Quantitative Risk Analysis of SMIF Reallocation Proposal

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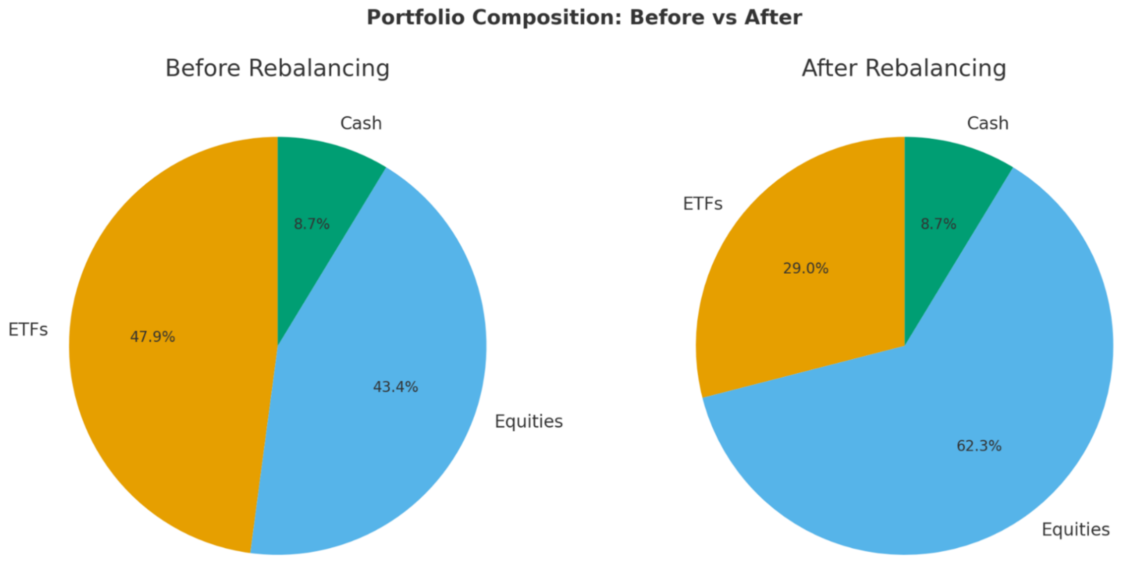
UNC CHARLOTTE STUDENT MANAGED INVESTMENT FUND

UNIVERSITY OF NORTH CAROLINA CHARLOTTE

Proposed Solution

Move from 47% ETFs to 29% ETFS immediately, 25% by end of semester

1. Keep VOO for S&P hedge
2. Keep VEA, XLU, and VCR for now - look to propose alternatives
3. Sell all other ETFs and distribute (AGG, XLV, XLE, VDC, XLI)
4. Reallocate the ~18% we're selling into equities we already own



Allocation Specifics for ETFS Outside of AGG

Target Stocks	Allocation Logic
Healthcare (ABBV, ABT, UNH, JNJ, CVS)	Equal split from XLV liquidation
Energy (LNG)	From XLE
Industrials (MMM, HII)	Split from XLI
Consumer Staples (WMT)	From VDC

