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Course: Risk Practice  
Professor : Dr. Elliot Noma, PhD

# Quantifying Investment Risk: A Multi-Method VaR Framework for Personalized Portfolios

“What if your portfolio could warn you before a crisis? What if it even adapted to your risk personality—like being conservative or aggressive—just like a Netflix recommendation system?”

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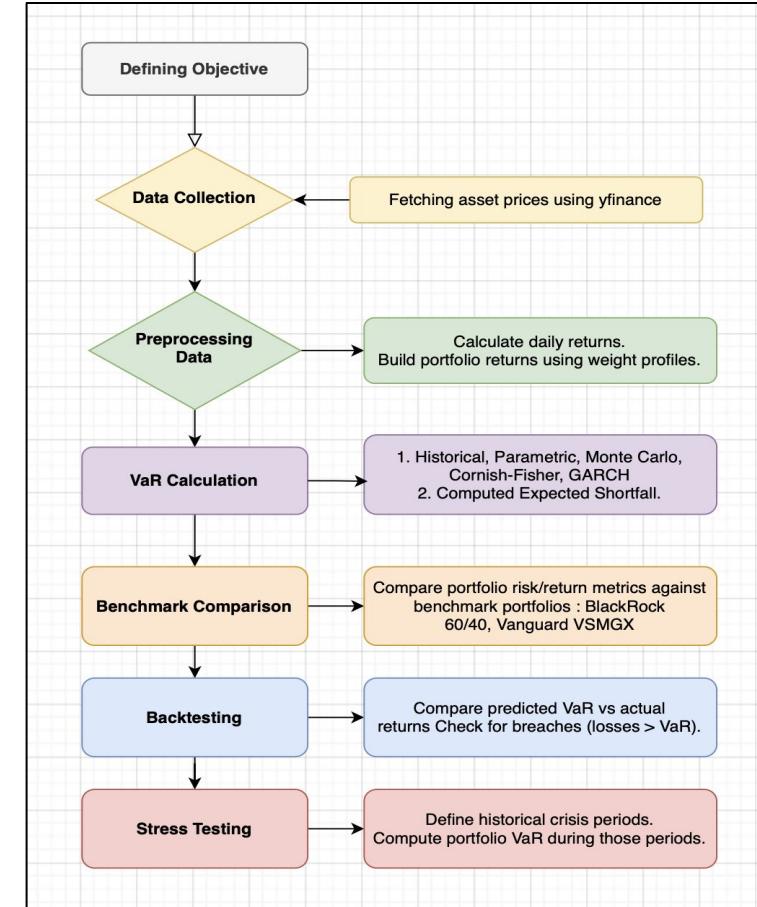
# Workflow & Methodology

```
# === 2. Portfolio Configuration (Constants) ===
tickers = [
    'SPY',          # SPDR S&P 500 ETF – U.S. Large Cap Equities
    'AGG',          # iShares Core U.S. Aggregate Bond ETF – Broad Bond Exposure
    'QQQ',          # Invesco QQQ ETF – Nasdaq 100 (Tech-heavy Equities)
    'GLD',          # SPDR Gold Shares – Exposure to Gold (Commodities)
    'BTC-USD',      # Bitcoin (USD) – Leading Cryptocurrency
    'ETH-USD',      # Ethereum (USD) – Smart Contracts & Altcoins
    'IVV',          # iShares S&P 500 ETF – U.S. Large Cap Equities (BlackRock Portfolio)
    'IEFA',          # iShares MSCI EAFE ETF – International Equities (BlackRock Portfolio)
    'VTI',          # Vanguard Total Stock Market ETF (Vanguard Portfolio)
    'VXUS',          # Vanguard Total International Stock ETF (Vanguard Portfolio)
    'BND',          # Vanguard Total Bond Market ETF (Vanguard Portfolio)
    'VWOB'          # Vanguard Emerging Market Bond ETF (Vanguard Portfolio)
]

start_date = '2015-01-01'
end_date = '2024-12-31'
confidence_level = 0.95
rolling_window = 60 # Days for rolling VaR calculation
```

