Evaluating the Performance Persistence of Mutual Fund and Hedge Fund Managers

Iwan Meier

Self-Declared Investment Objective

Fidelity®

Magellan®

Fund

(fund number 021, trading symbol FMAAX)

Prospectus

May 30, 2007

Fund Basics

Investment Objective

Magellan Fund seeks capital appreciation.
Investment “Details”

- Fidelity Management & Research Company (FMR) normally invests the fund's assets primarily in common stocks.
- FMR may invest the fund's assets in securities of foreign issuers in addition to securities of domestic issuers.
- FMR is not constrained by any particular investment style. At any given time, FMR may tend to buy "growth" stocks or "value" stocks, or a combination of both types [...].
- In addition to the principal investment strategies discussed above, FMR may lend the fund's securities to broker-dealers or other institutions to earn income for the fund.
- FMR may also use various techniques, such as buying and selling futures contracts and exchange traded funds [...].

www.morningstar.com
Style Allocation Over Past 10 Years

February 1998 - February 2007

MSCI Emerging Markets
MSCI Japan
MSCI EASEA
Lehman Global Ex US Treasury Bond
Russell 2000 Growth
Russell 2000 Value
Russell 1000 Growth
Russell 1000 Value
Citigroup USBIG Corporate Index
Citigroup USBIG Treasury Index, 10+ years
Citigroup USBIG Treasury Index, 1-10 years
Citigroup 3-month T-bill


Roadmap

- Methodologies to find the right benchmark for hedge funds
- Style drift of peer-group-based benchmarks
- The challenges for return-based style analysis when managers change
Style Benchmarks

- Peer-group-based style factors
- Asset-based style factors (ABS)
- Return-based style factors (RBS)
- Primitive trading strategies (PTS)

Ways to Form Peer Groups

- Self-declared fund objectives
- Holdings-based approach (Morningstar Style Box)
- Return-based style analysis, cluster analysis

References:
Biases Inherited from Databases

- Short history
- Selection bias
- Survivorship bias
- Instant history bias
- Sampling differences

Overlap of Four Major Databases

Some Strategies are More Problematic

<table>
<thead>
<tr>
<th>Sub-Universe</th>
<th>Average Correlation</th>
<th>Lowest Correlation</th>
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</thead>
<tbody>
<tr>
<td>Convertible Arbitrage</td>
<td>0.8183</td>
<td>0.6350</td>
</tr>
<tr>
<td>Emerging Markets</td>
<td>0.9284</td>
<td>0.8301</td>
</tr>
<tr>
<td>Equity Market Neutral</td>
<td>0.4276</td>
<td>0.1258</td>
</tr>
<tr>
<td>Event Driven</td>
<td>0.9232</td>
<td>0.8458</td>
</tr>
<tr>
<td>Fixed Income Arbitrage</td>
<td>0.5407</td>
<td>0.2254</td>
</tr>
<tr>
<td>Global Macro</td>
<td>0.5598</td>
<td>0.2698</td>
</tr>
<tr>
<td>Long/Short</td>
<td>0.4575</td>
<td>-0.1901</td>
</tr>
<tr>
<td>Merger Arbitrage</td>
<td>0.9193</td>
<td>0.8797</td>
</tr>
<tr>
<td>Relative Value</td>
<td>0.6702</td>
<td>0.3042</td>
</tr>
<tr>
<td>Short Selling</td>
<td>0.8811</td>
<td>0.7796</td>
</tr>
<tr>
<td>Distressed Securities</td>
<td>0.8645</td>
<td>0.7218</td>
</tr>
<tr>
<td>Fund of Funds</td>
<td>0.8757</td>
<td>0.7985</td>
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</tbody>
</table>


Return-Based Style Factors

- Non-observed variables that are extracted from fund returns
- Determine a parsimonious set of driving factors that explains a large fraction of the variation in returns
- Typically, principal component analysis is used to find these implicit, common style factors
Many Strategies Exhibit One Major Style Factor

