any multi-year mean reversion across stocks.
- Hedge fund managers have near-zero tilts beyond one-year momentum.
- Small non-13F investors lean toward contrarian trading at all lags. They tend to lose with 1yr momentum and gain with any multi-year reversion across stocks.

<table>
<thead>
<tr>
<th></th>
<th>P11</th>
<th>P212</th>
<th>P1324</th>
<th>P2536</th>
<th>P3748</th>
<th>P4960</th>
<th>P1360</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mutual Fund</td>
<td>0.0023*</td>
<td>0.0059**</td>
<td>0.0034*</td>
<td>0.0021</td>
<td>0.0014</td>
<td>0.0011</td>
<td>0.0035</td>
</tr>
<tr>
<td>Mutual Fund/Hedge Fund</td>
<td>0.0046*</td>
<td>0.0121**</td>
<td>0.0110**</td>
<td>0.0072*</td>
<td>0.0041*</td>
<td>0.002</td>
<td>0.0114**</td>
</tr>
<tr>
<td>Hedge Fund</td>
<td>0.0142*</td>
<td>0.0303**</td>
<td>0.0203*</td>
<td>0.0095</td>
<td>-0.0025</td>
<td>-0.0119</td>
<td>0.0003</td>
</tr>
<tr>
<td>Other Investment Advisor</td>
<td>-0.0007</td>
<td>-0.0026</td>
<td>-0.0056*</td>
<td>-0.0048*</td>
<td>-0.0021</td>
<td>-0.0016</td>
<td>-0.0049</td>
</tr>
<tr>
<td>Pension Fund (internal)</td>
<td>-0.0017*</td>
<td>-0.0009</td>
<td>-0.0015</td>
<td>-0.0016</td>
<td>-0.0011</td>
<td>-0.0002</td>
<td>-0.0028</td>
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<tr>
<td>Investment Bank</td>
<td>-0.0078**</td>
<td>-0.0043*</td>
<td>-0.0024</td>
<td>0.0011</td>
<td>0.0033</td>
<td>0.0032*</td>
<td>0.0024</td>
</tr>
<tr>
<td>Bank and Trust</td>
<td>-0.0067*</td>
<td>-0.0134**</td>
<td>-0.0100*</td>
<td>-0.0025</td>
<td>0.0011</td>
<td>0.0023</td>
<td>-0.0015</td>
</tr>
<tr>
<td>All 13F Investors</td>
<td>0.0020*</td>
<td>0.0056**</td>
<td>0.0035*</td>
<td>0.0022</td>
<td>0.0014</td>
<td>0.0007</td>
<td>0.0033*</td>
</tr>
<tr>
<td>Non-13F Investors</td>
<td>-0.004</td>
<td>-0.0115**</td>
<td>-0.0087*</td>
<td>-0.0065</td>
<td>-0.0041</td>
<td>-0.003</td>
<td>-0.0094*</td>
</tr>
</tbody>
</table>

Ps refer to the lags of months covered before the quarterly active tilt is measured, e.g., P1360 covers returns from 13 to 60 months ago. All tilts are measured with the same sign as returns.

Asterisks (*) (***) denote statistical significance at 95% (99.9%) confidence level (based on t-statistics of quarterly active tilts over time, using Newey-West with 4 lags).

Source: Thomson Reuters, Compustat, Barra, AQR.
Evolving Quality and Low-Beta Tilts By Three Investor Groups
Hedge Funds Are One Other Side for Quality / Low-Risk Investing

QUALITY (GPOA): MFs Pro Profitability, vs HFs

LOW RISK (BAB): HF&MFs High Beta, vs Non-13F

2YR smoothed percentile difference versus the market
SEE WEIGHTED TILT MEASURES IN THE APPENDIX

Source: Thomson Reuters, Compustat, Barra, AQR.
Turning to Return Regression Evidence: Equity Managers
Active Equity Managers Favor Small Caps, Strong Momentum and Junky Stocks

- Recall that return regressions only estimate average linear relations, but they reflect all positions
- As a group, active equity managers – both long-only and hedge funds – exhibit highly significant market exposures as well as significant small-cap tilts, pro-momentum tilts, and anti-quality tilts
- Net alpha has been negative for mutual funds and positive for hedge funds

