TASK 1

From the sources provided, the concept of long-term profitability in trading strategies is closely tied to alpha decay. According to Penasse (2017), many anomalies in financial markets exhibit alpha decay after discovery, with predictive power deteriorating over time. This decay can be mathematically modeled by the equation:

$$\alpha_t = \alpha_{t-1} \times \phi + \varepsilon_t$$

where α_t represents the alpha at time t, ϕ is the persistence parameter (less than 1 for decaying alpha), and ε_t is a white noise error term (Penasse, 2017). Di Mascio et al. (2022) document that institutional investors' trading performance decays within 12 months, with few strategies maintaining profitability beyond this period. The study of LSTM neural networks by Chen and Cheon (2024) indicates that machine learning-based strategies also suffer from alpha decay as market conditions evolve. In fact, this phenomenon is consistent with the Efficient Market Hypothesis (EMH), which suggests that markets integrate information rapidly, eroding previously profitable inefficiencies.

Historically, anomaly-based strategies, such as those involving momentum or value factors, initially display substantial returns but see a gradual erosion over time as more market participants exploit these anomalies. McLean and Pontiff (2016) provide empirical evidence of this trend, noting that returns from published anomalies decline post-publication, supporting the notion of alpha decay.

From the research by Di Mascio et al. (2022), adaptive strategies that dynamically respond to changing information environments have shown relative success. Institutional investors tend to adjust their trading intensity in response to alpha decay, attempting to capture remaining alpha before it dissipates. Adaptive strategies often use a switching model based on performance metrics such as the Sharpe ratio:

$$SR = \frac{E[R_p - R_f]}{\sigma_p}$$

where R_p is the portfolio return, R_f the risk-free rate, and σ_p the standard deviation of returns (Guo & Ou-Yang, 2021)

Penasse (2017) suggests that anomaly-based strategies might temporarily regain effectiveness if new mispricings emerge, but these instances are usually short-lived. Similarly, Chen and Cheon (2024) highlight the challenges faced by machine learning models in adapting to evolving market regimes, with LSTM models showing limited adaptability over time.

Additionally, strategies incorporating predictive signals, as discussed in the research on Exegy's Signum service, aim to mitigate alpha decay by dynamically adjusting thresholds for signal activation. Such services monitor real-time trading patterns to avoid crowded trades, thereby preserving alpha for a longer duration.

Ultimately, the persistence of any alpha depends on the market's capacity to assimilate new information. The continued success of long-term strategies is contingent upon ongoing research, adaptation, and the careful balancing of model complexity to prevent overfitting while maintaining predictive power.

sources are the pdfs and papers sent by Pranay Sir in the group

BRIDGEWATER PURE ALPHA STRATEGY

Bridgewater Associates: A Long-Standing Alpha Strategy

Bridgewater Associates is one of the world's largest hedge funds, founded in 1975 by Ray Dalio. Based in Westport, Connecticut, Bridgewater specializes in systematic investing through its flagship funds, **Pure Alpha** and **All Weather**, utilizing macroeconomic insights, risk parity, and quantitative models to generate sustainable returns.

The Pure Alpha Strategy

Bridgewater's **Pure Alpha** strategy has been a consistent performer, delivering returns exceeding 12% annualized since its inception in 1991. Unlike traditional long-short equity hedge funds, Pure Alpha employs a **global macro strategy**, leveraging systematic research, economic indicators, and risk-balanced diversification across asset classes, including equities, fixed income, commodities, and currencies.

The fund is known for its **strong downside protection**, having navigated crises such as the 2008 financial collapse and the COVID-19 downturn with minimal losses relative to broader markets.

Equity Curve & Performance Analysis

- Over three decades, Pure Alpha has demonstrated **low correlation with equity markets**, making it an attractive hedge against systemic risk.

- During volatile periods like 2008, when the S&P 500 dropped 38%, Pure Alpha returned **+9.4%**, showcasing its ability to generate returns in adverse market conditions.

- However, between 2019-2020, the fund underperformed, reflecting the challenges of adapting to changing market dynamics.

Key Insights on Long-Term Profitability

1. **Systematic & Macro-Driven Approach**: Unlike discretionary funds, Bridgewater relies on data-driven economic forecasting and quantitative models.

2. **Diversification & Risk Parity**: Allocation across multiple asset classes helps mitigate drawdowns.

3. **Adaptability**: Continuous refinement of algorithms and market theses allow for sustained performance.

4. **Liquidity & Leverage Management**: Avoiding excessive leverage and maintaining liquidity ensure resilience in market stress periods.

