Replication: Factor Momentum

Based on Arnott, Kalesnik, & Linnainmaa (2023)

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Arnott, Kalesnik & Linnainmaa (2023) – *Factor Momentum*

Main Idea:

- Extends momentum research to factor portfolios—showing that factor returns themselves exhibit momentum.
- Finds that factor momentum **subsumes** industry momentum.
- Uses principal component analysis to identify systematic sources of momentum.

Key Insight:

- Momentum is strongest in high-eigenvalue factors explaining most of cross-sectional returns.
- Momentum arises from systematic components, not just stock-level trends.

Relevance: Our replication reproduces Appendix plots comparing factor and industry momentum.

Ehsani & Linnainmaa (2022) – *Factor Momentum and the Momentum Factor*

Contribution:

- Shows that momentum in stock returns stems from momentum in factor returns.
- Factors show strong autocorrelation: winners stay winners, losers stay losers.

Interpretation:

- Momentum reflects timing of factor exposures, not a separate risk factor.
- Complements Arnott et al. (2023) by providing theoretical grounding.

Link: Our replication validates these findings using Fama–French and JKP datasets.

AQR Alternative Trends UCITS Fund (2025) – *Practical Application*

Context:

- AQR's trend-following fund applies cross-asset and factor momentum.
- Combines price-based and fundamental trend signals across global assets.

Performance (Q1 2025 Report):

- Annualized return: 11.9%; Sharpe ratio: 0.76.
- Low equity correlation (-0.20) and positive macro exposure.

Outline

Data Description

Datasets Used:

- **Fama–French 17 Industry Portfolios:** Monthly excess returns (July 1963–Dec 2024).
- **JKP Factors:** Cross-sectional factor returns (value, profitability, investment, quality, risk).
- **Thematic Factors:** Growth, leverage, volatility, and other economic themes.

Data Processing:

- Cleaned and aligned to a common monthly sample.
- Standardized names and applied readable labels.

Final Sample: July 1963 – December 2024 (U.S. market).