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RSQ 98.7%</td>
<td>RSQ 99.3%</td>
<td>RSQ 81.1%</td>
<td>RSQ 67.1%</td>
</tr>
<tr>
<td>Intercept</td>
<td>0.000</td>
<td>-0.001</td>
<td>0.003</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td>-1.99</td>
<td>-3.12</td>
<td>4.15</td>
<td>3.35</td>
</tr>
<tr>
<td>MKT</td>
<td>0.925</td>
<td>0.946</td>
<td>0.389</td>
<td>0.243</td>
</tr>
<tr>
<td></td>
<td>163.1</td>
<td>126.8</td>
<td>17.57</td>
<td>11.92</td>
</tr>
<tr>
<td>SMB</td>
<td>0.063</td>
<td>0.053</td>
<td>0.136</td>
<td>0.069</td>
</tr>
<tr>
<td></td>
<td>7.39</td>
<td>5.15</td>
<td>4.47</td>
<td>2.45</td>
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<tr>
<td>HML</td>
<td>-0.040</td>
<td>-0.006</td>
<td>-0.053</td>
<td>0.004</td>
</tr>
<tr>
<td></td>
<td>-4.93</td>
<td>-0.63</td>
<td>-2.04</td>
<td>0.18</td>
</tr>
<tr>
<td>UMD</td>
<td>0.033</td>
<td>0.025</td>
<td>0.158</td>
<td>0.102</td>
</tr>
<tr>
<td></td>
<td>6.75</td>
<td>5.10</td>
<td>10.76</td>
<td>7.51</td>
</tr>
<tr>
<td>QMJ</td>
<td>-0.050</td>
<td>-0.030</td>
<td>-0.210</td>
<td>-0.166</td>
</tr>
<tr>
<td></td>
<td>-4.29</td>
<td>-2.33</td>
<td>-5.53</td>
<td>-4.75</td>
</tr>
</tbody>
</table>

MKT: Value-weighted CRSP market portfolio, SMB: Small Minus Big size factor, HML: High Minus Low value factor (based on book-to-market), UMD: Up Minus Down momentum factor (based on performance in the past year, skipping past month), QMJ: Quality Minus Junk quality factor (based on numerous indicators as in AFP 2014). All style factors are constructed by averaging Top30% minus Bottom 30% portfolio in U.S. large-cap and small-cap universes, as in FF 1993.

CRSP MF is the composite of U.S. equity mutual funds from the CRSP survivorship-bias-free mutual fund database. HF Equity L/S Combo is a simple average of Equity L/S hedge fund returns from Credit Suisse and HFR databases. HF Combo-3 is a simple average of the Credit Suisse hedge fund index (asset-weighted), the HFR fund-weighted hedge fund index (equal-weighted), and the HFR fund-of-funds index (equal-weighted).

All series are either long/short portfolio returns (SMB, HML, UMD, QMJ) or total returns in excess of cash and net of fees

Source: AQR, CRSP, CS, HFR
Past performance is not a guarantee of future performance.
Hedge Funds Returns Reflect Both Market Risk Premia and Style Premia

- Hedge fund index combo returns since 1994 are regressed on various market risk premia (MRP) and style premia (or alternative risk premia, ARP).
- The 4.3% average excess return of the HF combo is split into 1.7% MRP, 1.8% ARP, and 0.8% alpha.
- Very significant equity market loadings and significant loadings on many factors.
- Negative loading only on Defensive stock selection.

### HF Combo-3, Jan 1994 - Jun 2016: 14-factor regression

<table>
<thead>
<tr>
<th>RSQ 75.9% Coefficient</th>
<th>t Stat</th>
<th>In-sample Premium</th>
<th>Return Contrib.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.001</td>
<td>1.13</td>
<td>0.8%</td>
</tr>
<tr>
<td>MSCI</td>
<td>0.268</td>
<td>19.13</td>
<td>4.8% 1.3%</td>
</tr>
<tr>
<td>MSCI lag</td>
<td>0.042</td>
<td>3.10</td>
<td>5.0% 0.2%</td>
</tr>
<tr>
<td>BarcAgg</td>
<td>0.078</td>
<td>1.37</td>
<td>3.0% 0.2%</td>
</tr>
<tr>
<td>GSCI</td>
<td>0.016</td>
<td>1.63</td>
<td>0.5% 0.0%</td>
</tr>
<tr>
<td>VAL-SS</td>
<td>0.004</td>
<td>0.31</td>
<td>4.7% 0.0%</td>
</tr>
<tr>
<td>MOM-SS</td>
<td>0.097</td>
<td>5.57</td>
<td>2.2% 0.2%</td>
</tr>
<tr>
<td>DEF-SS</td>
<td>-0.024</td>
<td>-1.60</td>
<td>10.2% -0.2%</td>
</tr>
<tr>
<td>VAL-AA</td>
<td>0.025</td>
<td>1.43</td>
<td>2.7% 0.1%</td>
</tr>
<tr>
<td>MOM-AA</td>
<td>0.038</td>
<td>1.91</td>
<td>5.0% 0.2%</td>
</tr>
<tr>
<td>CAR-AA</td>
<td>0.036</td>
<td>2.05</td>
<td>8.2% 0.3%</td>
</tr>
<tr>
<td>DEF-AA</td>
<td>0.052</td>
<td>3.01</td>
<td>4.0% 0.2%</td>
</tr>
<tr>
<td>Vol Sell</td>
<td>0.051</td>
<td>2.20</td>
<td>7.1% 0.4%</td>
</tr>
<tr>
<td>Trend</td>
<td>0.089</td>
<td>4.00</td>
<td>6.1% 0.5%</td>
</tr>
<tr>
<td>SmallCap</td>
<td>0.191</td>
<td>5.65</td>
<td>0.5% 0.1%</td>
</tr>
</tbody>
</table>