NAV Pure Alpha (orange) vs SPY (S&P500 ETF in blue)
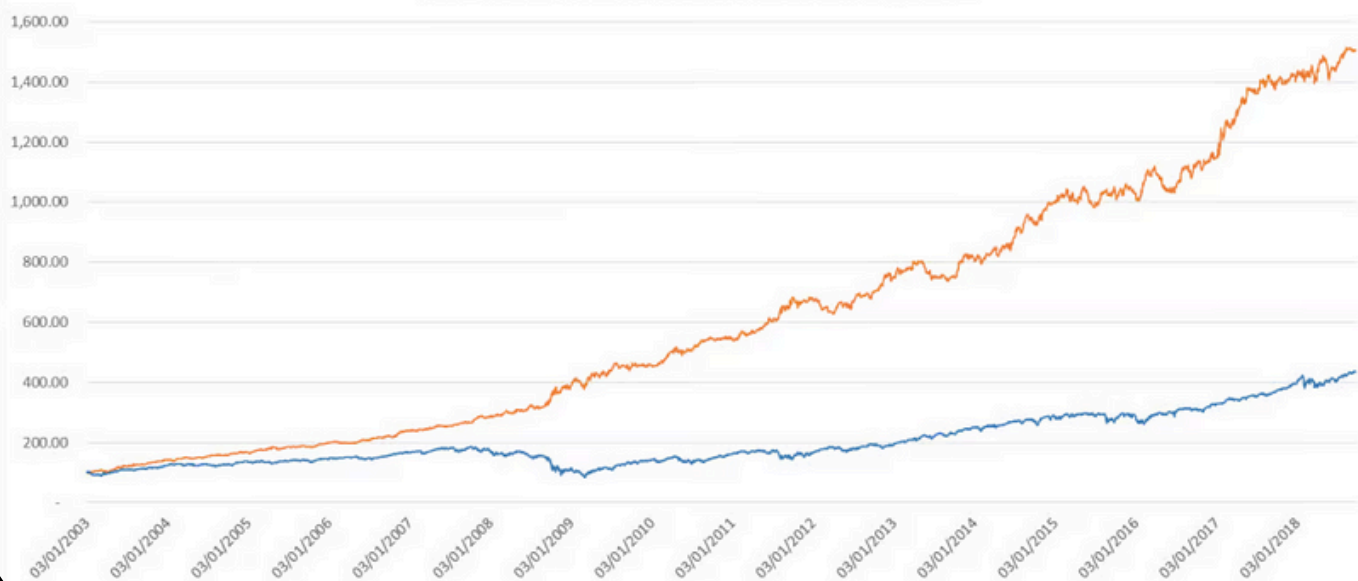
70% Global Stock Index, 30% Global Bond Index Vs. Bridgewater Pure Alpha I
(January 1, 2012 – December 31, 2022)
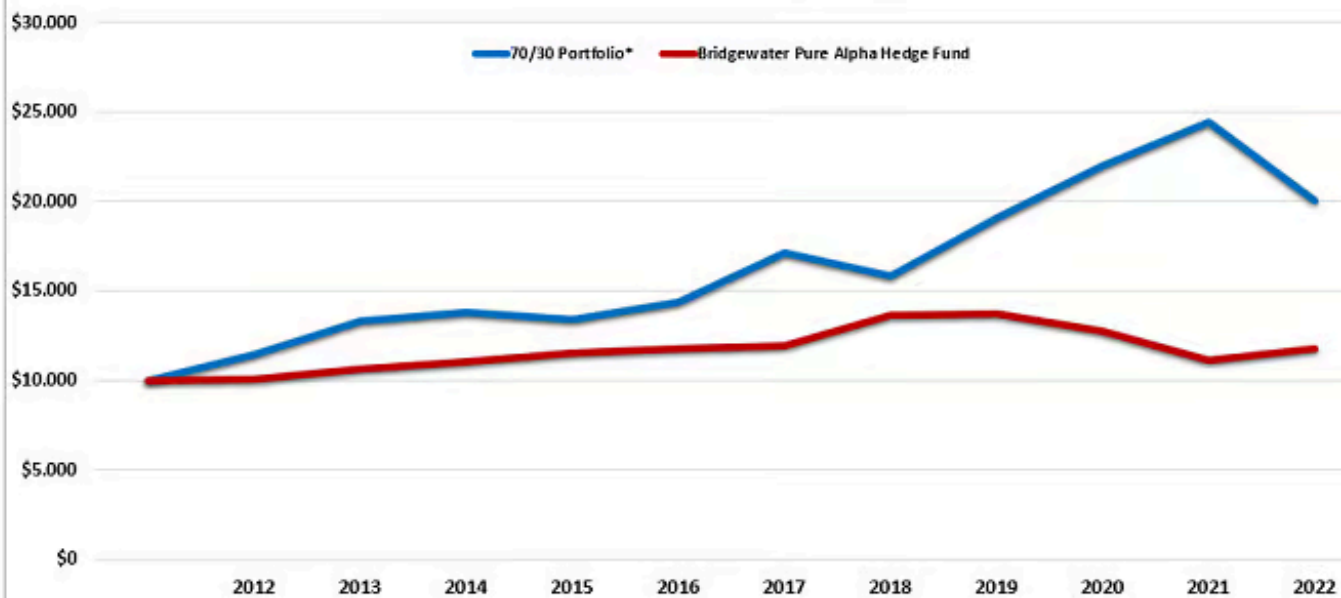
*includes 20 basis points annually deducted for fees for the ETF portfolio