Outline

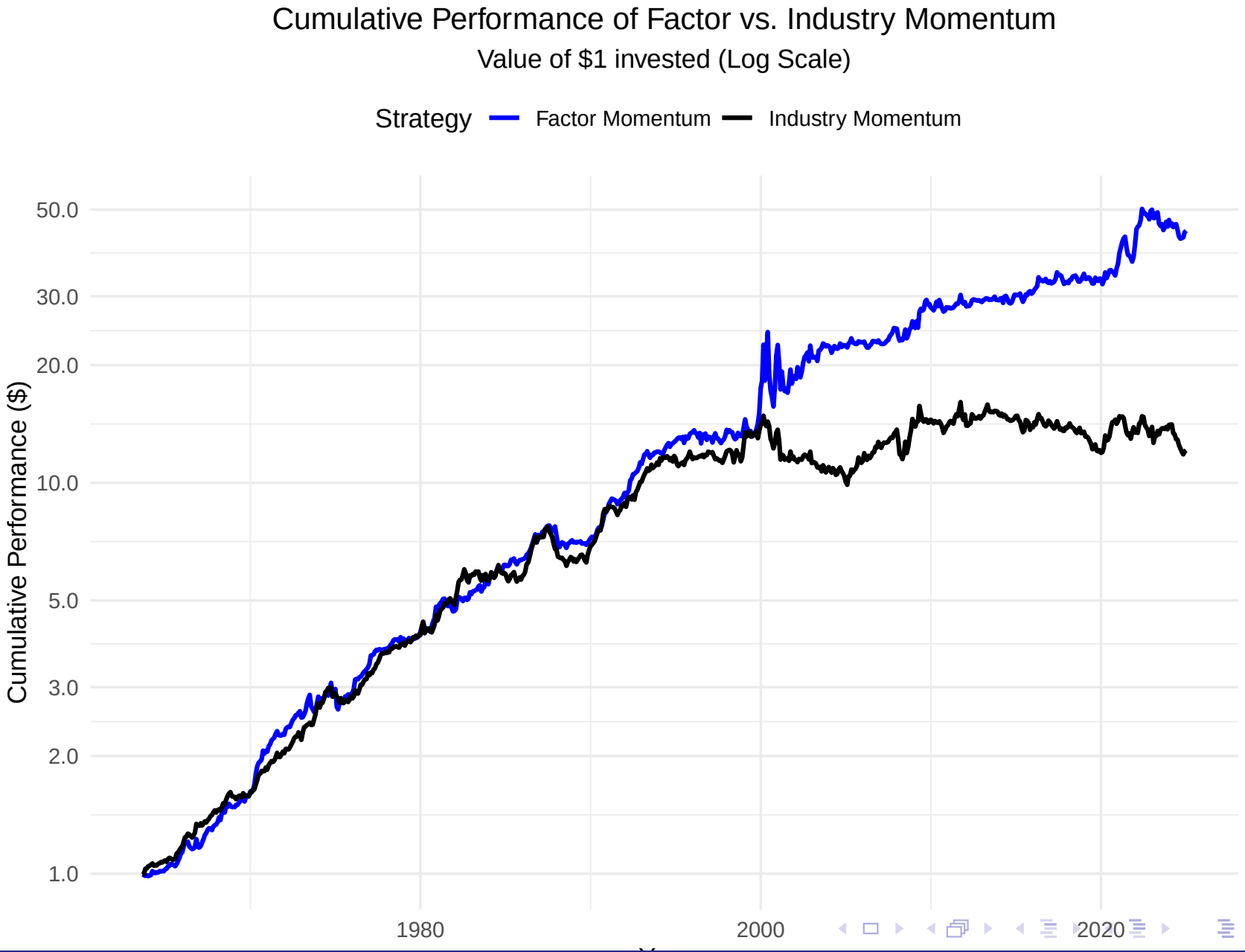
Replication Methodology

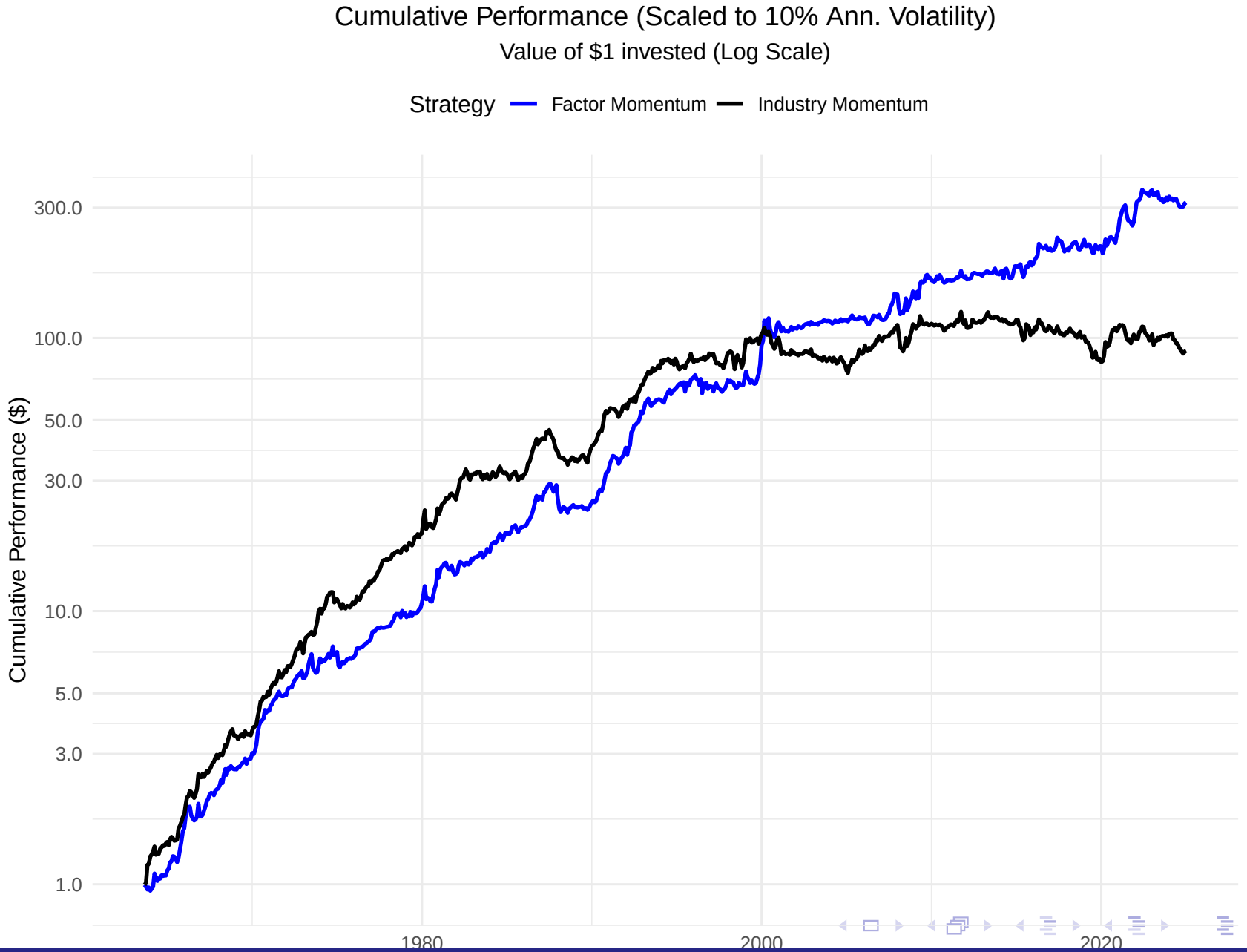
Objective: Replicate Arnott et al. (2023) Appendix figure comparing **Factor** vs. **Industry Momentum**.

Strategy:

1. For each month:
   - Rank all assets by previous month's return.
   - Go **long** the top half (winners), **short** the bottom half (losers).
2. Apply to Fama–French 17 industries and selected JKP factors.
3. Equal-weight portfolios; rebalance monthly.
4. Compute 1-month long–short return.

Outline


Cumulative Performance of Factor vs. Industry Momentum
Value of $1 invested (Log Scale)
Strategy
Factor Momentum
Industry Momentum
Cumulative Performance ($)
50.0
30.0
20.0
10.0
5.0
3.0
2.0
1.0
1980
2000
2020


Cumulative Performance (Scaled to 10% Ann. Volatility)
Value of $1 invested (Log Scale)
Strategy
Factor Momentum
Industry Momentum
Cumulative Performance ($)
300.0
100.0
50.0
30.0
10.0
5.0
3.0
1.0
1980
2000
2020