### Notes:
- HF Combo-3 is a simple average of the Credit Suisse hedge fund index (asset-weighted), the HFR fund-weighted hedge fund index (equal-weighted), and the HFR fund-of-funds index (equal-weighted).
- Market risk premia (MRP): MSCI is the MSCI all-country equity index return, and MSCI lag is its one-month lagged return. BarcAgg is the Barclays Aggregate U.S. fixed-income index return, GSCI is the S&P GSCI commodity futures index return.
- Alternative risk premia (ARP, i.e. other factors): VAL is a market-neutral value strategy, MOM is a market-neutral momentum strategy, CAR is a market-neutral carry strategy, DEF is a market-neutral defensive strategy; all four applied in many asset classes, and described in Imanen, Israel, and Moskowitz 2012. These premia are also split to stock selection (SS) and asset allocation (AA) parts. Vol Sell is an equity index volatility selling strategy. Trend is a trend-following strategy applied in many asset classes. Small-Cap is a global Small-Minus-Big strategy. All from AQR, all but the last one are net of t-costs and most are partly discounted.

### Additional Information:
- All monthly return series are either long/short portfolio returns or total returns in excess of cash (average cash return was 2.5%) and net of fees. Return contribution for each factor is the product of its coefficient times its in-sample annual average return (while 12 x Intercept is the annualized alpha).
- Source: AQR, CRSP, CS, HFR, MSCI, Barclays, Bloomberg

Past performance is not a guarantee of future performance.
Evolving Market Pricing
- Address Arbitraging-Away Concerns By Tracking Trend Changes in Valuations
So The Factor Worked in the Past – But Is It All Over Now?

Valuations May Tell If an Opportunity Has Been Arbitraged Away

Forward-looking yields or valuations should show that past success is not due to one-off richening and the ex-ante opportunity has not vanished

- Otherwise we may expect fewer investors on the other side and lower strategy returns going ahead

We track value spreads (relative valuations of long and short sides) for the major style premia – to assess both arbitraging-away/crowding concerns and contrarian trading opportunities

Despite common concerns of factor crowding, we find little evidence of it in valuations (currently near their 20-30yr norms). Only the defensive style appears expensive

- Even for this factor, contrarian style timing has not been helpful in recent decades

So, predictive relations are weak. The same goes for contemporaneous relations between changing valuations and realized returns for L/S style premia. No 1-for-1 mapping due to “wedges” such as changing portfolio contents, evolving fundamentals, etc.

- Thus, richening value spreads may not ensure strong performance for L/S strategies, nor vice versa

These topics are the source of another Arnott-Asness debate. I refer to writeups in RAFI and AQR websites.
Evolving Style Premia Valuations for Global SS and AA
So Far No Red Light on Crowding: More Oscillations than Downtrends

Source: AQR. Value spreads are calculated for long/short style portfolios using several different valuation measures as described in AQR Whitepaper “Are Defensive Stocks Expensive? A Closer Look at Value Spreads”, Chandra, Ilmanen and Nielsen (2015). Please read important disclosures in the Appendix for a description of the investment universe and the methodology used to construct the backtests. Hypothetical data has inherent limitations some of which are disclosed in the Appendix.
Overall Verdict on the Four Style Premia
- Do They Have a Sustainable Other Side?
- Who Is It?
Style Premia Assessed on Multiple Dimensions