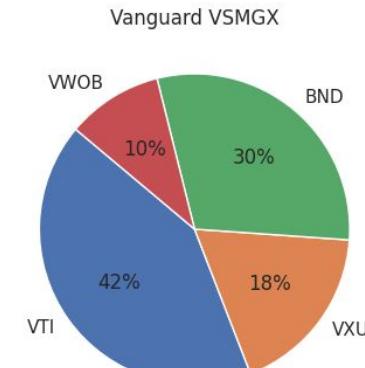
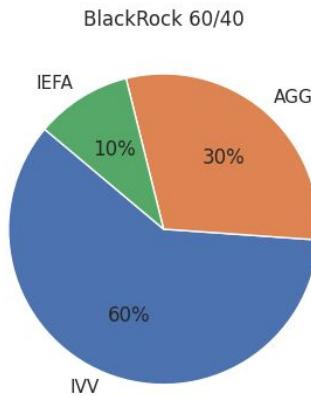
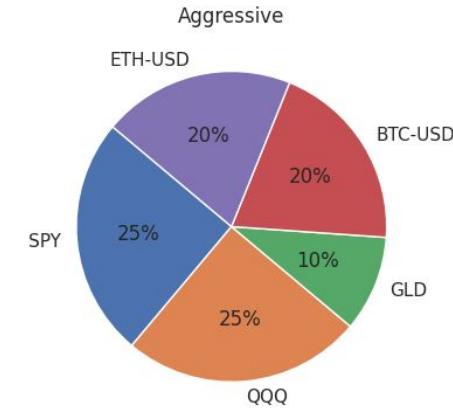
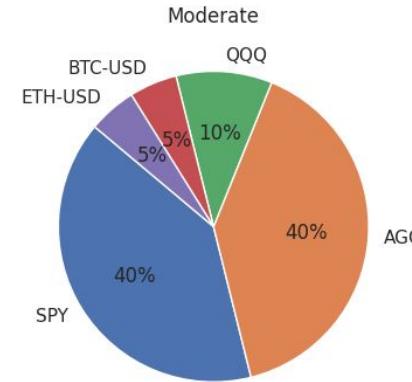
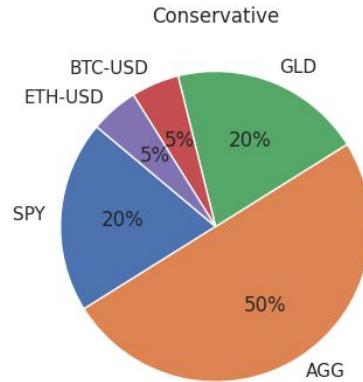
```
# === 2.1 Behavioral Risk Profiles ===
risk_profiles = {
    "Conservative": {'SPY': 0.2, 'AGG': 0.5, 'GLD': 0.2, 'BTC-USD': 0.05, 'ETH-USD': 0.05},
    "Moderate":     {'SPY': 0.4, 'AGG': 0.4, 'QQQ': 0.1, 'BTC-USD': 0.05, 'ETH-USD': 0.05},
    "Aggressive":   {'SPY': 0.25, 'QQQ': 0.25, 'GLD': 0.1, 'BTC-USD': 0.2, 'ETH-USD': 0.2},
}

benchmark_profiles = {
    "BlackRock 60/40": {'IVV': 0.60, 'AGG': 0.30, 'IEFA': 0.10},
    "Vanguard VSMGX": {'VTI': 0.42, 'VXUS': 0.18, 'BND': 0.30, 'VWOB': 0.10}
}
```