Arnott et al. (2023) Plot

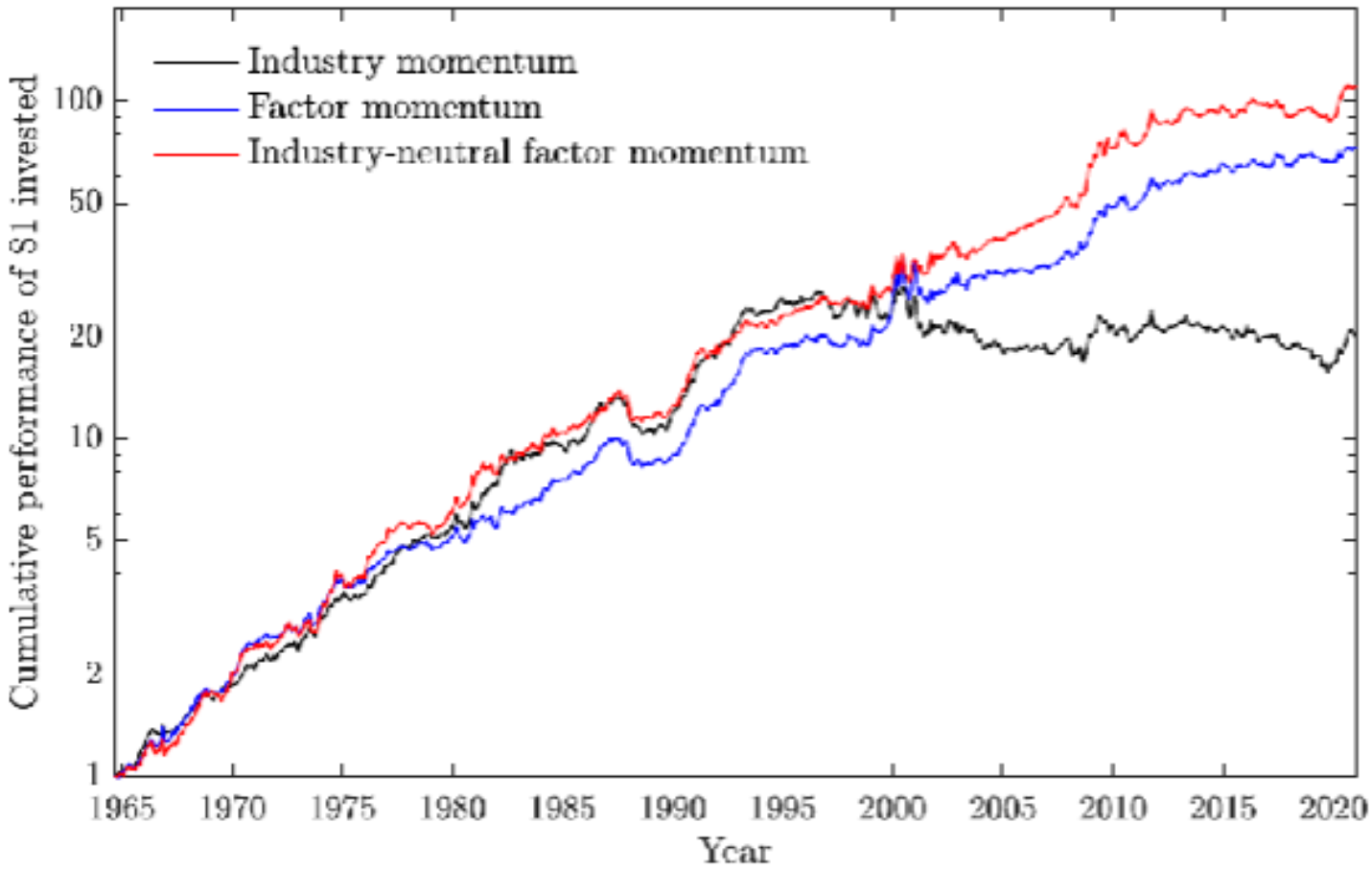


Figure: Industry vs. Factor vs. Industry-Neutral Factor Momentum (1965–2020).

Outline

Factor Correlation Heatmap (Part 1)

