Detailed Summary of Master's Thesis:

"Factor Momentum and the Momentum Factor: A European Approach"
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Introduction

Momentum is a known anomaly challenging the Efficient Market Hypothesis by showing that past returns predict future returns. Traditionally studied at the individual stock level, recent pioneering research (Ehsani and Linnainmaa, 2022) demonstrates that momentum also operates at the factor level, where factors explain cross-sectional stock returns. This thesis extends their U.S.-focused findings to the European market, characterized by different regulatory and structural conditions, using econometric techniques and novel datasets.

The work aims to evaluate whether factor momentum patterns hold in Europe, their relevance to individual stock momentum, and implications for asset pricing and risk management. The thesis advances the understanding of momentum by constructing and testing a new factor—FMOM—that targets momentum within factors themselves, not just at the stock level.

Key chapters cover theory (asset pricing models, factor construction), empirical tests on factor autocorrelations and momentum strategies, factor momentum's relationship with covariance and principal components (PCs), interaction with classical stock momentum, and exploration of firm-specific momentum effects.

Theory Review

This section outlines the theoretical framework underlying asset pricing and factor modeling.

- **CAPM (Capital Asset Pricing Model):**
  A one-factor model linking expected returns to market risk (beta). It assumes rational agents and market efficiency but is empirically limited.
- **Arbitrage Pricing Theory (APT):**
  A generalization of CAPM introducing multiple unnamed factors to explain returns via factor sensitivities.
- **Fama-French Factor Models:**
  - *Three-Factor Model* adds size (SMB) and value (HML) factors to CAPM.
  - *Five-Factor Model* further includes profitability (RMW) and investment (CMA).
    These models capture broad dimensions explaining stock return variation beyond market risk.
- **Factor Construction:**
  Factors are formed via portfolio sorts based on firm characteristics (book-to-market, profitability, investment) into univariate and bivariate portfolios, with returns computed as value-weighted differentials of top vs. bottom groups.

- **Momentum Factor (UMD):**
  Introduced by Carhart (1997), UMD captures return continuation based on past 12-month performance. Variants include industry momentum and intermediate-term momentum.
- **Alternative Factors:**
  Other factors include AQR's Betting Against Beta (BAB) and Quality Minus Junk (QMJ), representing complementary dimensions of risk and return.

Data and Methodology

Two primary datasets are compiled for European and global factors, supplemented by a third dataset of characteristic-based factors:

- **Dataset 1:**
  Adapted European factors (~1990–2023) drawn from Fama-French and AQR sources, with modifications accommodating data constraints (e.g., top/bottom 30% portfolios instead of deciles).
- **Dataset 2:**
  A comprehensive global factor set (153 factors) spanning many countries, derived from Kelly, Jensen, and Pedersen's database.
- **Dataset 3:**
  Characteristic-based factors built from a large stock dataset (~12 million monthly observations) using methods enabling simultaneous factor construction and capturing non-linear interactions.

Consistency between datasets is assessed via correlation analysis across common factors, showing strong alignment despite construction differences.

Factor Momentum Detection and Characterization

- **Autocorrelation Tests:**
  A regression framework tests whether factor returns exhibit persistence based on prior 12-month returns, using a binary indicator variable. Significant positive slopes in many factors indicate presence of factor momentum in Europe, though somewhat weaker compared to U.S. results, possibly due to shorter sample length.
- **Momentum Strategies:**
  Two strategies are evaluated: time-series momentum (long positive, short negative past return factors) and cross-sectional momentum (long top half, short bottom half relative to median factor performance). They generate statistically significant returns, reaffirming factor momentum's existence in Europe.

Factor Momentum and Covariance Structure (KNS Model)

- **KNS Sentiment Model:**
  The model posits that momentum arises from the interaction of sentiment-

driven investors and rational arbitrageurs constrained by risk and capital limits, resulting in persistent mispricing and autocorrelated factor returns. Sentiment shocks follow an AR(1) process leading to momentum patterns.

- **Principal Component (PC) Approach:**
  Hypothesizing that factors explaining greater variance (high eigenvalues from PCA) exhibit stronger momentum, a momentum strategy trading PC factors is constructed (FMOMPC). The strategy includes: computing eigenvectors dynamically, forming PC returns, normalizing and demeaning, then constructing a momentum portfolio.
- **Empirical Findings:**
  FMOMPC yields significant returns with higher momentum concentrated in top PCs. Cross-sectional regressions show that high-eigenvalue PCs span lower-eigenvalue ones but not vice versa, confirming systematic factors' dominance in momentum.
- **Conceptualizing FMOM:**
  FMOM is defined as a momentum factor built on factor momentum strategies, whether from individual factors (FMOMind) or PCs (FMOMPC), framing momentum as a factor attribute rather than solely a stock-level phenomenon.

