Does Return Horizon Matter? 
Implications for stock returns, mutual fund returns, and investment performance measurement

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Some little known investment research history

In the mid 1960s, staff at the University of Chicago developed the first comprehensive stock return database.

- Now known as the Center for Research in Securities Prices (CRSP) database.

The question arose, at what frequency should we measure returns?

The leadership declared that we shall study monthly returns.

Upon observation that history contains many months, the leadership further declared that we should focus our studies upon the arithmetic mean of the monthly returns.

And so it has been done, for over fifty years.

Please be aware that this slide is a spoof, and there is no need to call Snopes.
Most studies of stock market performance are based on monthly returns: we know a lot about the parameters of monthly returns. 
- Means, variances, skewness, betas, alphas, Sharpe ratios, etc.

But most investors’ horizons are much longer.

Most under-diversified investments in stocks underperform benchmarks in the long run.
- True for individual stocks, and also for active mutual funds.

Widely used measures of investment performance such as the Sharpe Ratio or (Jensen’s) Alpha are different over long vs. short horizons.
This discussion is based on:

“Do stocks outperform Treasury Bills?”

“Do global stocks outperform US Treasury Bills?”

“Why do so many mutual funds underperform?”
work in progress with Michael Cooper and Feng Zhang.
Do Global Stocks Outperform US Treasury Bills?

- We study compound returns to 61,981 common stocks issued by 61,100 firms, drawn from 42 countries, 1990 to 2018.
  - Including 3,731 stocks from India.

- Return data is from CRSP, Compustat Global, and Compustat North America.

- Returns are measured in US dollars to provide a common benchmark.
Figure 1: Percent of Stock/Months with Indicated Return

- Blue line: US Stocks
- Red line: Non-US Stocks

The graph illustrates the distribution of monthly returns for US and non-US stocks, showing the percent of stocks with the indicated returns.
Figure 2: Percent of Stock-Years with Indicated Buy-and-Hold Return

- **US Stocks**
- **Non-US Stocks**
Figure 3: Percent of Stock-Decades with Indicated Buy-and-Hold Return

- US Stocks
- Non-US Stocks
Figure 4: Percent of Stocks with Indicated Full Sample Period Buy-and-Hold Return

- US Stocks
- Non-US Stocks
Buy-and-Hold Returns, 1990-2018

In India, 41.4% of stocks outperform US T-bills over the full sample.
“Wealth Creation” by Stock Investing

We measure, as of December 2018, the difference between the wealth of investors who held common stocks as compared to investing the same capital in one month Treasury Bills.

This is also the “Net Future Value” of the series of cash flows to investors in aggregate.