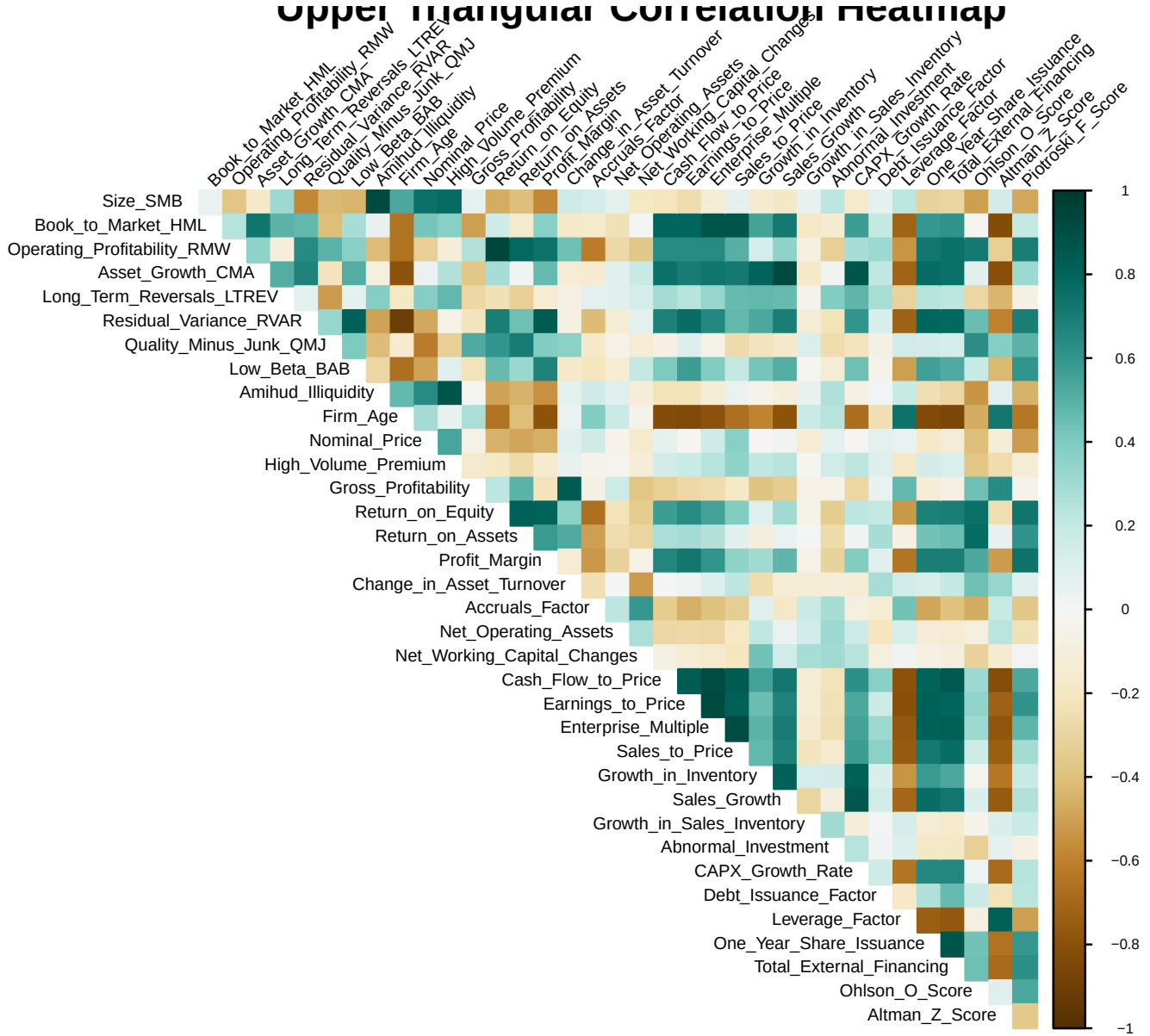
Analysis:

- Correlation calculated among selected JKP factors.
- Helps identify relationships between factors being timed.
- **High correlations (dark green):**
  - Strong among **profitability factors** — Gross Profitability, ROE, Profit Margin.
  - **Investment factors** (Asset Growth, CAPX Growth) also highly correlated.
  - Value-style factors moderately correlated with profitability.
- Fundamental factors move together, reinforcing systematic momentum.

Factor Correlation Heatmap (Part 2)

Analysis (continued):

- **Low/negative correlations (brown areas):**
  - Distress and volatility proxies (Ohlson O-Score, Altman Z-Score, Residual Variance) have weak or negative links with profitability/value.
  - Size (SMB) and momentum variables are largely orthogonal.
- Indicates that some factors add **diversification** rather than reinforcement.
- Overall: Factor momentum mainly comes from **clusters of correlated, fundamental drivers**.