The Four Style Premia Tick Most Boxes, But These Are Not Directly Connected

1. **Empirical return edge:** Long-run evidence of each style being profitable in several asset classes has been persistent, pervasive, and robust – though each style has suffered some multi-year losing periods

2. **Economic intuition:** Many explanations for each, most clearly behavioral for Momentum. Defensive style may have the most compelling theories with leverage aversion and lottery preferences

3. **Flow/Holdings evidence:**
   - Momentum has Retail on the other side, while MFs and HFs are procyclic. Both U.S. 13F data (and regressions) and German holdings data agree on MF & HF momentum tilt, with small investors taking the reversal side
   - Value has evidence of mixed signs and weak net patterns
   - Defensive has “the other side” in HFs & MFs. Both HFs & MFs have high-beta tilt in 13F. Both are anti-quality in return regressions. HFs are also anti-profitability in 13F but MFs are pro.
   - Carry is mildly favored by HFs, based on return regressions
   - (Small-caps, like Momentum, are clearly favored by HFs & MFs, with Retail on the other side)

4. **Evolving market pricing:** Defensive is the only style that is clearly expensive versus its history. Even there, contrarian style timing would not have been helpful in the past. Finally, “wedges” break the 1-for-1 link between changing valuations and contemporaneous realized returns.
Opposite Question: Other Side for Systematic Losses
- Gap Between Dollar-Weighted and Time-Weighted Returns
Challenge of Investors Experiencing Below-Market Returns

Qui Bono?

In many contexts, dollar-weighted (DW, “investor”) returns lag time-weighted (TW, “investment”) returns

- Apparently this gap reflects ill-timed investor flows. Which other side then profited from these losses?

Dichev (2007) showed that NYSE/AMEX investors earned 1.3% lower DW than TW returns between 1926 and 2002, and even worse gap for NASDAQ and many other equity markets in recent decades

- Gap can be studied in many contexts and aggregation levels. Here focus on equity market-level net inflows, inferring net distributions from market capitalization and market return histories.
- Correlations of distributions with past and future market returns show that investors chase past multi-year returns, while inflows also often predict lower future returns.
- The IRR of the investment can be interpreted as the DW return, proxying actual investor experience. The negative gap between the DW and TW returns was taken as indicative of poor timing decisions.

The method has since been applied to many investments:

- Mutual funds’ DW-TW gaps are widely publicized by Morningstar and others
- Dichev-Yu (2011) applied to hedge funds and found (-)3-7% gaps using per-fund inflows
- Hsu-Myers-Whitby (2015, “HMW”) studied different mutual fund sectors and found negative gaps everywhere: (-)2% for all funds (1991-2013), even larger for index funds, and worst gaps were for growth funds and high-fee funds
Candidate Answers to “Qui Bono?”

Smart Investors, Equity Issuers, or Nobody

**Smart investors doing the opposite** (e.g., not chasing multi-year outperformers)
- But these are part of the net flows in Dichev (2007), so losers must cover even their profits
- HMW (2015) uses mutual fund inflows so the other side to mainly retail *could be* institutional

**Equity issuers** timing the market opportunistically
- Baker-Wurgler (2002) find successful issuer timing especially in the 1990s dot.com era
- Sloan-You (2015) estimate 1% annual wealth transfer in the U.S. 1973-2008 related to equity issuance, repurchases, etc. (mainly as investors tend to buy overpriced equity from issuers)

**Nobody?**
- Hayley (2012) stresses problems with IRR maths. The DW-TW gap reflects correlations of inflows with past and future returns. Only the latter reflect bad timing and these are a small contributor to the observed gap.
- If persistent inflows and falling average returns over time imply opposite trends, the market delivers lower returns on DW basis (cf. HMW(2015): index funds’ DW-TW gap of -2.7% in 1991-2013).
- More generally, merely opposite secular trends between inflows and returns, more than multi-year return chasing, may explain the prevalence of negative DW-TW gaps. To be explored...
Appendix
- Some Excerpts on Related Concepts
- More Slides on Our 13F Holdings Analysis
- More Slides on Our Value Spread Analysis
- ...
Selected Excerpts and References
Related to slide 7

Perold-Sharpe 1988 FAJ, DYNAMIC STRATEGIES FOR ASSET ALLOCATION: Authors contrast concave vs convex strategies—e.g., rebalancing to constant-mix such 60/40 vs buying portfolio insurance. Followers of the more popular strategy (in preferences, not in flows because those must be equal) will subsidize the group following the other strategy; the minority should earn a premium. “Ultimately, the issue concerns the preferences of the various parties that will bear the risk and/or enjoy the reward from investment. There is no reason to believe that any particular type of dynamic strategy is best for everyone (and, in fact, only buy-and-hold strategies could be followed by everyone.)”