It is also the December 2018 Market Capitalization of the stock, minus the December 2018 equivalent of shareholder equity infusions, plus the December 2018 equivalent of dividends and share repurchases.
<table>
<thead>
<tr>
<th>Firm Name</th>
<th>Country</th>
<th>PERMCO/GVKEY*</th>
<th>Wealth Created ($US millions)</th>
<th>Accumulated % of Global Gross Wealth Creation</th>
<th>Accumulated % of Global Net Wealth Creation</th>
<th>Annualized Dollar Weighted Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPLE INC</td>
<td>U.S.</td>
<td>7</td>
<td>1,006,035</td>
<td>1.51%</td>
<td>2.25%</td>
<td>21.00%</td>
</tr>
<tr>
<td>MICROSOFT CORP</td>
<td>U.S.</td>
<td>8048</td>
<td>954,787</td>
<td>2.95%</td>
<td>4.38%</td>
<td>17.77%</td>
</tr>
<tr>
<td>AMAZON COM INC</td>
<td>U.S.</td>
<td>15473</td>
<td>696,738</td>
<td>3.99%</td>
<td>5.94%</td>
<td>29.35%</td>
</tr>
<tr>
<td>ALPHABET INC</td>
<td>U.S.</td>
<td>45483</td>
<td>528,536</td>
<td>4.79%</td>
<td>7.12%</td>
<td>17.62%</td>
</tr>
<tr>
<td>EXXON MOBIL CORP</td>
<td>U.S.</td>
<td>20678</td>
<td>515,827</td>
<td>5.56%</td>
<td>8.27%</td>
<td>11.26%</td>
</tr>
<tr>
<td>BERKSHIRE HATHAWAY INC DEL</td>
<td>U.S.</td>
<td>540</td>
<td>438,959</td>
<td>6.22%</td>
<td>9.26%</td>
<td>12.12%</td>
</tr>
<tr>
<td>JOHNSON &amp; JOHNSON</td>
<td>U.S.</td>
<td>21018</td>
<td>437,430</td>
<td>6.88%</td>
<td>10.23%</td>
<td>13.87%</td>
</tr>
<tr>
<td>WALMART INC</td>
<td>U.S.</td>
<td>21880</td>
<td>407,376</td>
<td>7.49%</td>
<td>11.14%</td>
<td>13.13%</td>
</tr>
<tr>
<td>TENCENT HOLDINGS LTD</td>
<td>Hong Kong</td>
<td>270615*</td>
<td>377,356</td>
<td>8.06%</td>
<td>11.99%</td>
<td>50.10%</td>
</tr>
<tr>
<td>ALTRIA GROUP INC</td>
<td>U.S.</td>
<td>21398</td>
<td>360,711</td>
<td>8.60%</td>
<td>12.79%</td>
<td>17.12%</td>
</tr>
<tr>
<td>NESTLE SA/AG</td>
<td>Switzerland</td>
<td>016603*</td>
<td>354,068</td>
<td>9.13%</td>
<td>13.59%</td>
<td>12.88%</td>
</tr>
<tr>
<td>PROCTER &amp; GAMBLE CO</td>
<td>U.S.</td>
<td>21446</td>
<td>315,778</td>
<td>9.60%</td>
<td>14.29%</td>
<td>12.59%</td>
</tr>
<tr>
<td>INTEL CORP</td>
<td>U.S.</td>
<td>2367</td>
<td>312,027</td>
<td>10.07%</td>
<td>14.99%</td>
<td>16.23%</td>
</tr>
<tr>
<td>JPMORGAN CHASE &amp; CO</td>
<td>U.S.</td>
<td>20436</td>
<td>298,095</td>
<td>10.52%</td>
<td>15.65%</td>
<td>9.16%</td>
</tr>
<tr>
<td>SAMSUNG ELECTRONICS CO LTD</td>
<td>South Korea</td>
<td>104604*</td>
<td>284,884</td>
<td>10.95%</td>
<td>16.29%</td>
<td>18.61%</td>
</tr>
<tr>
<td>HOME DEPOT INC</td>
<td>U.S.</td>
<td>5085</td>
<td>282,676</td>
<td>11.37%</td>
<td>16.92%</td>
<td>16.17%</td>
</tr>
<tr>
<td>COCA COLA CO</td>
<td>U.S.</td>
<td>20468</td>
<td>281,365</td>
<td>11.80%</td>
<td>17.55%</td>
<td>12.99%</td>
</tr>
<tr>
<td>ROCHE HOLDING AG</td>
<td>Switzerland</td>
<td>025648*</td>
<td>276,330</td>
<td>12.21%</td>
<td>18.17%</td>
<td>13.80%</td>
</tr>
<tr>
<td>CHEVRON CORP NEW</td>
<td>U.S.</td>
<td>20440</td>
<td>270,235</td>
<td>12.62%</td>
<td>18.77%</td>
<td>11.05%</td>
</tr>
<tr>
<td>MERCK &amp; CO INC NEW</td>
<td>U.S.</td>
<td>21188</td>
<td>266,496</td>
<td>13.02%</td>
<td>19.37%</td>
<td>11.96%</td>
</tr>
<tr>
<td>UNITEDHEALTH GROUP INC</td>
<td>U.S.</td>
<td>7267</td>
<td>264,762</td>
<td>13.42%</td>
<td>19.96%</td>
<td>21.28%</td>
</tr>
<tr>
<td>NOVARTIS AG</td>
<td>Switzerland</td>
<td>101310*</td>
<td>249,576</td>
<td>13.79%</td>
<td>20.52%</td>
<td>9.96%</td>
</tr>
<tr>
<td>ORACLE CORP</td>
<td>U.S.</td>
<td>8045</td>
<td>245,690</td>
<td>14.16%</td>
<td>21.07%</td>
<td>19.43%</td>
</tr>
<tr>
<td>PFIZER INC</td>
<td>U.S.</td>
<td>21394</td>
<td>231,589</td>
<td>14.51%</td>
<td>21.59%</td>
<td>7.04%</td>
</tr>
<tr>
<td>VISA INC</td>
<td>U.S.</td>
<td>52983</td>
<td>231,202</td>
<td>14.85%</td>
<td>22.10%</td>
<td>22.85%</td>
</tr>
</tbody>
</table>
Concentration of Wealth Creation