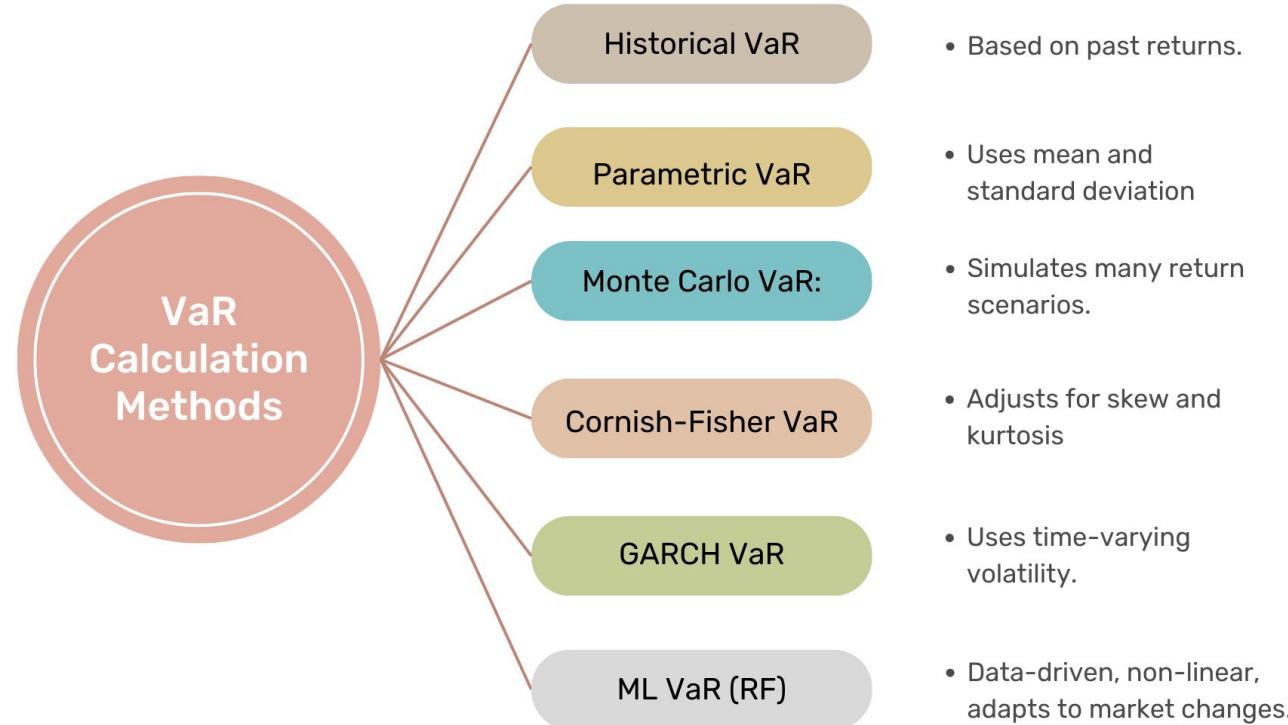


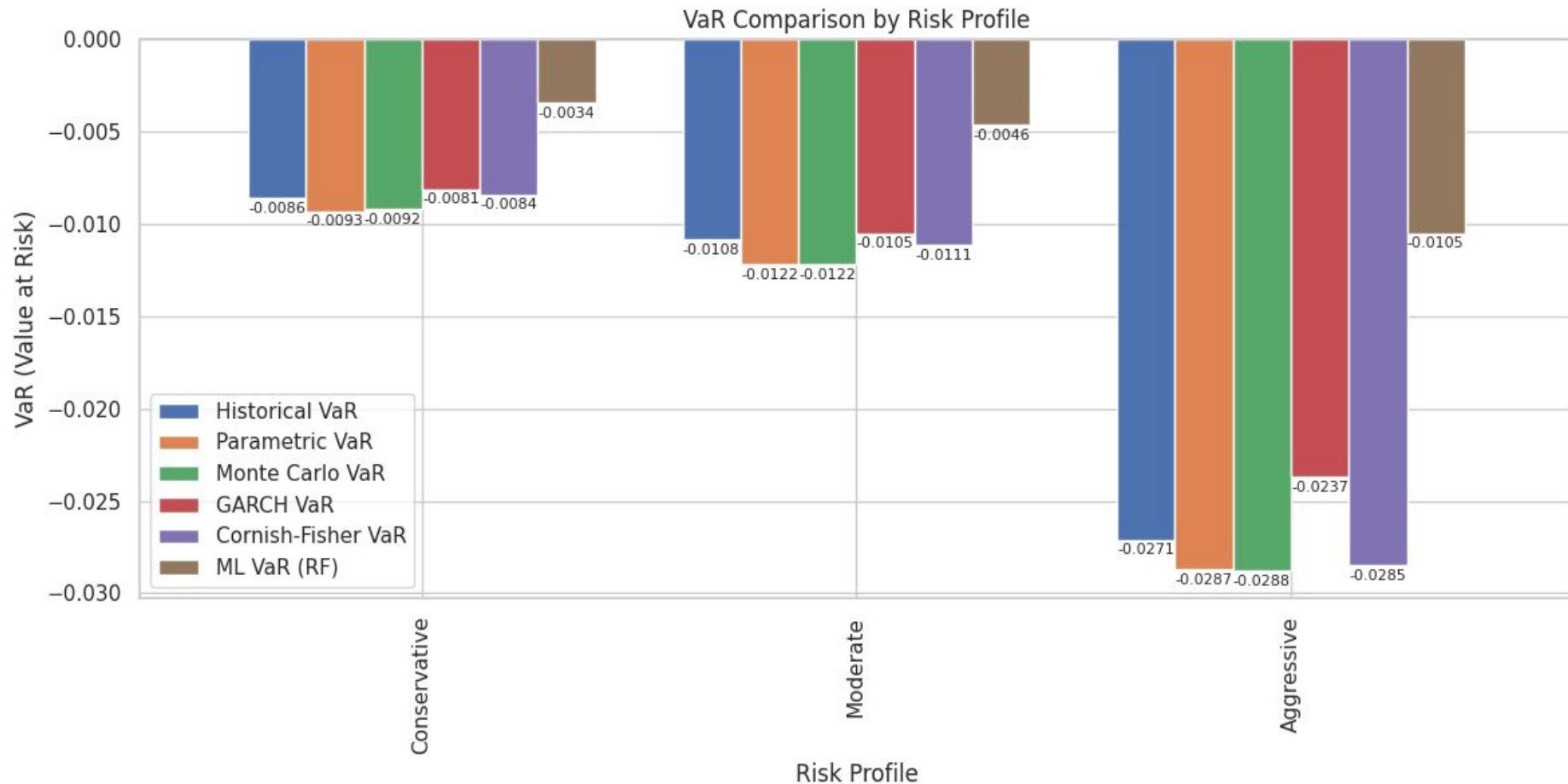


## Asset Allocations: Behavioral & Benchmark Portfolios



# VaR Methods - Traditional & Enhanced

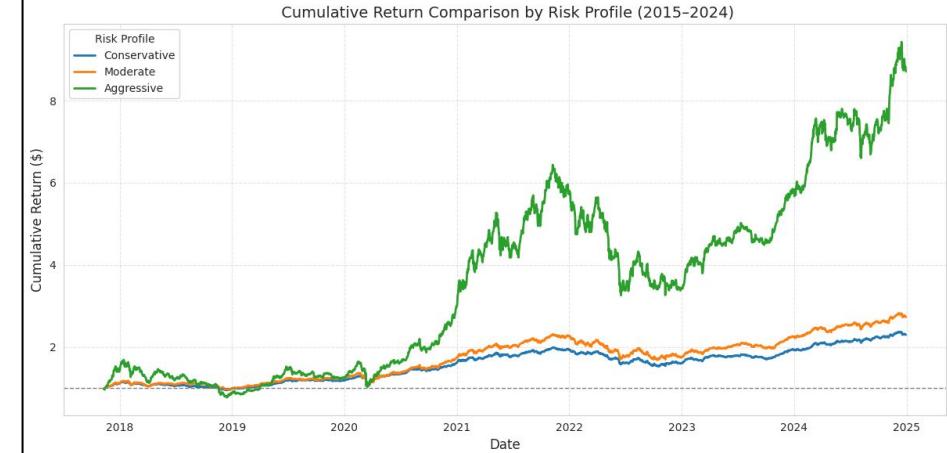
