Portfolio Returns Assignment: R&D Capital Replication

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**Objective:**

The objective of this assignment was to replicate the portfolio returns analysis with respect to R&D Capital Expenditure, as shown in class.

**Data Sources:**

* ***Annual*** Stock level information(CRSP-CompStat Merged Fundamentals Annual table; WRDS)
* ***Monthly*** returns and market Capitalisation data ( Monthly Stock table; WRDS)
* ***Monthly*** Market and Fama-French factor data ( Kenneth R. French Data Library)

**Pre-Processing:**

* Null Handling, including discarding non-numeric returns.
* Filtered out NULL/ “A” Share-Class. Currency limited to US Dollars.
* Adjusted for delay in release of financial statements by trading on the information in the following year
* Working on Share Code 10/11 only. Discarding Financial Companies (SIC Codes not in 6000 – 6999)

**Methodology:**

The following methodology was adopted

1. Creating Sorted Portfolios
   1. Equal-weighted sorted portfolio
      1. Stocks split *monthly* into 6 brackets ( 5 quantiles from Low-High + 1 N/A R&D bucket)
      2. Average returns of each bracket calculated on a monthly basis
   2. Value-weighted sorted portfolio
      1. Stocks split similar to equally weighted portfolio
      2. Weighted average of returns by market cap of each bracket calculated on a monthly basis
   3. Equal-weighted sorted portfolio, without top 1000 companies
      1. Stocks split in 6 brackets, discarded top 1000 companies, by market capitalisation
      2. Average returns of each bracket calculated on a monthly basis
   4. Value-weighted sorted portfolio without top 1000 companies
      1. Stocks split in 6 brackets, discarded top 1000 companies, by market capitalisation
      2. Weighted average of returns by market cap of each bracket calculated on a monthly basis

Average Returns for each portfolio was calculate over different time periods: 1981 – 2012; 1981 – 2000; 2000 – 2012; and 2013 – 2020

1. Creating Long (High R&D) – Short (Low R&D) portfolios
   1. A long short portfolio was created by long-ing the stocks in the high R&D quantile and shorting the stocks in the low R&D quantile. Subtracting the risk free rate from the portfolio to get the portfolio’s risk premium
   2. An identical approach was applied across all four portfolios and the returns were regressed against the Market Risk Premium (for CAPM) and; Market Risk Premium, SMB and HML (for Fama-French 3 factor model)
   3. The alphas for the models, and the sharpe ratios corresponding to the portfolios were also computed.

**Insights and Recommendations:**

Equally Weighted Returns

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Value-Weighted Returns

Table

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Ex-Top 1000 MV Stocks; Equally Weighted

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Ex-Top 1000 MV Stocks; Value Weighted

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**Portfolio Performance Metrics:**

Portfolio performance for Period up to 2012

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Portfolio performance for Period up to 2013-2020

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The analysis and the corresponding plots indicate that High R&D investment firms do indeed outperform Low R&D quantile firms. regardless of how the stocks are weighted in the portfolio.

Value weighted Portfolios created after excluding the large cap companies seem to have a very high alpha(≈3%). These alphas are statistically significant (p is <0.000).

These alphas disappear (not significant)when the large cap companies are taken into account (p ≈ 0.016).

Thus, it is recommended that we invest in a value weighted, Long-Short sorted portfolio (on R&D investment), excluding top 1000 companies by market cap.

**Appendix:**

Chart, line chart

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Value Weighted portfolios

Chart, line chart

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Value Weighted portfolios (ex-Top 1000 Stocks)