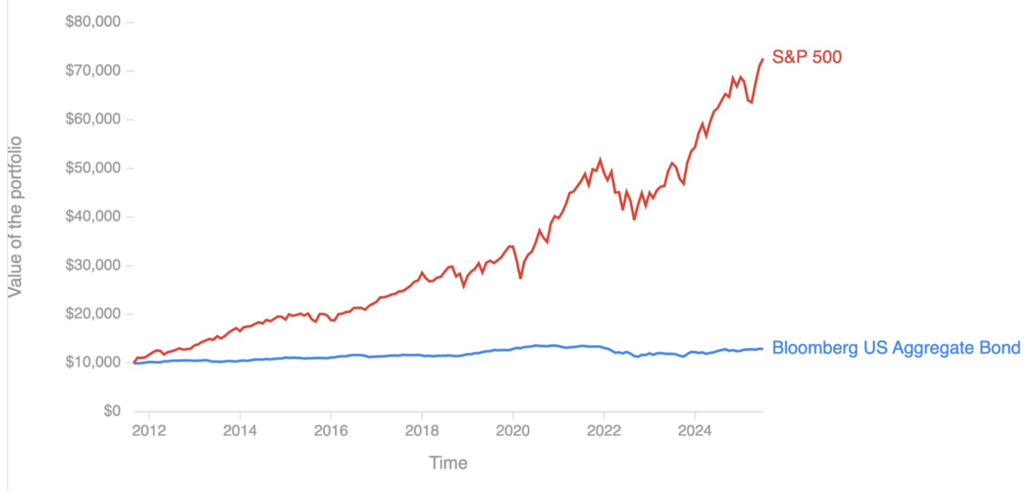
AGG Liquidation Justification

Current Weight: ~14.8%

Why?

- AGG's yield is insufficient given current inflation and real-rate conditions.
- The 15% allocation is extremely defensive for a position that has gained 1% for all-time gain.
- Contributes no alpha to our portfolio.
- Breakdown of diversification benefit: In 2022, when stocks fell, so did bonds proving that bonds no longer hedge equities as they once did.

In summary, AGG has massively lagged equities, dragging on compounded portfolio value.

