Analytical Tools for Timing Equity Factors
About The Company

1. Founded in 2013 by MSCI/Barra alumni
2. 5-year effort researching new approaches to equity factor modeling
3. Now offering innovative equity analytics tools:
   A. Windfactors
   B. Best-match Returns
   C. Directional Risk Models
   D. Factor Valuation & Earnings Analytics
Fundamental Multi-factor Models: Typical Approach

Step 1. Define Factor Exposures

Step 2. Estimate Factor Returns

Step 3. Calculate Forecasts

\[ r_e = \sum_k X_{ak} r_k + r_i \]

Variables:
- \( r_e \): equity return
- \( k \): the factors
- \( X_{ak} \): the assets’ factor exposures
- \( r_k \): the common factor returns
- \( r_i \): the assets’ idiosyncratic returns

Most models use periodic cross-sectional regressions to solve this formula.
Typical Equity Factor Strategies

A. Maintain exposure to one or more risk premia:
   1. Value (B/P, E/P)
   2. Momentum
   3. Quality
   4. Low Volatility
   5. Low Size
   6. Dividend Yield

B. Minimize exposure to all other factors
## Equity Factor Investing

### Factor “Trading” vs. Factor “Investing”

<table>
<thead>
<tr>
<th>Strategy Type</th>
<th>Constraints</th>
<th>Bet On</th>
<th>Neutralize</th>
<th>Horizon</th>
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<tbody>
<tr>
<td>Trading</td>
<td>Long - Short</td>
<td>Technicals</td>
<td>All Fundamentals</td>
<td>~1 Day</td>
</tr>
<tr>
<td>Investing</td>
<td>Long Only</td>
<td>Risk Premia</td>
<td>All Other Fundamentals</td>
<td>~1 Month</td>
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**Factor Investing Trends**

- Traditional long-only strategies have been repackaged into low-cost ETFs
- Active managers innovating to maintain higher fees
  - New data sources (not sure any have paid off)
  - Factor timing models
## Recent Factor Strategy Performance

### Single Factor ETFs

<table>
<thead>
<tr>
<th>Issuer</th>
<th>Fund</th>
<th>Ticker</th>
<th>1YR</th>
<th>3YR</th>
<th>5YR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blackrock</td>
<td>iShares Edge MSCI Min Vol USA ETF</td>
<td>USMV</td>
<td>14.8%</td>
<td>12.2%</td>
<td>12.1%</td>
</tr>
<tr>
<td>Blackrock</td>
<td>iShares Edge MSCI USA Momentum Factor ETF</td>
<td>MTUM</td>
<td>3.2%</td>
<td>16.2%</td>
<td>13.9%</td>
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<tr>
<td>Blackrock</td>
<td>iShares Edge MSCI USA Quality Factor ETF</td>
<td>QUAL</td>
<td>4.2%</td>
<td>11.2%</td>
<td>10.1%</td>
</tr>
<tr>
<td>Blackrock</td>
<td>iShares Edge MSCI USA Size Factor ETF</td>
<td>SIZE</td>
<td>4.1%</td>
<td>9.9%</td>
<td>9.0%</td>
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<tr>
<td>Blackrock</td>
<td>iShares Edge MSCI USA Value Factor ETF</td>
<td>VLUE</td>
<td>-8.7%</td>
<td>8.5%</td>
<td>6.1%</td>
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*Source: iShares.com*

### Diversified Factor ETFs

<table>
<thead>
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<th>Issuer</th>
<th>Factors Used</th>
<th>Ticker</th>
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<th>3YR</th>
<th>5YR</th>
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<tr>
<td>Blackrock</td>
<td>Value, Momentum, Quality, Size</td>
<td>LRGF</td>
<td>-5.7%</td>
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<tr>
<td>Global X</td>
<td>Value, Momentum, Size, Low Volatility</td>
<td>SCIU</td>
<td>1.8%</td>
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<tr>
<td>GSAM</td>
<td>Value, Momentum, Quality, Low Volatility</td>
<td>GSLC</td>
<td>3.0%</td>
<td>11.3%</td>
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<tr>
<td>Hartford</td>
<td>Value, Momentum, Quality</td>
<td>ROUS</td>
<td>-4.2%</td>
<td>9.7%</td>
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<tr>
<td>SSGA</td>
<td>Value, Quality, Low Volatility</td>
<td>QUS</td>
<td>7.4%</td>
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*Source: Fidelity.com*

### Benchmark

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<th>Provider</th>
<th>Index</th>
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<tr>
<td>MSCI</td>
<td>MSCI USA Broad-market</td>
<td>2.4%</td>
<td>11.6%</td>
<td>9.3%</td>
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<tr>
<td>Windfactor</td>
<td>Single Factor ETF Diversification Strategy</td>
<td>3.4%</td>
<td>11.7%</td>
<td>10.3%</td>
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</tbody>
</table>

Diversified Factor ETFs are off to a poor start. Our DIY test beat most of them.
Factor Investing Analogy

Equity returns are the change in water depth.
Examples

Value
Bet on companies with lowest valuations.