<table>
<thead>
<tr>
<th>Study</th>
<th>Style</th>
<th>Database</th>
<th>Sample period</th>
<th>Sample</th>
<th>Cross-sectional variation explained by principal components</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td># of obs</td>
<td>1st  2nd  3rd</td>
</tr>
<tr>
<td>Fung and Hsieh (1997a)</td>
<td>Hedge funds, CTA pools</td>
<td>Tass, Paradigm LDC</td>
<td>1993-95</td>
<td>409</td>
<td>12% 10% 9%</td>
</tr>
<tr>
<td>Fung and Hsieh (1997b)</td>
<td>CTA pools</td>
<td>Tass</td>
<td>1987-95</td>
<td>75</td>
<td>36% 8% 6%</td>
</tr>
<tr>
<td>Fung and Hsieh (2002)</td>
<td>Convertible bond</td>
<td>Hedge Fund</td>
<td>1998-00</td>
<td>12</td>
<td>59% 13% -</td>
</tr>
<tr>
<td></td>
<td>High-yield bond</td>
<td>Research</td>
<td></td>
<td>20</td>
<td>63% 16% -</td>
</tr>
<tr>
<td></td>
<td>Mortgage-backed</td>
<td>(HFR)</td>
<td></td>
<td>17</td>
<td>55% 17% -</td>
</tr>
<tr>
<td></td>
<td>Fixed-income arbitrage</td>
<td></td>
<td></td>
<td>19</td>
<td>33% 24% 16%</td>
</tr>
<tr>
<td></td>
<td>Fixed-income diversified</td>
<td></td>
<td></td>
<td>39</td>
<td>36% 21% 11%</td>
</tr>
</tbody>
</table>


Asset-Based Style Factors

- An ABS factor is a portfolio of conventional assets defined by a simplified proxy of a particular class of hedge fund strategies (or style)
- To construct ABS factors, extract the common sources of risk in hedge fund returns and link these common sources of risk to observable returns on assets
Examples of ABS Factors

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Study</th>
<th>Data period</th>
<th>Regression result</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long/short equity</td>
<td>Fung and Hsieh (2004)</td>
<td>1994-2002</td>
<td>$0.01 + 0.46 \times (S&amp;P \ 500) + 0.44 \times (\text{Small-cap} - \text{Large-cap})$</td>
<td>0.77</td>
</tr>
<tr>
<td>Fixed-income arbitrage</td>
<td>Fung and Hsieh (2002)</td>
<td>1990-1997</td>
<td>$0.01 - 5.37 \times (\text{Change in credit spread})$</td>
<td>0.30</td>
</tr>
</tbody>
</table>

References:

The Application of ABS Factors

![Figure 3. The Credit Spread, 1924-99](image)

Two Examples of Primitive Trading Strategies

**Merger Arbitrage**
“[...] returns are positively correlated with market returns in severely depreciating markets but uncorrelated with market returns in appreciating markets.”

**Trend Followers**
“The owner of a lookback call option has the right to buy the underlying at the lowest price over the life of the option. Similarly, a lookback put option allows the owner to sell at the highest price. The combination of these two options is the lookback straddle, which delivers ex post maximum payout of any trend-following strategy.”

**Merger Arbitrage Resembles Uncovered Put on Market Index**

Trend-Followers Can Be Replicated by a Lookback Straddle


Roadmap

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ABS Factors For Equity Long/Short

- Sample period 1994-2002
- Regression result:
  \[
  \text{HFR Equity Hedge Index} = 0.01 + 0.46 \times (\text{S&P 500}) + 0.44 \times (\text{SC} - \text{LC})
  \]
  where
  \[
  \text{SC} = \text{Wilshire Small Cap 1750 Index}
  \]
  \[
  \text{LC} = \text{Wilshire Large Cap 750 Index}
  \]
- \(R^2\) of this regression is 0.77


Peer Groups May Shift Style

Style Changes of Merger Arbitrage

January 1990 - December 2001: 36-Month Moving Windows, Computed Monthly


Alternative Measures of Style Drift

- A low tracking error is an indication of a consistent fund
- Style benchmark turnover is the change in the weights defining the style benchmark
- The style drift score uses the variance of the weights

Roadmap

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Style Changes in Fidelity Magallan

Recent Bet of Fidelity

Fidelity Betting Big on Growth (and Homebuilders)
By Dan Lefkovitz | 05-16-07 | 05:40 PM

If a large-growth rally materializes, Fidelity will be ready. According to March 31, 2007, stock ownership information just filed with the SEC, Fidelity moved even further to the right of the large-growth style box during the first quarter, at the aggregate level. Examining Fidelity's big positions and its recent buys and sells reveals a lot about the shop's investment biases.