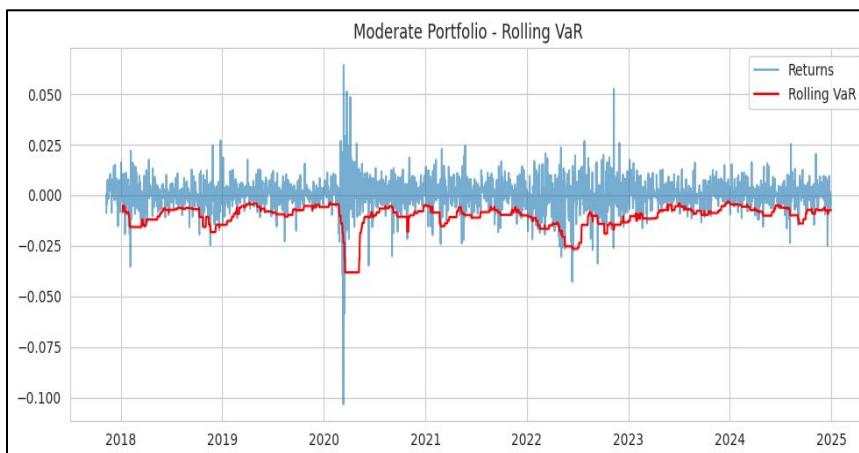
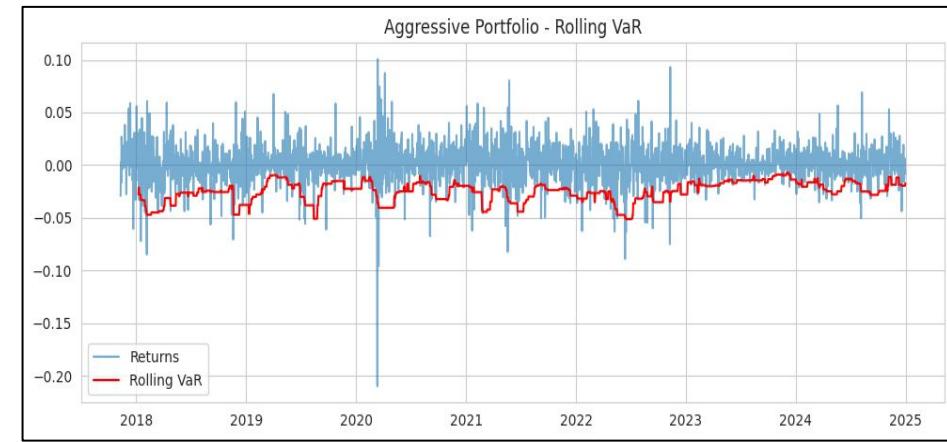
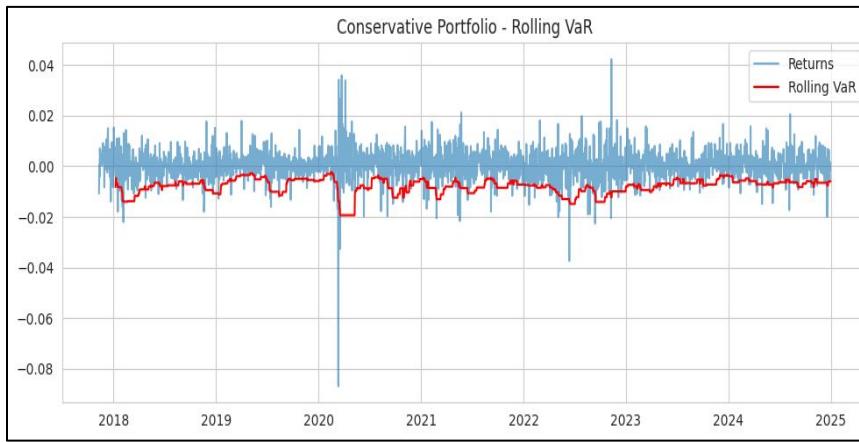






