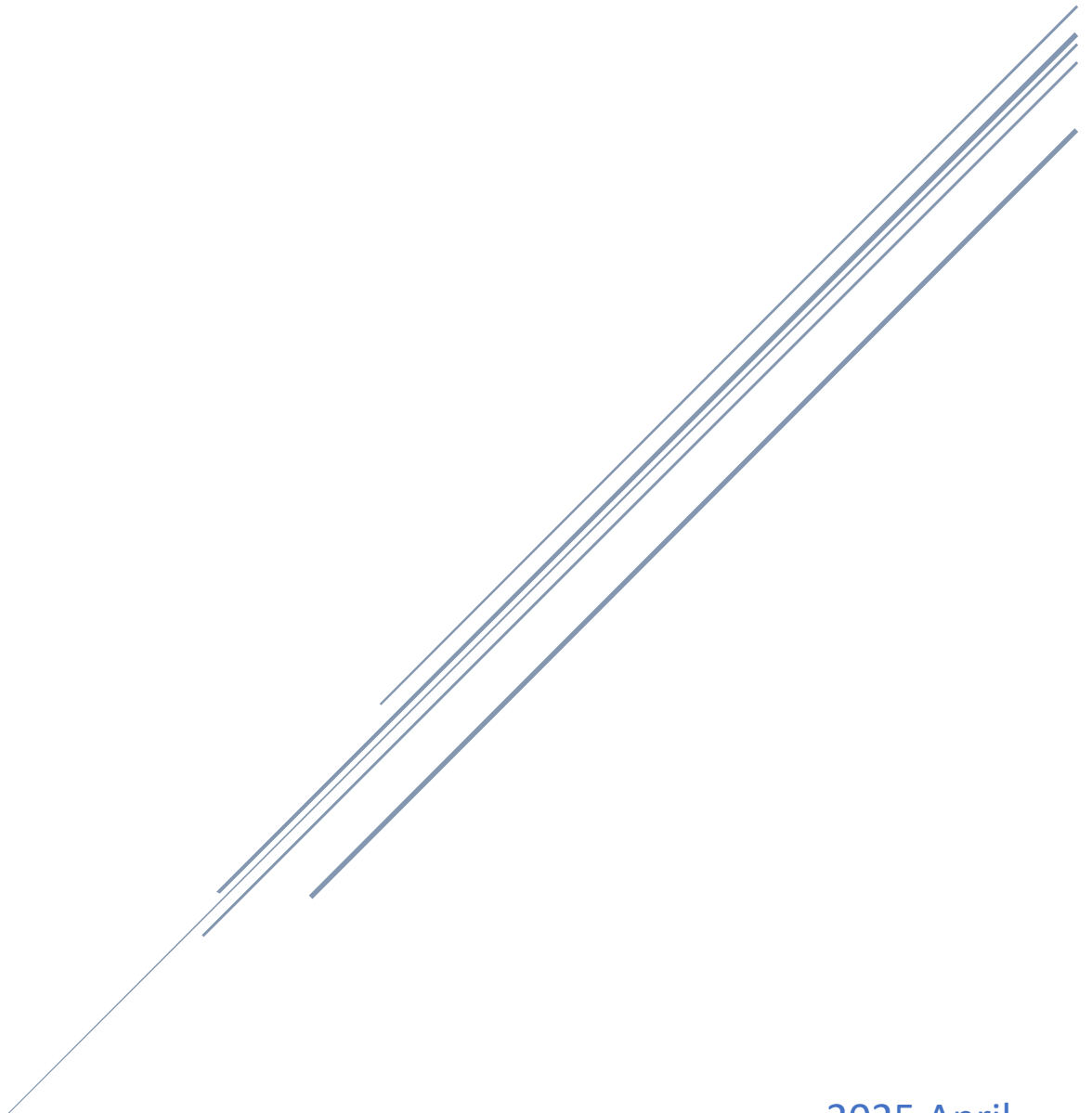


RELATIVE VALUE STRATEGY

FOR U.S BANKING INDUSTRY



2025 April
Jingxuan Yang

Bank Relative Value Investment Strategy

1. Executive Summary

1.1 Strategy Overview

This strategy seeks to capture valuation anomalies among U.S. banks within the S&P 500 by employing a multi-factor regression model. Based on the model's outputs, a market-neutral long-short portfolio is constructed to exploit relative mis-pricings.