Factor Momentum's Contribution to Individual Stock Momentum

- **Sources of Individual Momentum:**
  Using multifactor models, individual stock momentum profits derive from:
  1. Autocorrelation in factor returns.
  2. Lead-lag relationships between factors.
  3. Firm-specific return autocorrelation.
  4. Variation in mean returns among stocks.

FMOM directly captures the first two sources, while classical factor models capture the fourth. If firm-specific autocorrelation exists, FMOM alone should not explain all momentum.

- **Empirical Portfolio Regressions:**
  Momentum-sorted stock portfolios are regressed on different factor sets (FF5, FF5+UMD, FF5+FMOMind, FF5+FMOMPC). FMOM, especially FMOMPC(1–120), improves explanatory power significantly, outperforming UMD in some cases. Fit quality confirms that FMOM robustly explains stock momentum through factor mechanisms.
- **Spanning Tests with Alternative Momentum Factors:**
  FMOM explains not only classical UMD but also alternative momentum definitions (intermediate, lagged, CP/HP momentum). FMOMPC consistently dominates FMOMind in robustness and explanatory power.
- **Firm-Specific Momentum (RMOM):**
  Residual momentum constructed from factor model residuals shows diminished profitability as more factors are included (FF5 residuals exhibit very weak momentum), suggesting minimal firm-specific momentum. FMOM explains

virtually all residual momentum, reinforcing the notion that momentum arises at the factor rather than firm level.

Momentum vis-à-vis Classical Factors and Pure Factor Momentum

- **Correlations with Classical Factors:**
  Unconditional correlations between UMD and classical factors are modest or mixed, but conditional correlations based on prior positive or negative factor returns reveal strong systematic relationships, reflecting factor momentum's connection with broader factor dynamics.
- **Incidental vs. Pure Factor Momentum:**
  To isolate pure factor momentum (not induced by stock-level momentum), momentum-neutral factors are constructed by removing influence from individual stock momentum. Momentum-neutral factor strategies produce similar or slightly stronger returns than original factor momentum strategies, indicating that factor momentum is an inherent feature of the factors themselves.
- **Regression Tests:**
  Momentum-neutral strategies dominate original momentum factors when controlling for FF5, confirming that factor momentum is not merely a reflection of stock-level momentum but a genuine factor trait.

Conclusion and Future Directions

Your thesis establishes that factor momentum is present and significant within European markets, underpinning cross-sectional stock return variation through persistent autocorrelations in factor returns. The FMOM factor, especially when constructed using principal component techniques, outperforms classical stock momentum factors like UMD and captures all sources of momentum while also explaining additional components.

Limitations arise from the shorter European data period compared to U.S. studies and some methodological differences in factor construction. Yet, the results are broadly consistent with U.S. findings, suggesting factor momentum is a global phenomenon.

Future research should:

- Probe deeper temporal and macroeconomic drivers of factor momentum.
- Extend analysis to emerging markets and Asia-Pacific regions to validate universality.
- Explore machine learning for optimized factor construction capturing momentum dynamics.
- Develop tests distinguishing risk premia from mispricing within the KNS sentiment framework.

Overall, your study offers novel insights into European factor momentum, advocating for factor-level timing strategies as superior to individual stock momentum approaches for improving portfolio performance and risk management.

Suggested Interview Questions with Brief Guidance

1. **What motivated your research on factor momentum specifically in European markets?**
   Highlight market differences (regulatory, data availability) and the gap in extending U.S. findings to Europe.

2. **How do classical asset pricing models (CAPM, Fama-French) relate to your research on momentum?**
   Explain factor construction and how momentum adds to existing factors.

3. **What distinguishes factor momentum from traditional individual stock momentum?**
   Focus on factor-level autocorrelation and broader systematic dynamics rather than firm-specific returns.

4. **Could you explain the KNS sentiment model and its significance in your study?**
   Describe how sentiment and arbitrage interactions produce persistent factor momentum.

5. **How did you construct the FMOM factor and why is the principal components approach important?**
   Discuss methodology of constructing FMOMPC and the stronger momentum signal in high-eigenvalue PCs.

6. **What empirical evidence supports factor momentum's contribution to explaining individual stock momentum?**
   Reference portfolio regressions, spanning tests, and RMOM results indicating FMOM captures key momentum sources.

7. **How do you distinguish pure factor momentum from incidental momentum caused by individual stocks?**
   Outline momentum-neutral factor construction and related findings validating pure factor momentum.

8. **What are the practical implications of your findings for portfolio management?**
   Emphasize superior performance and risk management potential by timing factors rather than individual stocks.

9. **In what ways do your European results align or differ from U.S.-based studies?**
   Note consistent patterns but relatively weaker significance due to shorter data, structural market factors.

10. **What future research directions do you find most compelling following your thesis?**
    Mention macroeconomic drivers, geographic extensions, machine learning for factor design, and risk-mispricing tests.