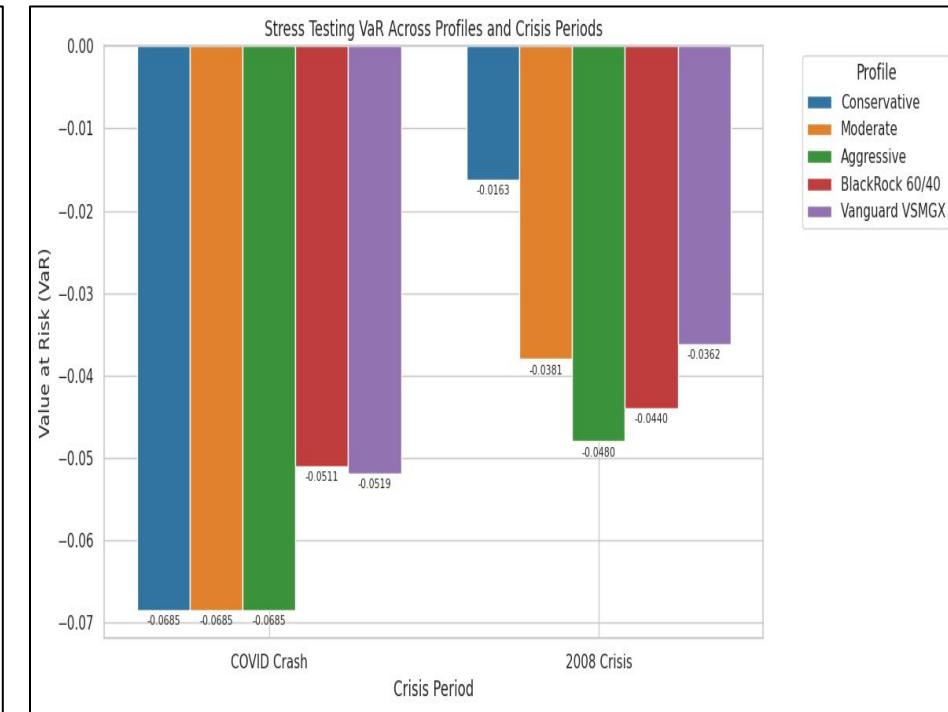
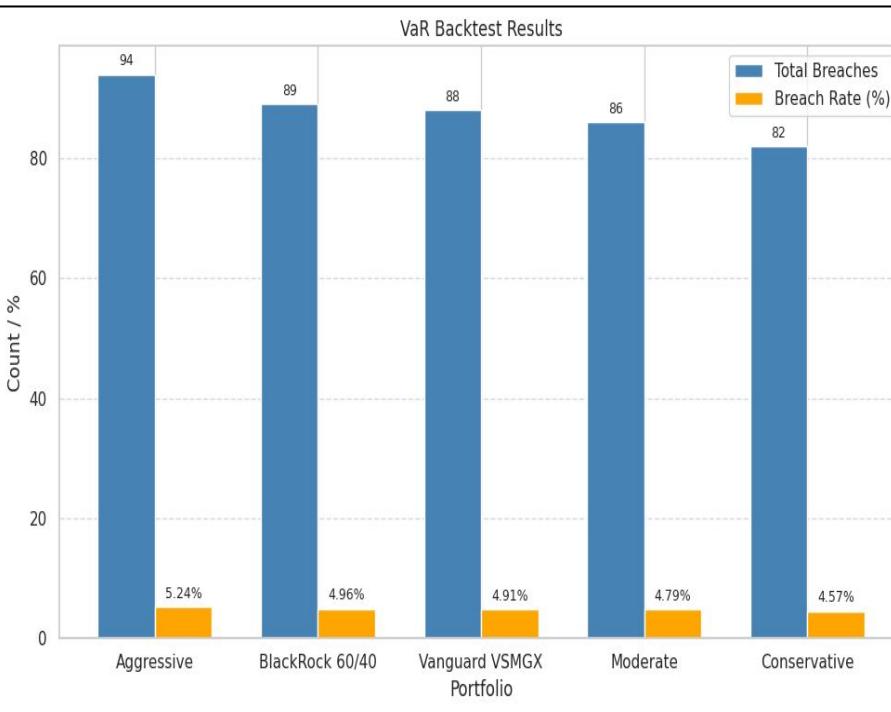
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# Rolling VaR across the Behavioral Portfolios