1.2 Investment Logic

- Each quarter, identify long and short candidates based on P/B valuation Z-scores.
- Take long positions in undervalued banks and short positions in overvalued banks.
- Construct a market-neutral portfolio to mitigate systematic risk.

1.3 Back-test Performance (2020 Jan–2025 Mar)

- Annualized Return: 8.61%
- Maximum Drawdown: -7.34%
- Win Rate: 80.95%

1.4 Key Advantages

- Fundamental-driven, transparent investment logic.
- Strong drawdown control and high trading win rate.
- Market-neutral structure capturing valuation mean reversion.

1.5 Limitations

- Changes in macroeconomic regimes may affect factor sensitivities, requiring periodic model recalibration.
 - Structural shifts in the banking industry may impair the model's forecasting accuracy.
 - Short selling costs are not explicitly modeled, which could drag on net returns.
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2. Strategy Framework

This strategy captures valuation mean-reversion in the banking sector by employing the price-to-book (P/B) ratio as the primary indicator and modeling fair value through a multi-factor regression approach.

2.1 Sector Selection

The banking sector is characterized by high systemic synchronization and cyclicity. Bank fundamentals, such as lending spreads and credit quality, are highly sensitive to macroeconomic conditions. This structural feature makes valuation deviations more predictable and suitable for relative value strategies.

Furthermore, the business models of banks are relatively straightforward compared to other industries, and their book values are transparent and reliable, making the P/B ratio a particularly effective valuation metric.

In this project, we focus on a group of major U.S. banks, including BAC, C, CFG, FCNCA, FITB, HBAN, JPM, KEY, MTB, PNC, RF, TFC, USB, WFC, and CMA.

2.2 Comparison Ratio Selection

In the banking sector, book value of equity provides a stable and fundamental anchor, capturing asset quality and capital adequacy. Relative to earnings-based valuation metrics, P/B ratios exhibit lower volatility across economic cycles, enhancing their reliability for cross-sectional comparisons among banks.

2.3 Timefram Selection

The dataset covers a period of approximately five years, starting from 2019Q4. This timeframe captures the post-COVID economic cycle and ensures the relevance of the valuation model.

2.4 Data Source Selection

For each bank, the average stock price over the three trading days following the financial report release date is used. Company fundamentals are sourced from TIKR, while macroeconomic indicators are sourced from the FRED database.

2.5 Portfolio Construction

Each quarter, a symmetric long-short portfolio is constructed based on P/B valuation deviations. The Z-score, calculated as the standardized residual between actual and fitted P/B, identifies mispriced banks. Signals are generated after financial filings.

Banks with Z-scores below -1 are selected for long positions, and those above +1 for short positions.

2.6 Trade Rules

Positions are rebalanced quarterly, with a maximum holding period of 20 trading days.

Each position is subject to a 20% take-profit limit and a 5% stop-loss threshold to control risk exposure.

Additionally, an individual position will be closed if the drawdown exceeds 10% during the holding period.

3. Model Construction

3.1 Factor Selection

Key fundamentals and macroeconomic variables are selected as explanatory factors, including NIM, CET1 Ratio, GDP growth rate, M2 growth, and unemployment rate. Non-linear terms (such as NIM^2 and $CET1^2$) are introduced to enhance the model's fit.

A binary dummy variable is created to distinguish regional banks from large national banks, based on a predefined ticker list.

The model includes fixed effects for both banks (Ticker) and time (Quarter) to control for unobserved heterogeneity across institutions and macroeconomic environments.

A cross-sectional regression is conducted for each quarter to estimate the fair P/B multiples of banks.

