Undergraduate Student Investment Management Fund

Semi-Annual Presentation
Friday December 4th, 2015
Meet the Fund
Overview of Investment Thesis

Invest in securities with two key features:

- **Underpriced**
  - Determined by ranking securities along eleven pricing anomalies

- **High Idiosyncratic Risk**
  - Individual risk of a stock after removing effects (in excess) of market/systematic risk

*Arbitrage Asymmetry and the Idiosyncratic Volatility Puzzle*
Stambaugh, Yu, Yuan (2015)
CAPM and Idiosyncratic Risk

- CAPM assumes the market is in equilibrium and all investors are fully diversified.
- Idiosyncratic risk is not priced/compensated.

1964: CAPM
1968: Levy
1986: Merton
2015: Stambaugh, et al.
CAPM and Idiosyncratic Risk

- Disagreement: The real-world market has frictions that prevent full diversification (Levy 1968, Merton 1986)
  - Diversification has costs (obtaining information, trading costs)
  - Behavioral reasons
- Result: the market is in a state of disequilibrium; idiosyncratic risk is priced and has a positive return

1964: CAPM
1968: Levy
1986: Merton
2015: Stambaugh, et al.
The Idiosyncratic Risk Puzzle

- Ang, et al. (2006) found that idiosyncratic risk actually has a **negative premium**
- This doesn’t make sense either under CAPM or the Levy/Merton imperfect market model
- Instead, Stambaugh, et al. explain it using a combination of **misprricing** and **constraints on arbitrage**
Idiosyncratic Risk Defined: IVOL

\[ R_i = \alpha + \beta_i (R_{mkt} - R_i) + e_i \]

\[ IVOL = \sum_{i=1}^{n} (e_i)^2 \]
Idiosyncratic Risk Defined: IVOL

SPY vs. SSNC Returns
October 2015

SPY Return  SSNC Return

Date


Daily Return (%)

8%
6%
4%
2%
0%
-2%
-4%
-6%
-8%

SPY vs. SONC Returns
October 2015

SPY Return  SONC Return

Date


Daily Returns (%)

8%
6%
4%
2%
0%
-2%
-4%
-6%
-8%
Mispricing

Overpriced Security
- Negative momentum
- High asset growth
- High net stock issuance
- Unprofitable
- High accruals

Underpriced Security
- Positive momentum
- Low asset growth
- Low net stock issuance
- Profitable
- Low accruals
Arbitrage Constraints

- Arbitrage capital cannot fully correct mispricing
- Arbitrage is more constrained in securities with higher IVOL
Arbitrage Constraints

<table>
<thead>
<tr>
<th></th>
<th>Price 9/30/15</th>
<th>Shares</th>
<th>Short Sale Value</th>
<th>Initial Margin Requirement (50%)</th>
<th>Total Margin Requirement</th>
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</thead>
<tbody>
<tr>
<td>SSNC</td>
<td>$70.04</td>
<td>143</td>
<td>$10,016</td>
<td>$5,007</td>
<td>$15,023</td>
</tr>
<tr>
<td>SONC</td>
<td>$22.95</td>
<td>436</td>
<td>$10,006</td>
<td>$5,003</td>
<td>$15,009</td>
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</tbody>
</table>
## Arbitrage Constraints

### SSNC

<table>
<thead>
<tr>
<th>Date</th>
<th>Price</th>
<th>Short Sale Value</th>
<th>Maintenance Margin (30%)</th>
<th>Total Margin Required</th>
<th>Margin Posted</th>
<th>Margin to Spare</th>
</tr>
</thead>
<tbody>
<tr>
<td>9/30</td>
<td>$70.04</td>
<td>$10,015</td>
<td>$3,004</td>
<td>$13,020</td>
<td>$15,023</td>
<td>$2,023</td>
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<td>10/7</td>
<td>$72.60</td>
<td>$10,381</td>
<td>$3,115</td>
<td>$13,496</td>
<td>$15,023</td>
<td>$1,527</td>
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<td>10/12</td>
<td>$73.47</td>
<td>$10,506</td>
<td>$3,152</td>
<td>$13,658</td>
<td>$15,023</td>
<td>$1,365</td>
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<td>10/19</td>
<td>$72.57</td>
<td>$10,378</td>
<td>$3,113</td>
<td>$13,491</td>
<td>$15,023</td>
<td>$1,532</td>
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### SONC