# Backtesting & Stress Testing

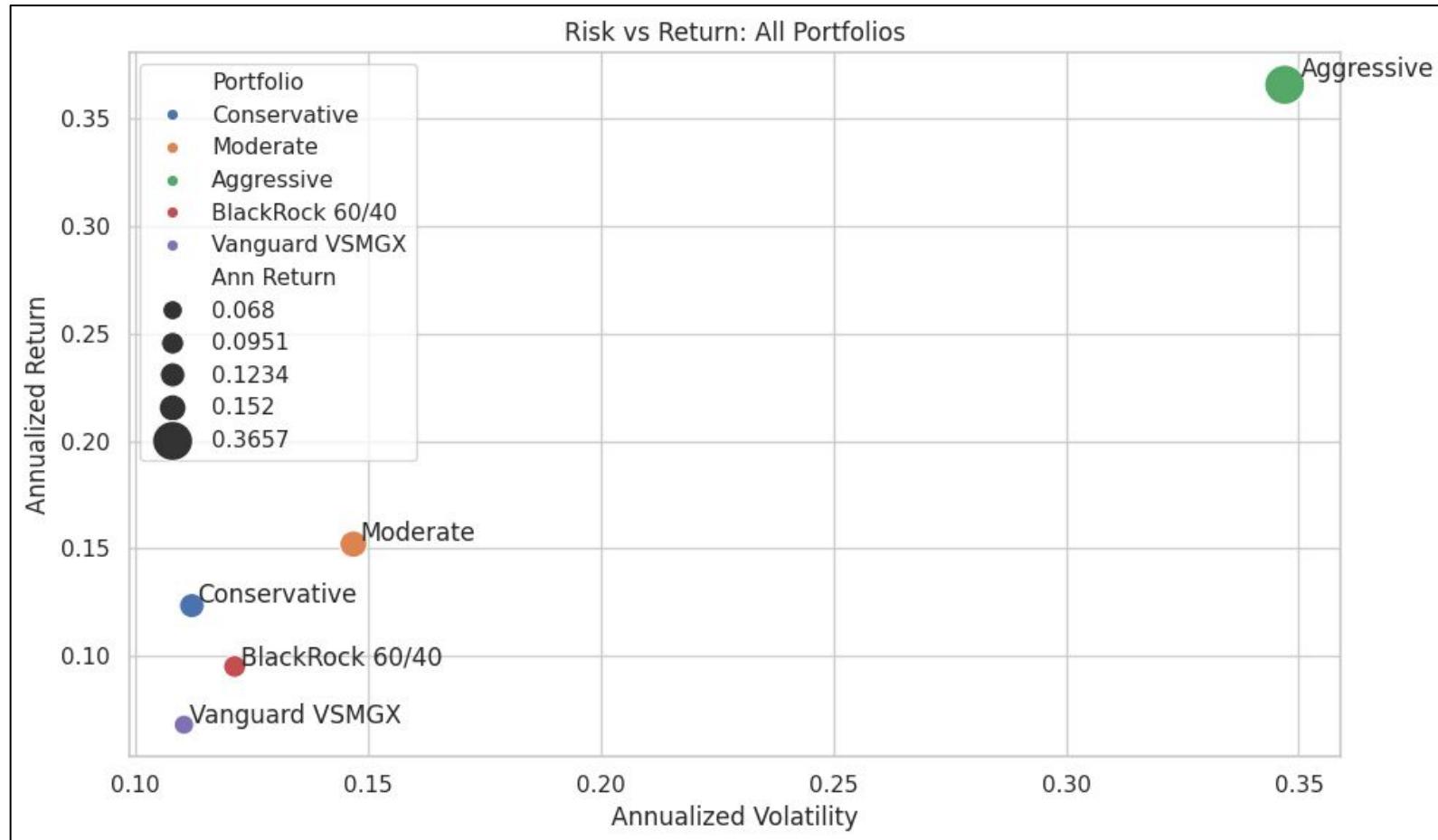


# Portfolio Risk & Performance Summary

- **Aggressive:** Highest return (36.6%) but also highest risk and breach rate.
- **Conservative:** Lowest risk with stable return (12.4%) and lowest breaches.
- **Moderate:** Best balance of return and risk.
- **VaR Methods:** Consistent across models — reliable results.
- **Backtesting:** Breach rates ~5% → models are well-calibrated.
- **Expected Shortfall:** Always higher than VaR — correct tail-risk capture.

	Ann Return	Ann Vol	VaR 95%	Param VaR	MC VaR	CF VaR	ML VaR	GARCH VaR	ES	Breaches	Breach Rate	Sharpe Ratio
Portfolio												
<b>Conservative</b>	0.1234	0.1122	0.0101	0.0111	0.0112	0.0110	0.0039	0.0103	0.0159	82	0.0457	1.0997
<b>Moderate</b>	0.1520	0.1469	0.0136	0.0146	0.0146	0.0145	0.0054	0.0132	0.0218	85	0.0474	1.0346
<b>Aggressive</b>	0.3657	0.3470	0.0320	0.0345	0.0344	0.0353	0.0129	0.0294	0.0511	94	0.0524	1.0541
<b>BlackRock 60/40</b>	0.0951	0.1214	0.0111	0.0122	0.0122	0.0114	0.0034	0.0112	0.0184	87	0.0485	0.7834
<b>Vanguard VSMGX</b>	0.0680	0.1105	0.0100	0.0112	0.0111	0.0108	0.0032	0.0093	0.0165	85	0.0474	0.6158

# Risk vs Return: Behavioral vs Benchmark





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# Thank you

Successful investment†