Sharpe 2005 MASTERS interview for the Journal of Investment Consulting: “I have a term that I may have invented in this context called ‘macroconsistency’. The idea is that you have a set of estimates—for example, in the mean-variance context, expected returns, risks and correlations. The question is: ‘Are the estimates macroconsistent?’ What I mean by that is if everyone in the world used those estimates, in whatever way they chose, would the markets clear? In a simple CAPM setting, a set of forecasts is macroconsistent if expected returns are proportional to beta values. However, it’s a much broader idea.”

Sharpe 2010 FAJ, ADAPTIVE ASSET ALLOCATION POLICIES: “In such a setting AAA policies are macroconsistent in the sense that it is possible for all investors to follow such strategies.” AAA policies respond to evolving net issuance patterns.

Leibowitz-Hammond 2004 JoPM, THE CHANGING MOSAIC OF INVESTMENT PATTERNS: Authors characterize four ways how investors respond to market movements: rebalancers, holders,valuators, shifters. Typical institutional investors are seen as rebalancers, unlike individuals.

Leibowitz-Bova 2011 MS Research, FACILITATING THE REBALancers: Authors classify investors into rebalancers (multi-asset-class fixed weights, typical for DB funds), semi-passive (often one asset class, more common in DC), and facilitators (others who cross asset classes but not with a prescribed allocation). Authors assess the size of each group and describe their interactions.

Cochrane 2011 JF, DISCOUNT RATES: “A huge literature explores how investors should exploit the market-timing and intertemporal-hedging opportunities implicit in time-varying expected returns. But the average investor must hold the market portfolio. We cannot all time the market, we cannot all buy value, and we cannot all be smarter than average. We cannot even all rebalance. No portfolio advice other than ‘hold the market’ can apply to everyone. A useful and durable portfolio theory must be consistent with this theorem.”
13F Analysis: Weighting for the Size of Each Investor Group

Another ($$$) Perspective to the “Other Side” Question

• We measured the types of stocks various institutions are holding
  – For example, hedge funds seem to hold stocks with betas that are 8 percentiles higher on the beta distribution than the typical stock in the market

• This does not account for the relative size of each institution type
  – Hedge funds may be providing liquidity to BAB investors
  – But if hedge funds only account for 5% of institutional assets, they cannot provide too much liquidity overall

We modify our measure by multiplying it by the relative size of a given investor group

• For example, the measure for hedge funds is multiplied by 5% when the relative hedge fund ownership in the market is 5%
• Recall that mutual funds had the largest weights
• A benefit of this measure is that it sums up to zero across all institution types
## Average Weighted Factor Tilts for Various Groups Since 1999

<table>
<thead>
<tr>
<th></th>
<th>B/P</th>
<th>P212</th>
<th>GPOA</th>
<th>BAB</th>
<th>SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mutual Fund</strong></td>
<td>-0.0001</td>
<td>0.0021**</td>
<td>0.0010**</td>
<td>-0.0011*</td>
<td>-0.0005*</td>
</tr>
<tr>
<td><strong>Mutual Fund/Hedge Fund</strong></td>
<td>0.0001</td>
<td>0.0015**</td>
<td>-0.0009**</td>
<td>-0.0021**</td>
<td>-0.0011**</td>
</tr>
<tr>
<td><strong>Hedge Fund</strong></td>
<td>-0.0001</td>
<td>0.0008**</td>
<td>-0.0011**</td>
<td>-0.0028**</td>
<td>-0.0025**</td>
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<tr>
<td><strong>Other Investment Advisor</strong></td>
<td>0.0000</td>
<td>-0.0002</td>
<td>0.0001</td>
<td>0.0006**</td>
<td>0.0005*</td>
</tr>
<tr>
<td><strong>Pension Fund (Internal)</strong></td>
<td>0.0004**</td>
<td>0.0000</td>
<td>0.0002**</td>
<td>0.0003**</td>
<td>0.0006**</td>
</tr>
<tr>
<td><strong>Investment Bank</strong></td>
<td>0.0000</td>
<td>-0.0001*</td>
<td>-0.0001</td>
<td>-0.0002**</td>
<td>0.0002**</td>
</tr>
<tr>
<td><strong>Bank and Trust</strong></td>
<td>-0.0002**</td>
<td>-0.0002**</td>
<td>0.0005**</td>
<td>0.0007**</td>
<td>0.0005**</td>
</tr>
<tr>
<td><strong>All 13F Investors</strong></td>
<td>-0.0002</td>
<td>0.0037**</td>
<td>0.0000</td>
<td>-0.0041**</td>
<td>-0.0021**</td>
</tr>
<tr>
<td><strong>Non-13F Investors</strong></td>
<td>0.0002</td>
<td>-0.0037**</td>
<td>0.0000</td>
<td>0.0041**</td>
<td>0.0021**</td>
</tr>
</tbody>
</table>