<table>
<thead>
<tr>
<th>Date</th>
<th>Price</th>
<th>Short Sale Value</th>
<th>Maintenance Margin (30%)</th>
<th>Total Margin Required</th>
<th>Margin Posted</th>
<th>Margin to Spare</th>
</tr>
</thead>
<tbody>
<tr>
<td>9/30</td>
<td>$22.95</td>
<td>$10,006</td>
<td>$3,002</td>
<td>$13,008</td>
<td>$15,009</td>
<td>$2,001</td>
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<td>10/7</td>
<td>$24.53</td>
<td>$10,695</td>
<td>$3,209</td>
<td>$13,904</td>
<td>$15,009</td>
<td>$1,105</td>
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<tr>
<td>10/12</td>
<td>$25.23</td>
<td>$11,000</td>
<td>$3,300</td>
<td>$14,300</td>
<td>$15,009</td>
<td>$709</td>
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<tr>
<td>10/19</td>
<td>$26.62</td>
<td>$11,606</td>
<td>$3,482</td>
<td>$15,088</td>
<td>$15,009</td>
<td>($79)</td>
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</table>
Arbitrage Constraints

SSNC Margin Requirements
October 2015

SONC Margin Requirements
October 2015

Assumes 50% initial margin, 30% maintenance margin
Arbitrage Constraints

- The restrictions are not the same on both sides: going long is cheaper than and less risky going short
  - Inherent margin calls (long requires leverage)
  - Outright restrictions in many funds
Asymmetric Arbitrage

Overpriced Securities + Unable to Short = Negative Expected Return

Underpriced Securities + Unable to Long = Positive Expected Return

Negative Overall Expected Return to IVOL
Asymmetric Returns

1922

The Journal of Finance

IVOL Effect (Basis Points)

Mispricing (Average Percentile)
## Returns

<table>
<thead>
<tr>
<th></th>
<th>Highest IVOL</th>
<th>Lowest IVOL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Most Overpriced 20%</strong></td>
<td>-1.89% (-12.05)</td>
<td>-0.39% (-3.04)</td>
</tr>
<tr>
<td><strong>Next 20%</strong></td>
<td>-0.88% (-5.86)</td>
<td>-0.04% (-0.44)</td>
</tr>
<tr>
<td><strong>Mid 20%</strong></td>
<td>-0.09% (-0.53)</td>
<td>0.02% (0.18)</td>
</tr>
<tr>
<td><strong>Next 20%</strong></td>
<td>-0.15% (-0.80)</td>
<td>0.23% (3.22)</td>
</tr>
<tr>
<td><strong>Most Underpriced 20%</strong></td>
<td>0.56% (3.27)</td>
<td>0.14% (2.04)</td>
</tr>
<tr>
<td><strong>Most Overpriced – Most Underpriced (Long/Short)</strong></td>
<td>-0.44% (-11.07)</td>
<td>-0.53% (-3.43)</td>
</tr>
</tbody>
</table>
Our Implementation

- Changes to mispricing metric
  - Five measures: asset growth, profitability, momentum, net stock issuance, accruals
- Long-only, no leverage
Anomaly Selection

• Goal: narrow down 11 mispricing anomalies from IVOL Theory to 5 to make mispricing forecasts more manageable

• Choose based on:
  • Confidence in supporting research & returns
  • Ease of calculation
  • Covariances
Advantages to SIM Fund Implementation

1. Long-only, no leverage = no risk of margin calls
2. Small investment size = no price impact
3. No redemption risk
IVOL Strategy Implementation
Portfolio Construction Process

1. Identify Data Sources and Charter Constraints
2. Choose Anomalies for Underpricing
3. Calculate and Rank Universe on Anomalies
4. Calculate and Rank Universe on IVOL
5. Select Securities from Intersection
Data Sources & SQL Server