Upper Triangular Correlation Heatmap
Size_SMB
Book_to_Market_HML
Operating_Profitability_RMW
Asset_Growth_CMA
Long_Term_Reversals_LTREV
Residual_Variance_RVAR
Quality_Minus_Junk_QMJ
Low_Beta_BAB
Amihud_Illiquidity
Firm_Age
Nominal_Price
High_Volume_Premium
Gross_Profitability
Return_on_Equity
Return_on_Assets
Profit_Margin
Change_in_Asset_Turnover
Accruals_Factor
Net_Operating_Assets
Net_Working_Capital_Changes
Cash_Flow_to_Price
Earnings_to_Price
Enterprise_Multiple
Sales_to_Price
Growth_in_Inventory
Sales_Growth
Growth_in_Sales_Inventory
Abnormal_Investment
CAPX_Growth_Rate
Debt_Issuance_Factor
Leverage_Factor
One_Year_Share_Issuance
Total_External_Financing
Ohlson_O_Score
Altman_Z_Score
Piotroski_F_Score
1
0.8
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
−1

Outline

Key Findings and Conclusion

- **Replication Findings:**
  - Both industry and factor momentum strategies yield positive returns.
  - Factor momentum appears stronger and more persistent, aligning with findings in the literature.
  - The performance gap seems to widen in the extended sample period.
- **Interpretation:**
  - Factor momentum seems to subsume industry momentum, as suggested in the literature.
  - **Correlation analysis identifies distinct clusters of fundamental drivers (e.g., Value, Profitability, Investment) suggesting systematic sources for factor momentum.**

Key Findings and Conclusion 2

- **Conclusion:**
  - Preliminary results support the hypothesis that short-term momentum is primarily driven by systematic factor dynamics rather than purely industry-specific effects.

Next Steps: Refinement and Analysis

Deeper Analysis (Kickoff Goals):

- **Factor Contribution Analysis:**
  - Which factors drive the overall factor momentum return?
  - **Further analyze the contribution of the identified factor clusters (Value, Profitability, Investment etc.) from the correlation analysis.**
- **Factor Regressions:**
  - Run regressions of individual JKP factors against FF3 / FF5+UMD models as requested in kickoff.
- **Asset Allocation Context:**
  - Calculate basic stats (Sharpe, Volatility) for the replicated Factor Momentum strategy.
  - Identify the best strategies for potential inclusion in a broader asset allocation framework.
  - Assess correlation with a standard 60/40 portfolio.

Questions and Discussion Points

Factor Set Alignment:

- Our JKP dataset seems to align well, but we couldn't precisely match/find these factors from the RFS paper:
  - Residual Variance, Sustainable Growth, Investment Growth Rate, Investment to Capital, Investment to Assets, Five-Year Share Issuance, Distress Risk, M/B Accruals.
- Should we proceed with the current matched set (approx. 35 factors)? Does this significantly impact the replication?

Sneak Peek: Factor Regression Example

Regression: JKP 'Book to Market HML' (Excess Return) FF3 Factors (MktRF + SMB + HML)

Key Results:

- **High HML Loading:** Coefficient on FF HML is 0.986 ($t = 36.8$), indicating the JKP factor strongly captures the standard value effect, as expected.
- **Significant Alpha:** The intercept is -0.41 percent per month ($t = -5.21$), suggesting the JKP HML factor underperformed the FF3 model's prediction.
- **SMB Exposure:** Significant negative loading on SMB (-0.108, t = -4.01), indicating a slight tilt towards larger stocks compared to the FF3 benchmark.
- **Model Fit:** The FF3 factors explain approx. 67 percent of the variance (Adj. R-squared = 0.666).

Thank You

Questions or comments?

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