Different Manager Styles

<table>
<thead>
<tr>
<th>Asset class</th>
<th>Sample From</th>
<th>Full Jan-88</th>
<th>Jan-92</th>
<th>Full May-90</th>
<th>Jun-92</th>
<th>Jul-92</th>
<th>Full May-96</th>
<th>Oct-05</th>
<th>Nov-05</th>
<th>Feb-07</th>
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<tbody>
<tr>
<td>Citigroup 3-month T-bill</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Citigroup USBIG Treasury Index, 1-10 years</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Citigroup USBIG Treasury Index, 10+ years</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2.4%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Citigroup USBIG Corporate Index</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2.4%</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Russell 1000 Value</td>
<td>38.4%</td>
<td>29.0%</td>
<td>37.0%</td>
<td>46.0%</td>
<td>34.4%</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Russell 1000 Growth</td>
<td>44.3%</td>
<td>47.0%</td>
<td>45.6%</td>
<td>-</td>
<td>-</td>
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<td>-</td>
<td>-</td>
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</tr>
<tr>
<td>Russell 2000 Value</td>
<td>2.3%</td>
<td>14.9%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Russell 2000 Growth</td>
<td>7.8%</td>
<td>7.7%</td>
<td>17.4%</td>
<td>29.9%</td>
<td>0.5%</td>
<td>24.2%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lehman Global Ex US Treasury Bond</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2.8%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MSCI EASEA</td>
<td>4.2%</td>
<td>-</td>
<td>-</td>
<td>14.8%</td>
<td>6.3%</td>
<td>18.7%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MSCI Japan</td>
<td>3.1%</td>
<td>1.2%</td>
<td>-</td>
<td>3.2%</td>
<td>1.6%</td>
<td>12.7%</td>
<td>-</td>
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<tr>
<td>MSCI Emerging Markets</td>
<td>-</td>
<td>0.3%</td>
<td>-</td>
<td>0.9%</td>
<td>-</td>
<td>-</td>
<td>1.3%</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Take-Aways

- It is important to understand the potential drawbacks of the selected benchmarks.
- Style rotation complicates the assessment of a fair benchmark even further.
- The fair benchmark might change with a new manager.

Step 1: Determine the Major Style

<table>
<thead>
<tr>
<th>Asset Classes</th>
<th>Basic</th>
<th>Basic plus HFR Merge Advantage Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimization Estimates</td>
<td>$R^2$ (%)</td>
<td>$R^2$ (%)</td>
</tr>
<tr>
<td>Subprime 5 Year Treas</td>
<td>10.5</td>
<td>10.5</td>
</tr>
<tr>
<td>S&amp;P Treasury 1-3 yr</td>
<td>-3.5</td>
<td>-3.5</td>
</tr>
<tr>
<td>S&amp;P Equity 2-4 yr</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>S&amp;P Corporate Bond</td>
<td>0.7</td>
<td>-11.6</td>
</tr>
<tr>
<td>Russell 2000 Value</td>
<td>6.2</td>
<td>6.2</td>
</tr>
<tr>
<td>Russell 1000 Growth</td>
<td>-0.2</td>
<td>2.2</td>
</tr>
<tr>
<td>Russell 2000 Value</td>
<td>0.2</td>
<td>2.7</td>
</tr>
<tr>
<td>Pratice Index Coll</td>
<td>0.2</td>
<td>2.7</td>
</tr>
<tr>
<td>Lehman Global Ex US Bond</td>
<td>-3.2</td>
<td>-3.2</td>
</tr>
<tr>
<td>AIGI EÁESA</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>MSCI Japan</td>
<td>3.1</td>
<td>3.1</td>
</tr>
<tr>
<td>CSRI EÁESP</td>
<td>-0.6</td>
<td>-1.1</td>
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<tr>
<td>HFR Merge Arbitrage</td>
<td>98.4</td>
<td>98.4</td>
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<tr>
<td>$R^2$</td>
<td>21.8</td>
<td>73.8</td>
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<tr>
<td>Adjusted $R^2$</td>
<td>15.3</td>
<td>71.4</td>
</tr>
</tbody>
</table>

Step 2: Understand the Risk Characteristics of a Particular Style

Current Research

- Cremers and Petaijisto (2007)
  How Active Is Your Fund Manager? A New Measure That Predicts Performance
  Working Paper Yale School of Management

- Fung and Hsieh (2007)
  Will Hedge Funds Regress towards Index-like Products?
  forthcoming Journal of Investment Management

- Encyclopedia of Alternative Investments
  edited by G.N. Gregoriou
  forthcoming, Chapman Hall UK

Figure 13  Style analysis with options.