Asterisks * (**) denote statistical significance at 95% (99.9%) confidence level (based on t-statistics of quarterly active tilts over time, using Newey-West with 4 lags).

Source: AQR and SEC's 13F filings

P212 is price momentum over 2-12 months. GPOA is gross profit over total assets. BAB (Betting Against Beta) is a levered beta-neutral portfolio that is long low beta stocks and short high beta stocks with the stock universe roughly the Russell 1000. M-CAP is market capitalization.
Weighted Value and Momentum Tilts By Selected Inv. Groups

**VALUE (B/P): A Time-Varying Picture**

**MOMENTUM (P212): HF&MFs Pro, vs. Non-13F**

2YR smoothed ownership-weighted percentile difference versus the markets

Source: AQR and SEC’s 13F filings

P212 is price momentum over 2-12 months. GPOA is gross profit over total assets. BAB (Betting Against Beta) is a levered beta-neutral portfolio that is long low beta stocks and short high beta stocks with the stock universe roughly the Russell 1000. M-CAP is market capitalization.
Weighted Quality and Low-Beta Tilts By Selected Inv. Groups

QUALITY (GPOA): MFs Pro-Profitability, vs HFs

LOW RISK (BAB): HF&MFs High Beta, vs Non-13F

2YR smoothed ownership-weighted percentile difference versus the market

Source: AQR and SEC’s 13F filings
P212 is price momentum over 2-12 months. GPOA is gross profit over total assets. BAB (Betting Against Beta) is a levered beta-neutral portfolio that is long low beta stocks and short high beta stocks with the stock universe roughly the Russell 1000. M-CAP is market capitalization.
Contrarian Style Timing Performance in U.S. Stock Selection
Contrarian Trading Rules Give Surprisingly Disappointing Results

Style timing based on value spreads may help a little on single-style portfolios, but style timing/rotation results pale when compared to a static Value + Momentum diversified combination.

Source: AQR. Data from January 1990 to December 2015. This is for illustrative purposes only. Please refer to the Appendix for description of the value timing backtest. Please read important disclosures in the Appendix for a description of the investment universe and the methodology used to construct the backtests and hypothetical style premia. Hypothetical data has inherent limitations some of which are disclosed in the Appendix.
Contrarian Timing Did Not Help in Global SS or AA (Macro)
And Strategic Multi-Style Diversification Gives a High Bar to Beat

Trading rules that try to improve the performance of style premia through contrarian timing did not outperform strategic allocations to these premia in any asset class we studied. Here L/S strategies in stock and industry selection as well as country allocation strategies in EQ, FI, FX.

Well-diversified multi-factor composites raise the bar to overcome. Tactical contrarian style rotation would have underperformed a balanced strategic allocation.

Average Hypothetical Gross Sharpes, with and without Value-based Timing
January 1995 – December 2015

<table>
<thead>
<tr>
<th></th>
<th>Single Style Strategies</th>
<th>Two-Style Strategy</th>
<th>Multi-Style Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>V/M/C/D</td>
<td>V + M/C/D</td>
<td>V + M + C + D</td>
</tr>
<tr>
<td>Avg. Gross Sharpes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stock Selection</td>
<td>Static: 0.54 Timed: 0.57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industry Selection</td>
<td>Static: 0.39 Timed: 0.38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Macro</td>
<td>Static: 0.47 Timed: 0.46</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>0.47</td>
<td>0.72</td>
<td>1.00</td>
</tr>
</tbody>
</table>

* V/M/C/D stand for Value, Momentum, Carry, and Defensive styles.