Figure 5: Cumulative Percentage of Global Dollar Wealth Creation, All Sample Firms

- Gross Wealth
- Net Wealth
Concentration of Wealth Creation

Figure 6: Cumulative Percentage of Global Dollar Wealth Creation, Top 1000 Firms

- Gross Wealth
- Net Wealth
India

The best performing 1% of stocks account for 83% of net wealth creation, 1990 to 2018.

Tata was the single largest wealth creator.
In the long run, most global stocks underperform US Treasury Bills.

Actual wealth gains to investors are driven by a few very successful stocks.

These results reflect that long horizon returns are strongly positively skewed, even if short horizon returns are not.
Implications for Active vs. Passive

- For investors without comparative advantage in stock picking, and mean-variance preferences.
  - The results reinforce the importance of diversification.
  - But, from a different perspective – you don’t want to take a chance on missing the four percent of stocks that generate all the wealth.
  - This is probably the key takeaway for many investors.

- For investors with skewness preference:
  - Skewness diversifies; you may want fewer stocks.

- For investors with comparative advantage in stock picking.
  - The potential gains are larger than may previously have been recognized.
How about portfolios?

Some preliminary results regarding US equity mutual funds.

Ongoing work with Feng Zhang and Mike Cooper.

CRSP survivorship-bias free mutual fund database,

January 1991 to December 2018.
**Lifetime (full sample) compound returns to active US equity funds, 1991 to 2018**

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Mean</th>
<th>Median</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fund life (months)</td>
<td>8743</td>
<td>130.2</td>
<td>108.0</td>
<td>0.65</td>
</tr>
<tr>
<td>Outperform market</td>
<td>8743</td>
<td>23.9%</td>
<td>0.0%</td>
<td>1.23</td>
</tr>
<tr>
<td>Outperform SPY</td>
<td>8743</td>
<td>29.2%</td>
<td>0.0%</td>
<td>0.91</td>
</tr>
<tr>
<td>Outperform T-Bill</td>
<td>8743</td>
<td>74.5%</td>
<td>100.0%</td>
<td>-1.13</td>
</tr>
<tr>
<td>Fund compound return</td>
<td>8743</td>
<td>178.5%</td>
<td>66.8%</td>
<td>4.70</td>
</tr>
<tr>
<td>Market compound return</td>
<td>8743</td>
<td>213.4%</td>
<td>119.7%</td>
<td>2.51</td>
</tr>
<tr>
<td>SPY compound return</td>
<td>8743</td>
<td>195.4%</td>
<td>114.8%</td>
<td>2.43</td>
</tr>
</tbody>
</table>
Fees and long term mutual fund performance

We know that on average active mutual funds underperform, due to their fees and expenses.