3.2 Regression Model

An Ordinary Least Squares (OLS) regression is used, regressing actual P/B ratios against the selected fundamental variables.

The residuals between actual and fitted P/B are calculated and standardized into Z-scores. The Z-score measures the degree of valuation deviation relative to the fair value, facilitating cross-bank and cross-quarter comparisons.

3.3 Signal Generation and Screening

Each quarter, banks are screened based on Z-scores:

Banks with Z-scores below -1 are considered undervalued (long signals);
Banks with Z-scores above +1 are considered overvalued (short signals);
Banks in between are treated as neutral and are not traded.

4. Back test Results

4.1 Performance Metrics (2019Q4–2025Q1)

Metric	BR	S&P500	10Y Treasury	Bank Sector
Annualized Return	8.61%	11.09%	-0.69%	5.47%
Annualized Volatility	9.13%	19.09%	8.88%	33.45%
Maximum Drawdown	-7.34%	-24.77%	-21.13%	-37.45%
Sharpe Ratio ($R_f =$	0.48	0.36	-0.54	0.04

4.2 Highlights

- The BR Strategy achieved an annualized return of 8.61% with a maximum drawdown of only 7.34%, demonstrating strong downside protection.
- Adjusted for a 4.25% risk-free rate, the strategy's Sharpe ratio is 0.48, outperforming both S&P500 (0.36) and bank sector index KBWB (0.04).
- Compared to long-term Treasuries (IEF), the strategy offers significantly better return-risk characteristics.

4.3 Additional Metrics

- Win Rate: 80.95%
 - Profit-to-Loss Ratio: 0.87
 - Simulation VaR: 6.86% @ 95% confidence level
 - Expected Return per Trade: 2.18%
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5. Strengths and Risks of the strategy

5.1 Strengths

• *Clear, Fundamentally Driven Logic*

The strategy is anchored on key banking fundamentals, leveraging P/B deviations from intrinsic value based on NIM, CET1 Ratio, and macroeconomic variables.

• *Stable Performance*

Achieves an annualized return of approximately 8.61% with moderate volatility and controlled maximum drawdown.

• *Low-Frequency Trading, Cost Efficiency*

Rebalancing occurs quarterly with a 20-trading-day holding period, minimizing transaction costs and market impact.

• *Market-Neutral Approach*

Long-short portfolio construction mitigates systemic market risks and enhances risk-adjusted returns.

• *Solid Foundation and High Scalability*

Built on robust valuation principles, the strategy has strong potential for scaling and can be easily integrated with other alpha strategies due to its short and defined holding period.

5.2 Risks

- *Concentration Risk*

Since the strategy selects only banks with extreme Z-scores ($>|1|$), it may result in a relatively small number of positions, leading to concentration risk.

- *Model Stability and Overfitting*

The regression model is calibrated quarterly; changes in market dynamics or banking fundamentals could impair model accuracy over time.

- *Extreme Liquidity Risk*

In times of market stress (e.g., systemic banking crises), even fundamentally strong positions could suffer large short-term losses or liquidity squeezes.

- *Macroeconomic Sensitivity*

As a sector-focused strategy, performance is highly sensitive to macroeconomic cycles, interest rate changes, and regulatory shifts affecting banks.

6. Conclusion and Outlook

6.1 Conclusion

This strategy successfully captures valuation inefficiencies within the U.S. banking sector. By systematically identifying banks with significant deviations from their intrinsic value and constructing a market-neutral long-short portfolio, the strategy delivers stable, risk-adjusted excess returns with limited volatility and drawdowns.

The model has already extended to include both large-cap and regional banks, further enhancing diversification and robustness. The transparent selection framework and low-frequency trading further contribute to operational efficiency.

6.2 Outlook

- *Incorporate Sentiment Indicators:*

Augment the model with alternative data sources such as news sentiment analysis, earnings call tone, and credit spread movements to better capture shifts in market psychology.

- *Apply Machine Learning Techniques:*

Utilize machine learning methods (e.g., random forests, gradient boosting) to model nonlinearities, complex interactions, and improve predictive accuracy.