<table>
<thead>
<tr>
<th><strong>Bloomberg</strong></th>
<th><strong>CRSP</strong></th>
<th><strong>Datastream</strong></th>
<th><strong>XBRL</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Equity Financial Data</td>
<td>• Equity Universe Data</td>
<td>• Returns Data</td>
<td>• Equity Financial Data</td>
</tr>
<tr>
<td>• Used for anomaly calculations</td>
<td>• Used for universe screening, anomaly calculations</td>
<td>• Used for anomaly calculations</td>
<td>• Possible Future Implementation</td>
</tr>
</tbody>
</table>

• Also created and implemented a SQL Server to store anomaly and portfolio data
• Will be used by future SIM Fund groups
Charter Constraints (Initial Universe)

- Firm domiciled in U.S.
- Price > $5.00
- Market cap > $1.2 billion
- Average Volume > 5,000 shares per day
Accruals

• Firms that have a lower accrual portion of their income (compared with the cash component of their income) generate abnormal higher returns
• Investors do not fully account for cash’s predictive power for future earnings
• Used Bloomberg – Quarterly Data
  • 1,102 securities ranked and matched

Accruals = (ΔCA - ΔCash) - (Δ CL - Δ STD - Δ TP) - Dep

Asset Growth

\[
\text{Asset Growth} = \left( \frac{\text{Assets}_{t-1}}{\text{Assets}_{t-12}} \right) - 1
\]

*Asset Growth and the Cross-Section of Stock Returns*

Cooper, Gulen, and Schill (2008)

- Firms that invest more (higher asset growth) have lower expected future returns than those that invest less (lower asset growth) over the next five years
- Used Bloomberg data to find total assets in Q3 2015 and Q3 2014
  - 1,102 securities ranked and matched
Momentum

- Momentum states that buying past short-term “winners” and selling past short-term “losers” provides excess returns.
- Used Thompson Reuters Datastream for return data from October 31, 2014 – September 30, 2015 to calculate momentum factors:
  - 1,239 securities ranked and matched.
- Strategy has been used as a stand-alone for SIM Fund in several prior years.

\[
\text{Momentum} = \text{Compound Returns from } t-12 \rightarrow t-2
\]

*Returns to Buying Winners and Selling Winners: Implications for Stock Market Efficiency*
Jegadeesh, Titman (1993)
Net Issuance

- Firms issue stock when management believes stock is overvalued and repurchases when management believes stock is undervalued.
- Firms with lower net issuance numbers are ranked favorably, and strategy yields significant positive returns over holding periods from 3 months – 3 years.
- Share data retrieved from CRSP.
  - 1,428 securities ranked and matched.

Net Issuance = \( \log(\text{Adj. Shares Out})_t - \log(\text{Adj. Shares Out})_{t-11} \)
Profitability

- Firms with higher gross profit numbers as a proportion of total assets are expected to generate abnormally high future returns
- Gross Profit and Total Asset data pulled from Bloomberg
  - 1,102 securities ranked and matched

Profitability = (Gross Profit) / (Total Assets)
Aggregate Anomaly Underpricing Rankings

- Every firm rated on each anomaly and captured in a table
- Simple average rank of all anomalies combined into final “aggregate underpricing ranking”
  - Firms with incomplete data for more than 1 anomaly were excluded

<table>
<thead>
<tr>
<th>Ticker</th>
<th>Accruals</th>
<th>Asset Growth</th>
<th>Momentum</th>
<th>Net Issuance</th>
<th>Profitability</th>
<th>Aggregate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company A</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Company B</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2.4</td>
</tr>
<tr>
<td>Company C</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Simple Average

Worst

Best
Idiosyncratic Volatility (IVOL)

• Collect daily total return data for entire universe
• Regress each security's return against S&P over a one-month period as shown below
  o Regressions run in both MatLab and Python for confirmation
• Sum of Squared Residuals from each regression collected and used to rank securities
  o Highest SSR ranked = highest IVOL

\[ \text{Return}_i = \alpha + \beta_i \left( \text{Return}_{\text{S&P500}} \right) + \varepsilon_i \]
Portfolio Construction

• Initial portfolio formed on intersection of top 30% in underpricing and IVOL rankings
• Independently excluded firms in M&A situations or with high-impact recent news
• Market cap-weighted, but with a 50bp floor and 5% ceiling
• First month: 46 securities purchased
Portfolio Mkt Cap Breakout

