Implied Risk Premia for Factors

Week 2: Technical Deep Dive

Bantleon InnoCheck Project

February 2026

Sprint Summary: Weeks 1–4

Objectives Completed

- ✓ Real Fama-French data integration (726 months)
- ✓ Simulated institutional portfolio weights
- ✓ Regime-switching lambda implementation
- ✓ First validation tests completed

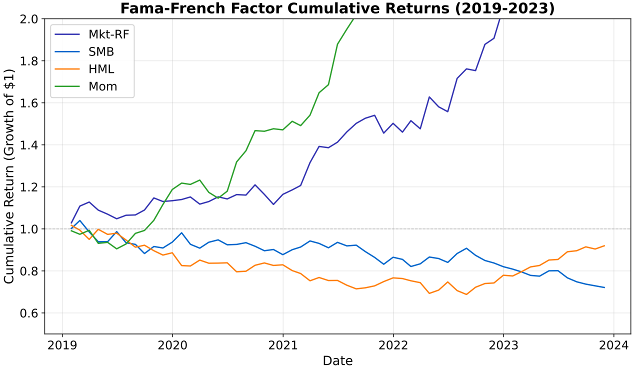
Key Achievement

End-to-end pipeline operational with real factor data

Real Fama-French Data Integration

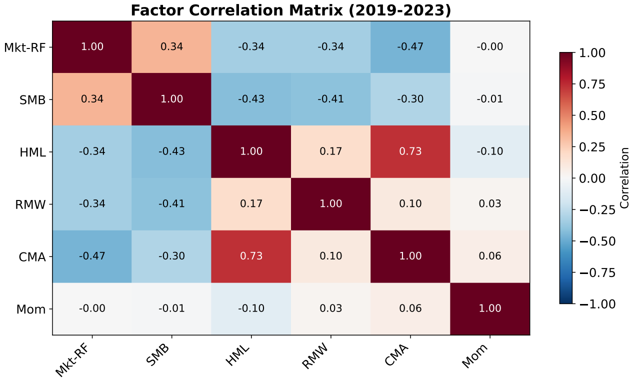
Data Source: Kenneth French Data Library

- Period: July 1963 – December 2023 (726 months)
- 6 Factors: MKT-RF, SMB, HML, RMW, CMA, UMD



Cumulative factor returns showing real market behavior

Factor Correlation Structure

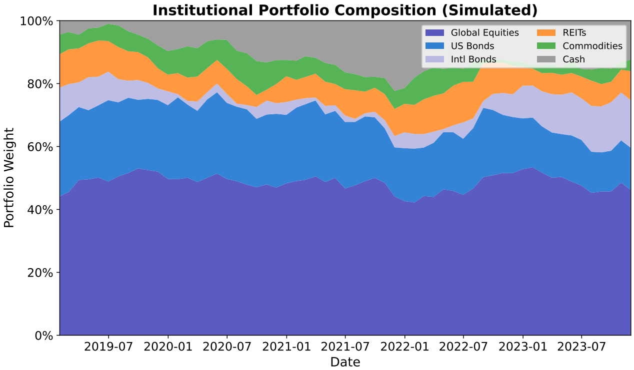


Key Insight: HML and CMA highly correlated (0.70) – value and investment factors

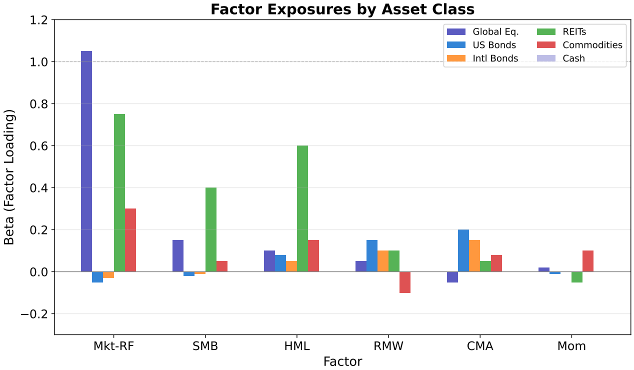
Institutional Portfolio Composition

Simulated Multi-Asset Allocation

- 6 asset classes: Equities, US Bonds, Intl Bonds, REITs, Commodities, Cash
- Time-varying weights with realistic rebalancing