So, add back fees to mutual fund returns:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Median</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outperform market</td>
<td>38.40%</td>
<td>0.00%</td>
<td>0.486</td>
</tr>
<tr>
<td>Outperform SPY</td>
<td>44.60%</td>
<td>0.00%</td>
<td>0.497</td>
</tr>
<tr>
<td>Outperform T-Bill</td>
<td>79.30%</td>
<td>100.00%</td>
<td>0.405</td>
</tr>
<tr>
<td>Fund compound return</td>
<td>241.56%</td>
<td>83.43%</td>
<td>4.900</td>
</tr>
<tr>
<td>Market compound return</td>
<td>213.35%</td>
<td>119.68%</td>
<td>3.114</td>
</tr>
<tr>
<td>SPY compound return</td>
<td>195.39%</td>
<td>114.77%</td>
<td>2.824</td>
</tr>
</tbody>
</table>
Other Observations Regarding Return Horizon

- Investment horizon, decision horizon, and return measurement horizon differ.
- As horizon increases:
  - Expected return increases
  - Variance of returns increases
  - Covariances between return pairs tend to increase.
  - Skewness increases.
  - Not proportionate to time, or to each other.
- The following slides contain some illustrations.
- These assume returns are independent and identically distributed through time.
- These focus on true, not estimated, parameters.
Return volatility grows much faster than horizon, and also faster than expected return.

Mean and Variance of Long Horizon Returns, when monthly mean is 0.75% and monthly standard deviation is 5%
True Sharpe Ratio for various investment horizons, iid returns (illustration)
Covariances

The Sharpe Ratio differs with horizon because expected return and variance grow with horizon, but non-linearly and at different rates.

Covariances also depend on horizon, and the relation is complex.

Implies that betas depend on horizon.

Which implies that alphas depend on horizon.
Illustrating of Horizon effects on Alpha

Ten Year Alphas (Annualized)

Correlation of Fund with Rest of Market

- Short Run Alpha = -6%
- Short Run Alpha = 0%
- Short Run Alpha = 6%
What is the interpretation?

- Zero short run alpha does not (except when beta = 1) imply zero long run alpha.

- Is this an indictment of alpha as a measure of skill? As a statistic for testing an asset pricing model?

- Jensen (1968) motivated alpha based on the CAPM, a single period model.
  - “The measure of portfolio performance summarized below is derived from a *direct application* of the theoretical results of the capital asset pricing models derived independently by Sharpe [20], Lintner [15] and Treynor [25].”

- The sign can even change, particularly for funds with positive short alpha and high short betas.
## Estimates from the Data: Short and Long Run Alpha for US Equity Mutual Funds, 1991-2018

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Mean</th>
<th>Median</th>
<th>Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subsample where monthly beta &gt; 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monthly alpha</td>
<td>3426</td>
<td>-0.15%</td>
<td>-0.08%</td>
<td>36.54%</td>
</tr>
<tr>
<td>Long Run Alpha</td>
<td>3426</td>
<td>-0.52%</td>
<td>-0.32%</td>
<td>12.99%</td>
</tr>
<tr>
<td><strong>Subsample where monthly beta &lt; 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monthly alpha</td>
<td>5317</td>
<td>-0.08%</td>
<td>-0.04%</td>
<td>43.45%</td>
</tr>
<tr>
<td>Long Run Alpha</td>
<td>5317</td>
<td>0.05%</td>
<td>0.03%</td>
<td>54.07%</td>
</tr>
</tbody>
</table>
Summary:

- Return horizon matters.
- We know a lot about the empirical distribution of short horizon returns.
- But investor horizons may be longer. All of the following depend on return measurement horizon, and not in simple ways:
  - Mean or expected return
  - Skewness of return
  - Variance of return.
  - Covariances of returns
  - Return betas
  - Return alphas
- We should be thinking more about long horizon returns.