

Research Proposal: Context-Aware Alpha Extraction (CAAE) Strategy

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Objective

This project aims to develop the **Context-Aware Alpha Extraction (CAAE) Strategy**, a quantitative investment approach that dynamically adjusts factor exposures (e.g., value, momentum, quality) based on market conditions, economic indicators, and sentiment. The strategy's goal is to maximize alpha by adapting factor weights to changes in macroeconomic regimes, sentiment trends, and volatility levels. By integrating traditional financial factors with alternative data sources, CAAE seeks to outperform static models being responsive to economic and market shifts.

Core Components

- **Factor Data and Construction:**
 - **Traditional Factors:** We will gather value, momentum, quality, and size factors from Compustat and CRSP via WRDS, calculated monthly. Each factor is ranked within its category, prioritizing stocks with higher factor scores. For example, value stocks are ranked based on book-to-market ratios, while momentum ranks are based on 6-12 month price performance.
 - **Macroeconomic Indicators:** Key economic indicators, interest rates, inflation, and VIX (volatility index), will be sourced from FRED and Yahoo Finance. These indicators inform regime classification and influence factor weights.
- **Macro Regime Classification:**
 - **Classification:** A machine learning model (e.g., logistic regression, XGBoost, Random Forest) will classify market regimes (e.g., bull, bear, high inflation) based on macro indicators. Predefined factor weights are assigned based on the classified regime, with more emphasis on quality and value during high-inflation periods and momentum during low-interest, growth-oriented environments.
- **Sentiment-Driven Momentum Adjustment:**
 - **Sentiment Analysis:** Using sentiment data from Google Trends, Reddit and News Sources, sentiment scores will be generated via NLP tools. Positive sentiment increases momentum exposure, while negative sentiment reduces it, adapting momentum holdings to market mood.
- **Volatility Management:**
 - **Scaling Portfolio Risk:** Volatility levels (e.g., VIX) inform the overall risk exposure. During high-volatility periods, we reduce exposure to riskier factors and increase weighting on safer assets like quality stocks. Rebalancing frequency adapts dynamically, with weekly rebalancing during turbulent markets and monthly in stable times.
- **Sector-Specific Weighting:**
 - To further enhance context-sensitivity, sector adjustments will be applied to factor allocations. For example, in high-interest-rate regimes, the strategy will reduce tech exposure while favoring sectors like utilities.

Implementation and Evaluation

1. **Data Collection and Preprocessing:** Collect and clean factor and macroeconomic data.
2. **Factor Scoring and Ranking:** Calculate and rank factor scores across stocks.
3. **Dynamic Factor Weighting:** Adjust factor weights based on macro regime classification and sentiment.
4. **Backtesting:** Use Python to backtest the CAAE strategy, measuring annualized returns, Sharpe ratio, and alpha, with training and validation evaluation.
5. **Optimization and Sensitivity Testing:** Evaluate sensitivity to trading costs, rebalancing frequency.

Expected Outcome

The CAAE strategy aims to produce higher risk-adjusted returns and alpha compared to static models by responding dynamically to economic, sentiment, and volatility changes, integrating traditional factors, alternative data, and context-aware adjustments, offering a modern, resilient approach to quantitative investing.