- Large (>10B USD): 24%
- Mid (2-10B USD): 56%
- Small (<2B USD): 20%
Sector Weights

- Consumer Discretionary: 37%
- Health Care: 22%
- Technology: 15%
- Consumer Staples: 9%
- Industrials: 9%
- Communications: 2%
- Energy: 4%
- Financial: 2%
## Returns

<table>
<thead>
<tr>
<th></th>
<th>IVOL</th>
<th>S&amp;P 500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return To Date:</td>
<td>2.15%</td>
<td>0.02%</td>
</tr>
<tr>
<td>Annualized Standard Dev:</td>
<td>8.69</td>
<td>4.21</td>
</tr>
</tbody>
</table>
Looking Forward

• Fully implement SQL Server
  • Store portfolio data and returns
  • Use for portfolio analytics
• Begin using XBRL data
• Analyze different ranking techniques (non-simple average)
• Fundamental Analysis
• Knowledge Transfer
At this time we would be happy to take your questions
Appendix

Anomaly Correlations

<table>
<thead>
<tr>
<th>Anomaly</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
<th>(9)</th>
<th>(10)</th>
<th>(11)</th>
<th>(12)</th>
</tr>
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<tbody>
<tr>
<td><strong>Panel A. Correlations: long minus short</strong></td>
<td></td>
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<tr>
<td>(1) Failure probability</td>
<td>1.00</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>(2) Olson's O (distress)</td>
<td>0.47</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>(3) Net stock issues</td>
<td>0.27</td>
<td>0.20</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(4) Composite equity issues</td>
<td>0.20</td>
<td>0.11</td>
<td>0.43</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(5) Total accruals</td>
<td>0.15</td>
<td>0.08</td>
<td>0.15</td>
<td>0.11</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(6) Net operating assets</td>
<td>0.09</td>
<td>0.16</td>
<td>0.22</td>
<td>0.10</td>
<td>0.26</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>(7) Momentum</td>
<td>0.62</td>
<td>0.18</td>
<td>0.22</td>
<td>0.25</td>
<td>0.15</td>
<td>0.14</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(8) Gross profitability</td>
<td>0.36</td>
<td>0.34</td>
<td>0.21</td>
<td>0.01</td>
<td>-0.12</td>
<td>0.13</td>
<td>0.19</td>
<td>1.00</td>
<td></td>
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<tr>
<td>(9) Asset growth</td>
<td>0.09</td>
<td>0.03</td>
<td>0.36</td>
<td>0.22</td>
<td>0.22</td>
<td>0.36</td>
<td>0.17</td>
<td>-0.01</td>
<td>1.00</td>
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<td>(10) Return on assets</td>
<td>0.58</td>
<td>0.41</td>
<td>0.16</td>
<td>0.01</td>
<td>0.03</td>
<td>0.02</td>
<td>0.31</td>
<td>0.38</td>
<td>-0.03</td>
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<td>(11) Investment-to-assets</td>
<td>-0.02</td>
<td>-0.01</td>
<td>0.19</td>
<td>0.12</td>
<td>0.34</td>
<td>0.32</td>
<td>0.08</td>
<td>-0.08</td>
<td>0.51</td>
<td>-0.08</td>
<td>1.00</td>
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<tr>
<td>(12) Combination</td>
<td>0.77</td>
<td>0.52</td>
<td>0.52</td>
<td>0.39</td>
<td>0.42</td>
<td>0.42</td>
<td>0.68</td>
<td>0.43</td>
<td>0.44</td>
<td>0.56</td>
<td>0.35</td>