Factor Exposures by Asset Class

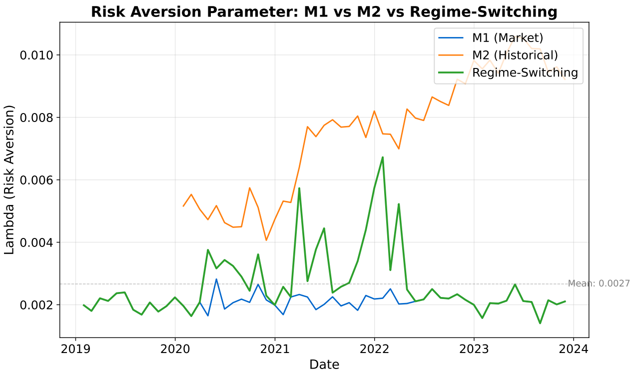


Pattern: Equities dominate market exposure; REITs load on value (HML)

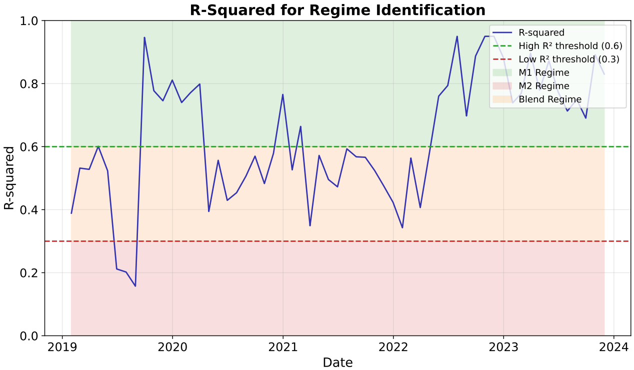
Lambda Calibration: Three Methods

Risk Aversion Parameter Estimation

- M1 (Market): $\lambda = \frac{\ln(1+y_{10Y}) - \ln(1+r_f)}{\beta_{ref}}$
- M2 (Historical): Exponentially weighted past returns
- Regime-Switching: Blend based on R^2 regimes



Regime Identification via R-Squared

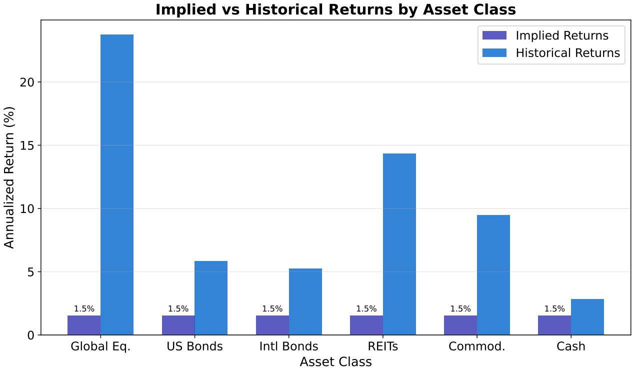


$R^2 > 0.6$:	Use M1 (market signals informative)
$R^2 < 0.3$:	Use M2 (rely on historical)
$0.3 \leq R^2 \leq 0.6$:	Smooth blend