Momentum
Bet on recent winners.

Quality
Bet on companies with certain fundamentals.
Are Value & Momentum Good Bets Now?

Typical models offer no start-of-period factor information.

Knowing where capital is today would help predict where it will flow.
What’s Been Tried: Value Spreads

Big Spread = Expensive Factor

Small Spread = Cheap Factor

For any factor, the difference in average valuation between high exposure stocks and low exposure stocks.
Problems with Value Spreads

A questionable design...

1. Arbitrary decile, quintile, tertile choice
2. Don’t control for other factors
3. Factors are designed to explain returns not valuations

... with unclear benefits

1. Return correlations appear weak without tech bubble
2. Limited ability to enhance tilt strategies (Asness)

Source: Cliff Asness, My Factor Philippic, May 2016
A windfactor is the probability that an equity investment will outperform its benchmark over the next 12 months.

Our Solution: Windfactors

A 75% chance of beating the US market next year assuming best-match conditions.
How Are They Calculated?

<table>
<thead>
<tr>
<th>Name</th>
<th>Best-match Periods</th>
<th></th>
<th></th>
<th>Windfactor</th>
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<tr>
<td></td>
<td>Return</td>
<td>Risk</td>
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<td>Apple Inc.</td>
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<td>Exxson Mobil</td>
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<tr>
<td>Johnson &amp; Johnson</td>
<td>4.9</td>
<td>23.3</td>
<td></td>
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<tr>
<td>Wells Fargo</td>
<td>-25.1</td>
<td>32.1</td>
<td></td>
<td>22</td>
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<tr>
<td>General Electric</td>
<td>2.8</td>
<td>25.1</td>
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<td>AT&amp;T Inc.</td>
<td>1.0</td>
<td>45.0</td>
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<td>Intel Corporation</td>
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<td>Walmart Inc.</td>
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<tr>
<td>Pfizer Inc.</td>
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<td>Coca-Cola</td>
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</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Best-match Periods</th>
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<th></th>
<th>Windfactor</th>
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<tbody>
<tr>
<td></td>
<td>Return</td>
<td>Risk</td>
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<td></td>
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<tr>
<td>Core S&amp;P 500</td>
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<td>Core S&amp;P Mid-Cap</td>
<td>-1.2</td>
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<tr>
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<tr>
<td>MSCI Min Vol USA</td>
<td>1.4</td>
<td>3.1</td>
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<td>67</td>
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<tr>
<td>U.S. Real Estate</td>
<td>-6.2</td>
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<td>U.S. Technology</td>
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<td>MSCI USA Momentum</td>
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<td>U.S. Energy</td>
<td>-5.8</td>
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<td>32</td>
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<tr>
<td>U.S. Consumer Services</td>
<td>4.5</td>
<td>8.0</td>
<td></td>
<td>71</td>
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</table>

US Windfactors as of 12/2016 for selected US stocks and iShares equity ETFs

Windfactors are based on the returns of similar investments during “best-match” historical periods.
Why Do They Matter?

Windfactors and best-match returns have been predictive of returns for:

1. Factors
2. Stocks
3. Indexes
4. Equity Funds

Highlights:
• Long-horizon (1-mo, 12-mo)
• Low correlation to traditional factors

<table>
<thead>
<tr>
<th></th>
<th>Stocks</th>
<th>Funds</th>
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<tbody>
<tr>
<td></td>
<td>1-mo Return</td>
<td>12-mo Return</td>
</tr>
<tr>
<td>IC</td>
<td>.01</td>
<td>.08</td>
</tr>
<tr>
<td>Count</td>
<td>64,000</td>
<td>5,400</td>
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<tr>
<td>t-stat</td>
<td>2.0</td>
<td>5.8</td>
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Tests of US large-cap best-match returns, 2008-2018

Tests of 2008 – 2018 iShares US Equity ETF returns
Methodology
Equity Valuations Explain Returns

Equity return $r_e$ can be explained by the following model:

$$r_e = \frac{D + P_1 - P_0}{P_0} = \frac{D + \frac{P_1}{F_0} - \frac{P_0}{F_0}}{\frac{P_0}{F_0}} = \frac{V_1 - V_0}{V_0}$$

Variables:

- $r_e$ = equity return
- $P_0$ and $P_1$ = starting and ending market values
- $D$ = dividends paid during the period
- $F_0$ = any start-of-period fundamental (we use sales)
- $V_0$ and $V_1$ = starting and ending asset valuations

Typical models explain returns
Windfactor models explain valuations
Revenue-based valuations offer **stability** (vs. earnings) and **consistency** across industries (vs. book value).
... Then Adjust For Market Level

Constant-market valuations ($V_0$ and $V_1$) are comparable over time. Active return equals the change over a period.
Explaining Equity Valuations With Factors

Start of Period: \[ V_0 = \sum_k X_{ak} V_{k0} + V_{i0} \]

End of Period: \[ V_1 = \sum_k X_{ak} V_{k1} + V_{i1} \]

Where:

- \( V_0 \) and \( V_1 \) = starting and (1-mo, 12-mo) ending asset valuations
- \( k \) = the factors
- \( X_{ak} \) = start-of-period asset exposures to the factors
- \( V_{k0} \) and \( V_{k1} \) = starting and ending factor valuations
- \( V_{i0} \) and \( V_{i1} \) = starting and ending asset-specific valuations
Factors are Structured to Explain Valuations

**Traditional factors explain returns (\(\Delta P/P\)):**
- Yield Factors: Earnings Yield (E/P), Dividend Yield (D/P)
- Value (BV/P)

**Factors explain valuations (e.g. P/Sales):**
- Business Factors (not defined by price):
  - Profit Margin: (E/S, EBITDA/S)
  - Characteristics: Dividends (D/S), Book Value (BV/S)
- Valuation Factors (P/B, P/E, P/D)

Alignment of dependent and independent variables using same numerator or denominator helps explanatory power.
From Factor Valuations to Returns

\[ R_e = \sum_{k} (\frac{X_{ak}}{V_0}) \times (V_{k1} - V_{k0}) + \frac{(V_{i1} - V_{i0})}{V_0} \]

Where:

- \( R_e \) = equity return
- \( V_0 \) = starting asset valuation
- \( k \) = the factors
- \( X_{ak} \) = start-of-period asset exposures to the factors
- \( V_{k0} \) and \( V_{k1} \) = starting and ending factor valuations
- \( V_{i0} \) and \( V_{i1} \) = starting and ending asset-specific valuations
Starting factor valuations are inversely related to factor returns

For almost all factors, average returns have been:

- Higher when starting valuations were lower
- Negative for periods where starting valuations were highest
- Positive for periods when starting valuations were lowest

Source: windfactor.com
### Factor Valuations vs Value Spreads

<table>
<thead>
<tr>
<th>Horizon</th>
<th>Factors Tested</th>
<th># of Periods</th>
<th>Avg Corr</th>
<th>Inversely Related</th>
<th>90% Conf.</th>
<th>Avg Corr</th>
<th>Inversely Related</th>
<th>90% Conf.</th>
<th>Avg Corr</th>
<th>Inversely Related</th>
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<tr>
<td>Characteristics</td>
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<tr>
<td>1 Month</td>
<td>36</td>
<td>244</td>
<td>-0.19</td>
<td>36</td>
<td>33</td>
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<tr>
<td>1 Month</td>
<td>49</td>
<td>244</td>
<td>-0.11</td>
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<td>12 Months</td>
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<td>-0.21</td>
<td>44</td>
<td>9</td>
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</table>

Source: Tests of Windfactor US Equity Factor Library 1998-2018

Factor valuations have shown stronger (negative) return correlations than spread-based measures.
Valuation-dependent Expected Factor Returns

Best-match returns are from historical periods with similar starting valuations. Alternative to “half-life” algorithms.
All Factors Have “Directional Risk”

Comparison of Expected Factor Returns

We now have information to make bets on any factor.
Portfolio Analytics

**Factor Exposures**

\[ X_k^P = \sum_f w_f \frac{X_k}{V_f} \]

**Factor Weights**

\[ w_k^P = V_k X_k^P \]

**Best-match Returns (and other scenarios)**

Mean:

\[ r_p(b) = \sum_k X_k^P r_{k(b)} \]

Volatility:

\[ \sigma_p(b) = \sum_{kl} X_k^P F_{kl} X_l^P \]

**Windfactors (Outperformance Probabilities)**

\[ op_p = 1 - NORMDIST (0, r_p(b), \sigma_p(b)) \]

Where:

- \( P \) is the portfolio
- \( f \) are the firms in the portfolio
- \( k \) (and \( l \)) are the common & firm-specific factors
- \( w_f \) are the (relative or absolute) weights of the firms \( f \) in the portfolio
- \( V_f \) are the valuations of firms \( f \)
- \( X_k \) are the firm’s exposures to factors \( k \)
- \( X_k^P \) are the portfolio exposures to factors \( k \)
- \( V_k \) are the factor valuations
- \( w_k^P \) are the portfolio weights in factors \( k \)
- \( r_{k(b)} \) is the portfolio’s best-match return
- \( F_{kl} \) is the covariance between best-match returns for factors \( k \) and \( l \)
- \( \sigma_{k(b)} \) is the portfolio’s best-match volatility
- \( op_p \) is the outperformance probability
Directional Risk for Any Equity Fund

- Forecasted volatility around forecasted mean
- Next 1-year return vs. US market

*Feb 2019 Directional Risk of iShares DVY in a best-match scenario (www.windfactor.com)*

**Directional risk** is the range of likely returns. Mean outcomes are non-zero.
Windfactor can enhance systematic ETF selection strategies tailored to both capital growth and equity income investors.
Windfactors can enable a new generation of cost-efficient funds with higher return potential.
Usage: Actionable Risk Analysis

Directional risk can be decomposed by factor.
Takeaways

1. Goal: Move beyond factor risk premia
2. Required: Good factor timing information
3. Solution: Directional risk models
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