- *Enhance Risk Management:*

Introduce dynamic stop-loss frameworks, volatility-based exposure adjustments, and macro stress-testing to mitigate extreme event risks.

- *Macro-Regime Adaptation:*

Integrate macro regime detection (e.g., monetary tightening vs easing cycles) to dynamically adjust thresholds and factor sensitivities.

7. Appendix

7.1 Model Summary

- **Regression Formula**

$P/B = NIM + NIM^2 + CET1\ Ratio + CET1\ Ratio^2 + Net\ Interest\ Income\ YoY + GDP_YoY + M2_Growth + Unemployment_YoY + Is_Regional_Bank + Ticker + Quarter$

- **Method:** Cross-sectional OLS regression per quarter

- **R² / Adjusted R²:** 0.818 / 0.792

- **Sample Period:** 2019Q4 – 2024Q4

- **Number of Observations:** 311

7.2 Key Regression Coefficients

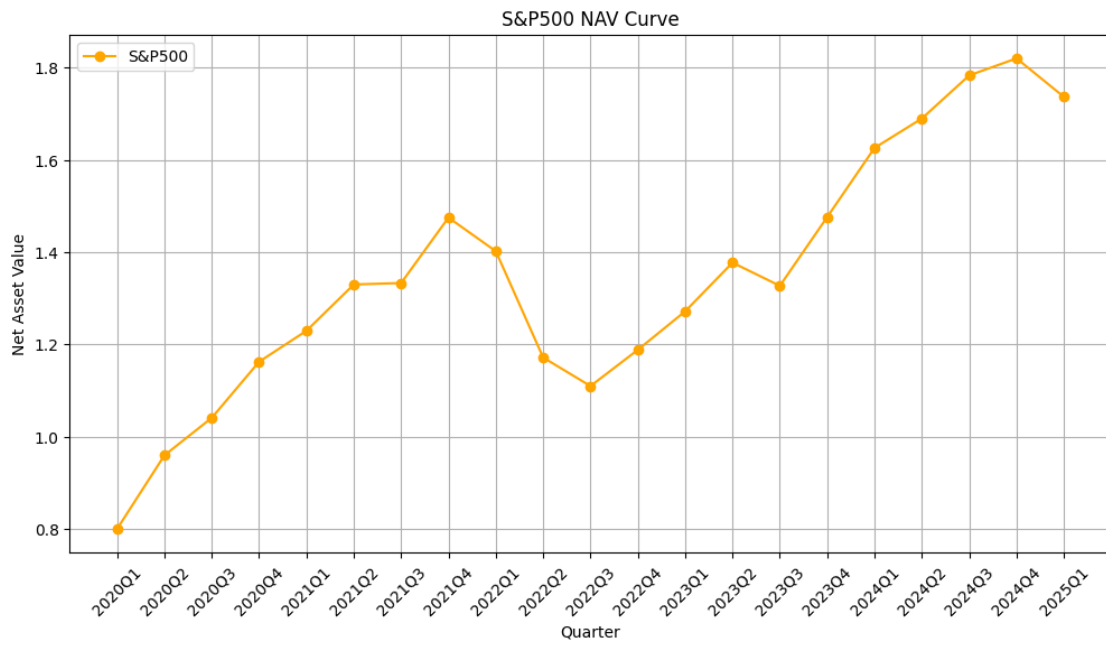
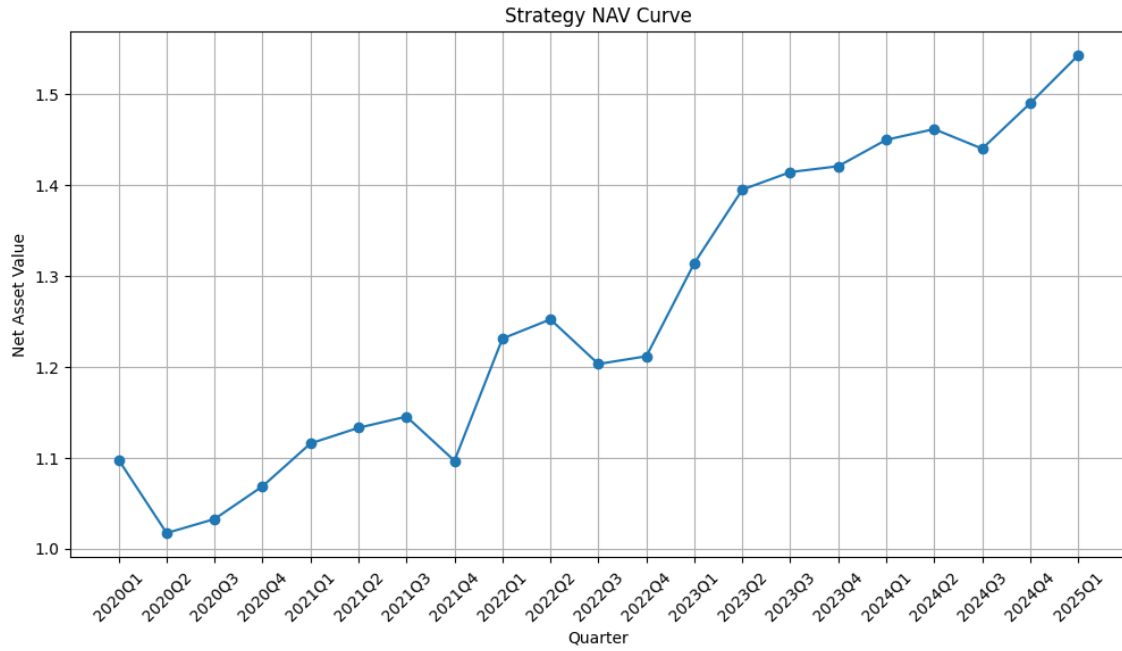
Variable	Coefficient	t-stat	p-value
NIM	0.5324	2.774	0.006
NIM ²	-0.0597	-1.758	0.080
CET1 Ratio	-0.2341	-2.048	0.041
CET1 Ratio ²	0.0096	1.972	0.050
GDP_YoY	0.0228	3.512	0.001
M2_Growth	0.0149	3.569	0.000
Unemployment_YoY	-0.002	-3.450	0.001
Net Interest Income YoY	-0.0016	-3.596	0.000
Is_Regional_Bank	-0.2757	-4.195	0.000