Source: AQR. Backtest from January 1995 to December 2015. The risk-free rate used in Sharpe ratio calculations is the Merrill Lynch 3 Month Treasury Bill Index. These are not the returns of an actual portfolio AQR manages and are for illustrative purposes only. Please refer to the Appendix for description of the value timing backtest. Please read important disclosures in the Appendix for a description of the investment universe and the methodology used to construct the backtests. Hypothetical data has inherent limitations some of which are disclosed in the Appendix.
Even Contemporaneous Relations Can Be Weak

Weak Correlation Between Value Spread Changes and L/S Factor Returns

Multiple Wedges Can Loosen the Relation Between Changing Value Spreads and Contemporaneous Returns

Intuition of a tight link...

...but four wedges can loosen the link, especially for L/S factor returns

Wedges Can Even Flip the Sign of the Contemporaneous Relation

Example of Defensive Factor Cheapening Coinciding With Outperformance

- A puzzling example is highlighted in a recent AQR paper “Are Defensive Stocks Expensive? A Closer Look at Style Value Spreads”
- U.S. Low Beta style was rich at the end of 2012, Yet U.S. BAB* outperformed in 2013-14 — even as value spreads widened.

Standardized Composite Value Spread, Hypothetical Low-Minus-High-Beta Portfolio, 1985-2014


Source: AQR Whitepaper “Are Defensive Stocks Expensive? A Closer Look at Value Spreads”, Chandra, Ilmanen and Nielsen (2015). The universe is a U.S. stock universe that is approximately the top 20th percentile by market-cap and the top 15th percentile by trading volume of U.S. stocks in MSCI Barra’s GEM model universe. This is for illustrative purposes only. Hypothetical data has inherent limitations, some of which are disclosed in the Appendix.
Antti Ilmanen, Principal, Portfolio Solutions Group

Antti Ilmanen, a Principal at AQR, manages the Portfolio Solutions Group, which advises institutional investors and sovereign wealth funds, and develops AQR’s broad investment ideas. Before AQR, Antti spent seven years as a senior portfolio manager at Brevan Howard, a macro hedge fund, and a decade in a variety of roles at Salomon Brothers/Citigroup. He began his career as a central bank portfolio manager in Finland. Antti earned a Ph.D. in finance from the University of Chicago and M.Sc. degrees in economics and law from the University of Helsinki. Over the years, he has advised many institutional investors, including Norway’s Government Pension Fund Global and the Government of Singapore Investment Corporation. Antti has published extensively in finance and investment journals and has received the Graham and Dodd award and the Bernstein Fabozzi/Jacobs Levy award for his articles. His book Expected Returns (Wiley, 2011) is a broad synthesis of the central issue in investing.
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Hypothetical performance results (e.g., quantitative backtests) have many inherent limitations, some of which, but not all, are described herein. No representation is being made that any fund or account will or is likely to achieve profits or losses similar to those shown herein. In fact, there are frequently sharp differences between hypothetical performance results and the actual results subsequently realized by any particular trading program. One of the limitations of hypothetical performance results is that they are generally prepared with the benefit of hindsight. In addition, hypothetical trading does not involve financial risk, and no hypothetical trading record can completely account for the impact of financial risk in actual trading. For example, the ability to withstand losses or adhere to a particular trading program in spite of trading losses are material points which can adversely affect actual trading results. The hypothetical performance results contained herein represent the application of the quantitative models as currently in effect on the date first written above and there can be no assurance that the models will remain the same in the future or that an application of the current models in the future will produce similar results because the relevant market and economic conditions that prevailed during the hypothetical performance period will not necessarily recur. There are numerous other factors related to the markets in general or to the implementation of any specific trading program which cannot be fully accounted for in the preparation of hypothetical performance results, all of which can adversely affect actual trading results. Discounting factors may be applied to reduce suspected anomalies. This backtest’s return, for this period, may vary depending on the date it is run. Hypothetical performance results are presented for illustrative purposes only. Hypothetical performance results are gross of advisory fees, net of transaction costs, and includes the reinvestment of dividends. If the expenses were reflected, the performance shown would be lower. Where noted, the hypothetical net performance data presented reflects the deduction of a model advisory fee and does not account for administrative expenses a fund or managed account may incur. Actual advisory fees for products offering this strategy may vary.