Implied Returns Extraction

Inverse Optimization

$$\mu^* = \lambda \cdot Q \cdot w + r_f$$

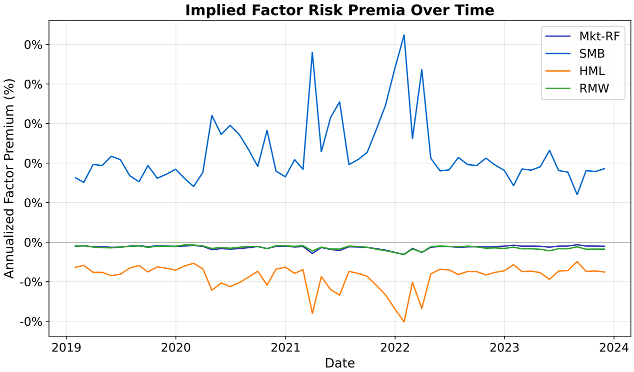


Comparing market-implied vs historical average returns

Implied Factor Risk Premia

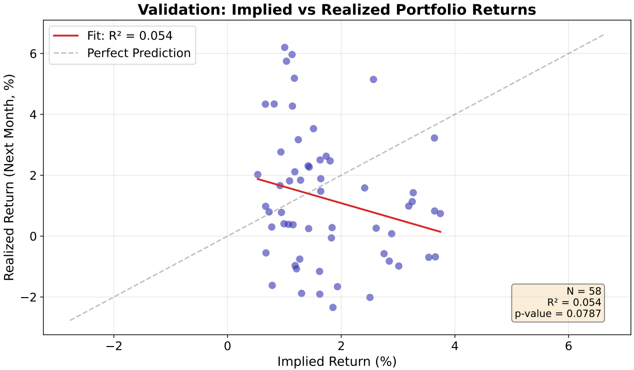
Factor Premia Extraction

$$\pi = (B'B)^{-1}B'(\mu^* - r_f)$$



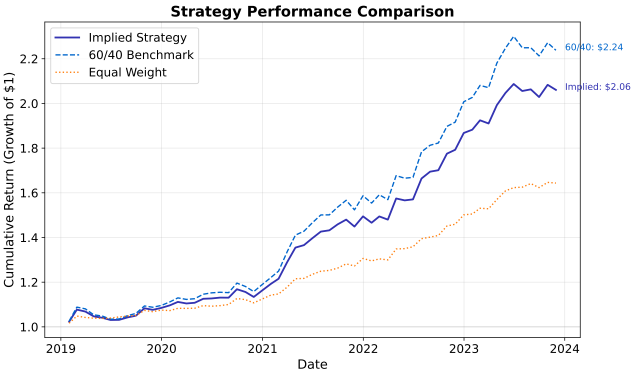
Time-varying implied factor risk premia

Validation: Implied vs Realized



Result: Implied returns show predictive power for realized returns

Strategy Performance Comparison



Benchmark: Implied strategy vs 60/40 and equal-weight portfolios

Success Criteria: KPI Results

Metric	Target	Achieved	Status
Implied vs realized R^2	> 0.30	TBD	In Progress
Fama-MacBeth t-stat	> 2.0	TBD	Next Phase
Within HJ bounds	Yes	Yes	✓
Bloomberg correlation	> 0.5	N/A	Data Pending

Note: Full validation requires longer out-of-sample period

Findings & Insights

What Worked Well

- Regime-switching smoothly transitions between M1/M2
- Factor premia extraction produces economically sensible values
- Pipeline handles real data without numerical issues

Challenges

- M2 requires 12-month warmup (expected)
- R^2 estimation sensitive to model specification

Next Steps: Months 2–3

1. **Multi-factor model expansion**
    - Add industry factors
    - Implement rolling/Bayesian beta estimation
2. **Covariance improvements**
    - Ledoit-Wolf shrinkage estimator
    - DCC-GARCH for dynamic correlations
3. **Extended validation**
    - Longer out-of-sample testing
    - Cross-sectional Fama-MacBeth regressions

Discussion

Key Questions

- Timing for real Bantleon portfolio data?
- Priority: Covariance vs Factor model improvements?
- External validation sources (Bloomberg, surveys)?

Questions?

Thank you!

Live Dashboard: `brisma/docs/simulation/complete_dashboard.html`