<td>1.00</td>
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<tr>
<td><strong>Panel B. Excess returns</strong></td>
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<td></td>
</tr>
<tr>
<td>Long leg (mean)</td>
<td>0.94</td>
<td>0.51</td>
<td>0.70</td>
<td>0.62</td>
<td>0.72</td>
<td>0.71</td>
<td>1.11</td>
<td>0.69</td>
<td>1.00</td>
<td>0.64</td>
<td>0.91</td>
<td>0.76</td>
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<tr>
<td>Short leg (mean)</td>
<td>-0.01</td>
<td>-0.19</td>
<td>0.07</td>
<td>0.20</td>
<td>0.13</td>
<td>0.06</td>
<td>-0.45</td>
<td>0.29</td>
<td>0.04</td>
<td>-0.34</td>
<td>0.15</td>
<td>-0.01</td>
</tr>
<tr>
<td>Long minus short (mean)</td>
<td>0.95</td>
<td>0.70</td>
<td>0.63</td>
<td>0.42</td>
<td>0.58</td>
<td>0.65</td>
<td>1.56</td>
<td>0.40</td>
<td>0.96</td>
<td>0.98</td>
<td>0.75</td>
<td>0.77</td>
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<tr>
<td>Long leg (t-statistic)</td>
<td>3.97</td>
<td>2.18</td>
<td>3.66</td>
<td>3.47</td>
<td>2.54</td>
<td>2.98</td>
<td>3.81</td>
<td>3.20</td>
<td>3.82</td>
<td>2.56</td>
<td>3.65</td>
<td>3.57</td>
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<tr>
<td>Short leg (t-statistic)</td>
<td>-0.01</td>
<td>-0.51</td>
<td>0.27</td>
<td>0.79</td>
<td>0.40</td>
<td>0.22</td>
<td>-1.23</td>
<td>1.33</td>
<td>0.14</td>
<td>-0.08</td>
<td>0.57</td>
<td>-0.05</td>
</tr>
<tr>
<td>Long minus short (t-statistic)</td>
<td>2.55</td>
<td>2.83</td>
<td>5.11</td>
<td>2.59</td>
<td>3.11</td>
<td>4.41</td>
<td>5.45</td>
<td>2.45</td>
<td>5.34</td>
<td>3.53</td>
<td>5.22</td>
<td>6.91</td>
</tr>
<tr>
<td><strong>Panel C. Benchmark-adjusted returns</strong></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Long leg (mean)</td>
<td>0.39</td>
<td>0.21</td>
<td>0.20</td>
<td>0.02</td>
<td>0.26</td>
<td>0.25</td>
<td>0.63</td>
<td>0.43</td>
<td>0.22</td>
<td>0.38</td>
<td>0.17</td>
<td>0.28</td>
</tr>
<tr>
<td>Short leg (mean)</td>
<td>-1.16</td>
<td>-0.93</td>
<td>-0.46</td>
<td>-0.41</td>
<td>-0.34</td>
<td>-0.51</td>
<td>-1.14</td>
<td>-0.23</td>
<td>-0.44</td>
<td>-0.90</td>
<td>-0.37</td>
<td>-0.60</td>
</tr>
<tr>
<td>Long minus short (mean)</td>
<td>1.55</td>
<td>1.13</td>
<td>0.66</td>
<td>0.43</td>
<td>0.61</td>
<td>0.76</td>
<td>1.77</td>
<td>0.66</td>
<td>0.66</td>
<td>1.28</td>
<td>0.54</td>
<td>0.87</td>
</tr>
<tr>
<td>Long leg (t-statistic)</td>
<td>3.39</td>
<td>3.37</td>
<td>3.87</td>
<td>0.29</td>
<td>1.85</td>
<td>2.27</td>
<td>4.95</td>
<td>4.42</td>
<td>1.76</td>
<td>4.40</td>
<td>1.59</td>
<td>7.66</td>
</tr>
<tr>
<td>Short leg (t-statistic)</td>
<td>-4.53</td>
<td>-6.17</td>
<td>-4.62</td>
<td>-3.85</td>
<td>-2.24</td>
<td>-4.75</td>
<td>-5.11</td>
<td>-2.19</td>
<td>-3.93</td>
<td>-4.29</td>
<td>-3.30</td>
<td>-7.07</td>
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<tr>
<td>Long minus short (t-statistic)</td>
<td>5.00</td>
<td>7.13</td>
<td>5.96</td>
<td>3.18</td>
<td>3.09</td>
<td>4.98</td>
<td>5.82</td>
<td>4.30</td>
<td>3.94</td>
<td>5.48</td>
<td>3.78</td>
<td>9.38</td>
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