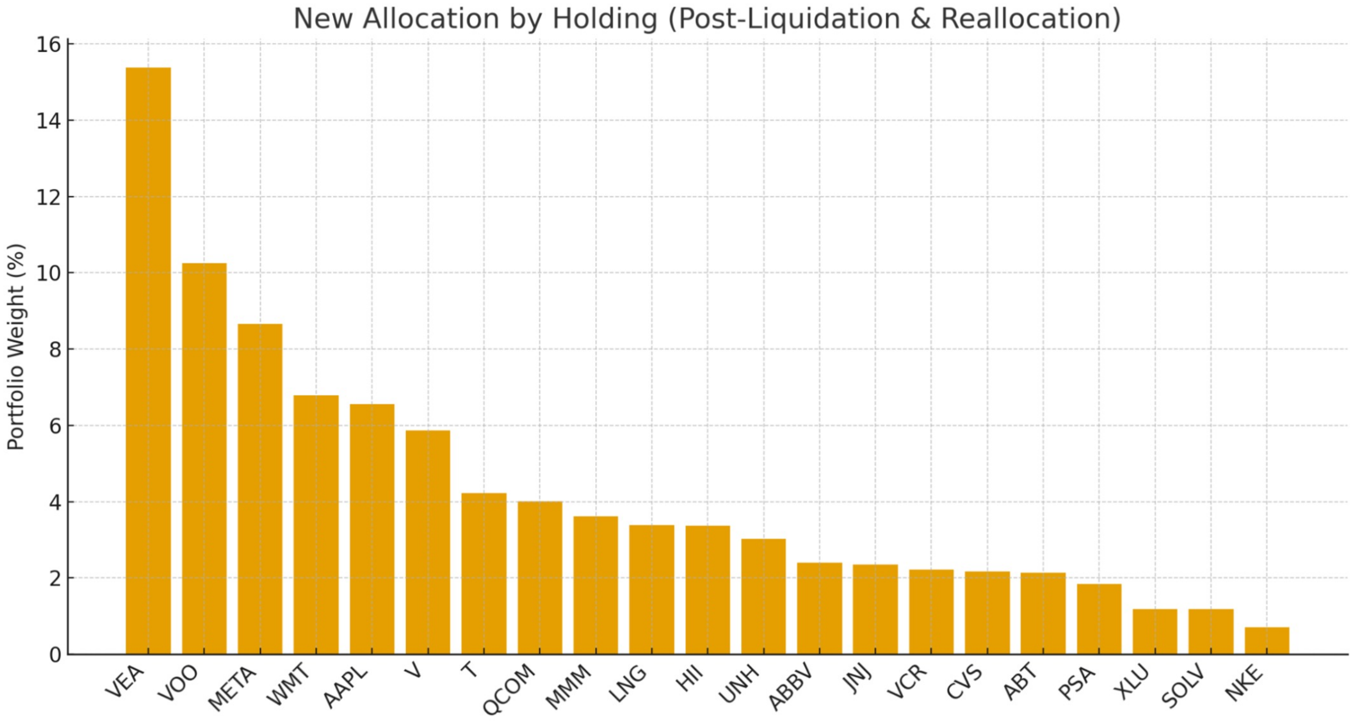


Reclaiming 15% of Our Portfolio from Inefficient Fixed Income

Current Weight: ~14.8%

Allocation Bucket	% of AGG Proceeds	Example Holdings	Rationale
Defensive Dividend Income	35% (~5.2%)	ABBV, ABT, UNH, PSA, T, CVS	Replaces AGG's yield (3–6%) with dividend income; low beta stabilizers
Quality Growth	35% (~5.2%)	AAPL, META, JNJ, V, WMT	Strengthens long-term core holdings with strong balance sheets & cash flow
Value / Cyclicals	30% (~4.4%)	HII, MMM, QCOM, LNG, SOLV	Captures upside from undervalued or industrial names in recovery cycles

New Allocation by Holding



Rationale:

- **Eliminate underperforming fixed income:** AGG no longer diversifies against equities
- **Replicate bond income via dividends:** 3–6% yields from defensives offset AGG's lost coupon.
- **Enhance compounding power:** Quality equities compound faster and remain within existing coverage.
- **No new positions added**

Key Message:

Reallocating AGG's capital entirely into equities increases total expected return by 1.5–2% annually while maintaining diversification and income stability through dividend-focused and quality-growth holdings

Old %, New %, and delta in percentage points)

- **VEA** 15.37 → **15.37** (0.00)
- **VOO** 10.25 → **10.25** (0.00)
- **META** 7.62 → **8.66** (+1.04)
- **WMT** 5.41 → **6.78** (+1.37)
- **AAPL** 5.52 → **6.56** (+1.04)
- **V** 4.82 → **5.86** (+1.04)
- **T** 3.36 → **4.22** (+0.86)
- **QCOM** 3.12 → **4.01** (+0.89)
- **MMM** 2.60 → **3.61** (+1.01)
- **LNG** 1.82 → **3.39** (+1.57)
- **HII** 2.36 → **3.37** (+1.01)
- **UNH** 1.59 → **3.02** (+1.43)
- **ABBV** 0.97 → **2.40** (+1.43)

- **JNJ** 0.74 → **2.35** (+1.61)
- **VCR** 2.22 → **2.22** (0.00)
- **CVS** 0.74 → **2.17** (+1.43)
- **ABT** 0.71 → **2.14** (+1.43)
- **PSA** 0.98 → **1.84** (+0.86)
- **XLU** 1.18 → **1.18** (0.00)
- **SOLV** 0.29 → **1.18** (+0.89)
- **NKE** 0.71 → **0.71** (0.00)
- **AGG** 14.80 → **0.00** (−14.80)
- **XLV** 2.85 → **0.00** (−2.85) *(reflected in the increases to ABBV/ABT/UNH/JNJ/CVS)*
- **XLE** 0.68 → **0.00** (−0.68) *(moved to LNG)*
- **XLI** 0.25 → **0.00** (−0.25) *(split to MMM/HII)*
- **VDC** 0.33 → **0.00** (−0.33) *(moved to WMT)*

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Risk Metrics and Evaluation

Objective:

- Evaluated risk metrics for two portfolio allocations (current vs. proposed) to assess the impact of rebalancing

Data & Methodology:

- Analyzed 27 securities (17 individual stocks, 9 ETFs, 1 money market fund)
- Downloaded 1.6 years of historical price data using yfinance API (Solventum IPO in April 2024)
- Calculated daily returns for each security and constructed weighted portfolio returns
- Used S&P 500 (SPY) as market benchmark for comparison

Risk Metrics Calculated:

- **Return metrics:** Annual return, annualized volatility, Sharpe ratio, Sortino ratio
- **Market-related metrics:** Beta, alpha, correlation with market, information ratio, tracking error
- **Downside risk metrics:** Value at Risk (VaR) at 95% and 99% confidence levels, Conditional VaR (CVaR), maximum drawdown, downside deviation

Quick Metric Refresher

RETURN METRICS:

- **Annual Return:** Expected yearly percentage gain/loss on the portfolio based on historical performance
- **Annualized Volatility:** Measure of how much returns fluctuate year-over-year; higher volatility = more unpredictable
- **Sharpe Ratio:** Risk-adjusted return metric; measures excess return per unit of total risk (higher is better)
- **Sortino Ratio:** Similar to Sharpe but only penalizes downside volatility; focuses on harmful risk (higher is better)

MARKET-RELATED METRICS:

- **Beta:** Sensitivity to market movements; beta < 1 means less volatile than market, beta > 1 means more volatile
- **Alpha:** Excess return beyond what's expected given the portfolio's beta; positive alpha indicates outperformance
- **Correlation with Market:** How closely portfolio moves with the S&P 500; ranges from -100% to +100%
- **Information Ratio:** Measures consistency of outperformance relative to benchmark per unit of tracking error
- **Tracking Error:** Standard deviation of difference between portfolio and benchmark returns; measures how much you deviate from the market

RISK METRICS:

- **Value at Risk (VaR 95%):** Maximum expected loss on 95% of days; only 5% of days should be worse than this
- **Value at Risk (VaR 99%):** Maximum expected loss on 99% of days; captures more extreme scenarios
- **Conditional VaR (CVaR 95%):** Average loss when losses exceed the 95% VaR threshold; shows tail risk
- **Conditional VaR (CVaR 99%):** Average loss in the worst 1% of scenarios; measures catastrophic loss potential
- **Maximum Drawdown:** Largest peak-to-trough decline experienced; shows worst historical loss period
- **Downside Deviation:** Volatility calculated using only negative returns; measures downside risk specifically

Current Metrics

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OLD ALLOCATION PORTFOLIO RISK METRICS
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RETURN METRICS:
  Annual Return:                16.17%
  Annualized Volatility:        11.71%
  Sharpe Ratio:                  1.00
  Sortino Ratio:                 1.30

MARKET-RELATED METRICS:
  Beta:                          0.63
  Alpha:                         1.95%
  Correlation with Market:      93.56%
  Information Ratio:            -0.49

RISK METRICS:
  Value at Risk (95%):          -0.98% (daily),    -15.54% (annual)
  Value at Risk (99%):          -1.89% (daily),    -29.98% (annual)
  Conditional VaR (95%):        -1.61% (daily),    -25.59% (annual)
  Conditional VaR (99%):        -2.80% (daily),    -44.49% (annual)
  Maximum Drawdown:            -12.01%
  Downside Deviation:            8.96%
  Tracking Error:                7.63%
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S&P 500 Metrics

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S&P 500 (SPY) BENCHMARK METRICS
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RETURN METRICS:
  Annual Return:                 19.87%
  Annualized Volatility:         17.36%
  Sharpe Ratio:                   0.89
  Sortino Ratio:                  1.11

MARKET-RELATED METRICS:
  Beta:                           1.00 (by definition)
  Alpha:                         0.00% (by definition)