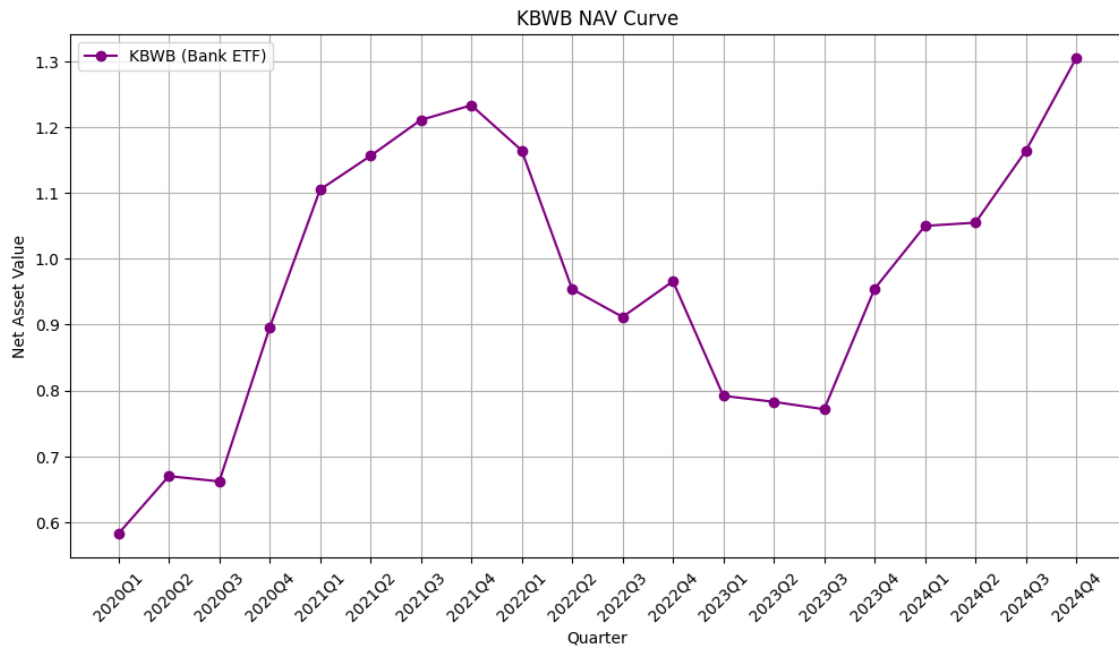
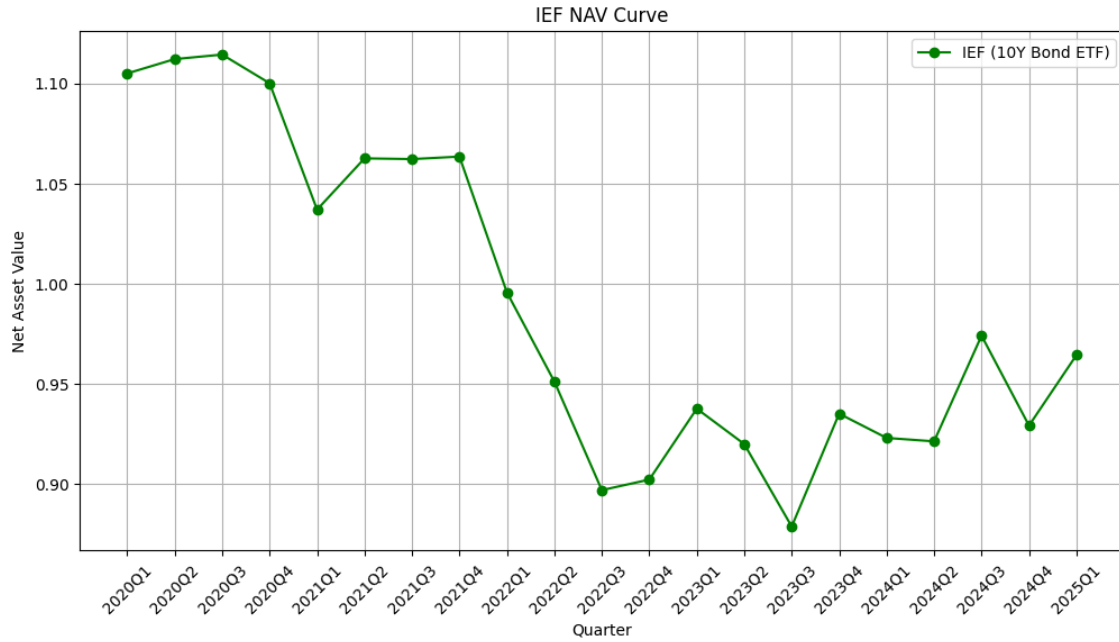
- NIM (+): Positive impact on P/B.
- CET1 Ratio (-): Higher capital ratio tends to lower P/B.
- GDP Growth (+): Supports higher valuations.
- Unemployment Rate (-): Deteriorates valuations.
- Regional Banks (-): Regional banks trade at valuation discounts.

7.3 Back test Metrics Summary

Metric	Value
Annual Return	8.61%
Annual Volatility	9.13%
Max Drawdown	-7.34%
Sharpe Ratio	0.94
Win Rate	80.95%
Win/Loss Ratio	0.87
95% Quarterly VaR (Normal)	6.55%
95% Quarterly VaR (Historical)	6.86%

7.4 NAV Curve





(Prepared by: Jingxuan Yang) (Date: April 2025)