There is a risk of substantial loss associated with trading commodities, futures, options, derivatives and other financial instruments. Before trading, investors should carefully consider their financial position and risk tolerance to determine if the proposed trading style is appropriate. Investors should realize that when trading futures, commodities, options, derivatives and other financial instruments one could lose the full balance of their account. It is also possible to lose more than the initial deposit when trading derivatives or using leverage. All funds committed to such a trading strategy should be purely risk capital.
Value Timing Backtest Methodology
Under/Over-weight Styles Based on 12m Moving Average Value Spreads STD

Methodology:
- Rebalance Frequency: Monthly
- Signal: Expanding window DIFF\(^1\) value spread z-score with minimum 60 months history, capped at +/- 2 STD
- Period: 1995 to Dec 2015\(^2\) (starts in 1995 to allow 60m of value spreads for the expanding z-scores)
- Style Returns: Ex-ante constant vol style returns, gross of t-costs
- Weighting: Styles are scaled proportionate to the value spread z-scores, in a range of 50% to 150% of the static model weight on the style. No shorting of styles.
  - For single-style strategies, we vary the ex-ante risk of the style based on it’s value spread z-score.
    - Scaling factor = (z-score + 4) / 4 \(^3\)
    - Weight = Min weight + Scaling factor \((150\% - 50\%)\)
  - For multi-style strategies, weights for each style are pro-rated up or down so that the weights add up to 100% at each point in time
  - We use a 12m moving average of the value spread z-score as value works at longer horizons.

Caveats:
- Correlations are not used in the backtests to scale weights. So, at the same point in time, the value-timed portfolio could have a different ex-ante vol than the static portfolio.
- For simplicity, the static capital weights assumed are equal-weighted across styles, thus making the styles not equal risk-weighted (since Val and Mom offset each other more). However, the tactical weights are anchored to these equal capital weights too.
- Even in the timing strategy, as weights are pro-rated to add up to 100% at each point in time\(^4\), if all styles are cheap at the same, then the strategy will still underweight the style that is less cheap than the others.

1. Results available for RATIO value spreads, but these cannot be used for Macro styles
2. Backtest upto Sep 2015 for UK and ROE Stock Selection styles
3. Because the range of possible z-scores is 4 STD from -2 STD to +2 STD
4. That is, irrespective of the agreement/correlation across factors, the backtest takes 100% weight (to mimic constant vol)

Source: AQR. Please read important disclosures in the Appendix for a description of the investment universe and the methodology used to construct the backtests and hypothetical style premia. Hypothetical data has inherent limitations some of which are disclosed in the Appendix.
Construction of Long/Short Style Premia

AQR backtests of Value, Momentum, Carry and Defensive theoretical long/short style components are based on monthly returns, undiscoun ted, gross of fees and transaction costs, excess of a cash rate proxied by the Merrill Lynch 3-Month T-Bill Index, and scaled to 12% annualized volatility. Each strategy is designed to take long positions in the assets with the strongest style attributes and short positions in the assets with the weakest style attributes, while seeking to ensure the portfolio is market-neutral. The Style Premia Strategy portfolio is based on the target asset group allocations included herein, roughly equally risk weighting styles within the asset group, resulting in a style allocation of approximately 34% to Value, 34% to Momentum, 18% to Defensive and 14% to Carry. The AQR backtest of the Style Premia Strategy is based on monthly returns, excess of a cash rate proxied by the Merrill Lynch 3-Month T-Bill Index and heavily discounted to reflect uncertainty in historical costs and opportunities; targeting 12% annualized volatility. The Style and Asset Group Composites, are based on an allocation to the style components and asset group components based on their liquidity and breadth. The components are then allocated with roughly equal weighting to each of the styles within an asset group (as not all four styles are present in each asset group). Please see below for a description of the Universe selection.

**Stock and Industry Selection**: approximately 2,000 stocks across Europe, Japan, and U.S.  **Country Equity Indices**: Developed Markets: Australia, Canada, Eurozone, Hong Kong, Japan, Sweden, Switzerland, U.K., U.S. Within Europe: Italy, France, Germany, Netherlands, Spain. Emerging Markets: Brazil, China, India, Israel, Malaysia, Mexico, Poland, Singapore, South Africa, South Korea, Taiwan, Thailand, Turkey. **Bond Futures**: Australia, Canada, Germany, Japan, U.K., U.S. **Yield Curve**: Australia Germany, United States. **Interest Rate Futures**: Australia, Canada, Europe (Euribor), U.K. and U.S. (Eurodollar). **Currencies**: Developed Markets: Australia, Canada, Euro, Japan, New Zealand, Norway, Sweden, Switzerland, U.K., U.S. Emerging Markets: Brazil, Hungary, India, Israel, Mexico, Poland, Singapore, South Africa, South Korea, Taiwan, Turkey. **Commodity Selection**: Silver, copper, gold, crude, Brent oil, natural gas, corn, soybeans.