RISK METRICS:
  Value at Risk (95%):          -1.59% (daily),    -25.32% (annual)
  Value at Risk (99%):          -2.91% (daily),    -46.17% (annual)
  Conditional VaR (95%):        -2.53% (daily),    -40.08% (annual)
  Conditional VaR (99%):        -4.21% (daily),    -66.85% (annual)
  Maximum Drawdown:            -18.76%
  Downside Deviation:           13.88%
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New Allocation Metrics

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================================================================================
NEW ALLOCATION PORTFOLIO RISK METRICS
================================================================================

RETURN METRICS:
  Annual Return:                18.37%
  Annualized Volatility:        13.34%
  Sharpe Ratio:                   1.04
  Sortino Ratio:                  1.35

MARKET-RELATED METRICS:
  Beta:                           0.71
  Alpha:                         2.94%
  Correlation with Market:      92.28%
  Information Ratio:             -0.21

RISK METRICS:
  Value at Risk (95%):          -1.06% (daily),    -16.84% (annual)
  Value at Risk (99%):          -2.00% (daily),    -31.76% (annual)
  Conditional VaR (95%):        -1.82% (daily),    -28.93% (annual)
  Conditional VaR (99%):        -3.19% (daily),    -50.67% (annual)
  Maximum Drawdown:            -13.39%
  Downside Deviation:           10.25%
  Tracking Error:                7.21%
```

New Allocation Metrics

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NEW ALLOCATION PORTFOLIO RISK METRICS
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RETURN METRICS:
  Annual Return:                  18.37%
  Annualized Volatility:          13.34%
  Sharpe Ratio:                     1.04
  Sortino Ratio:                    1.35

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  Value at Risk (99%):            -2.00% (daily),    -31.76% (annual)
  Conditional VaR (95%):          -1.82% (daily),    -28.93% (annual)
  Conditional VaR (99%):          -3.19% (daily),    -50.67% (annual)
  Maximum Drawdown:              -13.39%
  Downside Deviation:             10.25%
  Tracking Error:                  7.21%
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Comparison Summary

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COMPARISON SUMMARY
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Portfolio                Old Allocation New Allocation
Annual Return                  0.161688       0.183657
Volatility                     0.117053       0.133438
Sharpe Ratio                   0.996889       1.039115
Sortino Ratio                  1.303026       1.353375
Beta                           0.632274       0.710895
Alpha                          0.019498       0.029381
VaR 95% (Daily)               -0.009789       -0.01061
VaR 99% (Daily)               -0.018885       -0.02001
CVaR 95% (Daily)              -0.016122      -0.018227
CVaR 99% (Daily)              -0.028023      -0.031917
Max Drawdown                  -0.120119      -0.133917
Correlation with Market         0.93563       0.922798
Delta                               NaN            NaN


KEY CHANGES FROM OLD TO NEW ALLOCATION:
  Return change:         2.20%
  Volatility change:     1.64%
  Sharpe Ratio change:   0.04
  Beta change:           0.08
  VaR 95% change:        -0.08%
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Conclusion

Key Insights

- **Higher returns with acceptable risk:** +2.20% annual return for only +1.64% additional volatility
- **Superior risk-adjusted performance:** Both portfolios outperform S&P 500 on Sharpe ratio (1.00 & 1.04 vs 0.89)
- **Lower market sensitivity:** Beta of 0.71 means 29% less volatile than pure market exposure
- **Strong alpha generation:** +2.94% excess return beyond expected performance given beta
- **Better downside protection:** Maximum drawdown of -13.39% vs S&P 500's -18.76%

Metric	Old Allocation	New Allocation	S&P 500	Change
Annual Return	16.17%	18.37%	19.87%	+2.20% ✓
Volatility	11.71%	13.34%	17.36%	+1.64%
Sharpe Ratio	1.00	1.04		+0.04 ✓
Beta	0.63	0.71	1.00	+0.08
Alpha	1.95%	2.94%	0.00%	+0.99% ✓
Max Drawdown	-12.01%	-13.39%	-18.76%	-1.38%

QUESTIONS?