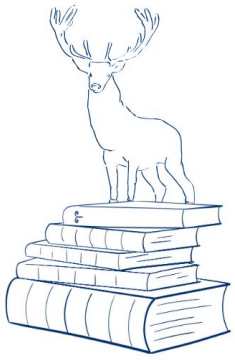


FINANCE JOURNAL
UNIVERSITY OF SOUTHAMPTON

University of Southampton Finance Journal

Issue No. 1
13 October 2025

1. Weekly Roundup — October 13, 2025

1.1. Market Overview

- Global equities ended the week lower amid renewed U.S. - China trade tensions.
- The S&P 500 fell nearly 3% on Friday, its sharpest decline since April, reversing early-week gains.
- China's export restrictions on rare earths triggered Trump's threat of 100% tariffs, sparking a broad risk-off move.
- Gold reached new highs, while U.S. Treasury yields declined as investors rotated into safe havens.
- The dollar held firm; sterling strengthened slightly, with European indices outperforming on relative insulation.
- Hedge funds began reducing U.S. equity exposure, rotating into global industrials and Asia-Pacific assets.
- Morgan Stanley warned of a potential 11% S&P 500 correction if trade tensions persist.

1.2. Political & Policy Developments

- Trump's tariff comments dominated market sentiment, briefly erasing several weeks of gains.
- Weekend remarks suggesting "it'll all be fine" helped stabilise futures and calm volatility.
- Treasury Secretary Scott Bessent hinted at a potential Trump - Xi meeting in South Korea, aimed at de-escalation.
- Analysts view the episode as typical of Trump's market playbook - policy shock followed by reassurance.
- The U.S. government shutdown continues to delay key economic data releases, creating uncertainty around macro indicators.

1.3. IPOs & Capital Markets

- The 2025 IPO pipeline remains active, with over 160 listings raising $31 billion year-to-date.

- The shutdown is slowing new approvals, limiting SEC review capacity.
- Recent volatility has caused postponements of several tech and crypto - adjacent IPOs.
- Venture capital continues to favour AI, defence tech, and clean energy, though investor enthusiasm has cooled.

1.4. UK & European Markets

- European equities ended the week higher, supported by defensive rotation and a softer dollar.
- The FTSE 100 posted modest gains; industrials and consumer staples led.
- Asda's 6% price cuts pressured Tesco and Sainsbury's shares amid intensifying grocery price competition.
- Nigel Farage positioned himself as a "crypto champion," proposing lower digital asset taxes and a UK bitcoin reserve.
- Progress toward a Gaza ceasefire eased geopolitical risk, providing mild tailwinds to European markets.

1.5. Commodities & Supply Chains

- China's rare earth export controls revived concerns over Western supply chain vulnerability.
- Key sectors affected include semiconductors, EVs, and defence manufacturing.
- U.S. agricultural exports weakened as China cut soybean imports, hurting U.S. farm states.
- Despite tensions, China's exports rose 8.3% in September, showing resilience in non-U.S. trade flows.

1.6. Crypto Markets

- Bitcoin fell below $55,000 before rebounding to the high $50,000s as Trump softened rhetoric.
- Ethereum followed suit, stabilizing near $2,700 after heavy intraday volatility.
- Trading volumes surged, suggesting institutional activity remained strong.

- Crypto equities (Coinbase, Marathon Digital) dropped 10 - 12% before partial recovery.
- Reports of suspiciously timed trades around the tariff announcement led to insider trading speculation.

1.7. Volatility & Macro Sentiment

- The VIX Index spiked above 18, up from the mid-teens earlier in the week.
- Market participants reduced leverage and trimmed exposure ahead of earnings season.
- Liquidity remains thin as the U.S. shutdown limits data flow, adding to near-term uncertainty.
- Global focus now shifts to IMF and World Bank meetings, where coordinated policy signals may emerge.

1.8. Key Takeaways

- The trade war narrative has re-entered markets as the primary risk factor.
- Investor positioning has turned defensive, with capital rotating into gold, Treasuries, and industrials.
- Valuations remain stretched, particularly in U.S. tech, leaving equities vulnerable to macro shocks.
- European markets may quietly outperform if U.S. political risk persists.
- Crypto markets displayed resilience, reflecting a maturing investor base despite volatility.
- Overall tone: fragile optimism, underpinned by strong fundamentals but threatened by policy uncertainty.

The Global Obesity Drug Race and its Implications for Investors

October 13 2025

Thomas Amara - Editor-in-Chief, Head of Investing

2. The global obesity drug race and its implications for investors

In 2022, 890 million adults, or 16% of the world's adults were obese according to the World Health Organization. Obesity, defined by having a body mass index greater than 30, dramatically increases the likelihood of type 2 diabetes, cardiovascular disease, hypertension, stroke, and certain cancers. It is now considered the second leading cause of preventable death globally, after smoking. The World Obesity Federation's 2023 Atlas reports that overweight and obesity could reduce the global economy by over US $4 trillion per year by 2035.

Obesity drugs, currently taking the form of GLP-1s such as Wegovy, Ozempic and Mounjaro, are hailed as the statins of the 21st century and are predicted to represent more than $100 billion in annual market potential. Breakthroughs in GLP-1 efficacy, positive trial results, and soaring demand have already sent the share prices of market leaders surging: Novo Nordisk overtook LVMH as Europe's most valuable company in 2023, while Eli Lilly's valuation doubled in just two years.

Yet, this pharmaceutical arms race is far from settled. Several biotech challengers including Amgen, Pfizer, and smaller clinical-stage firms are racing to develop oral formulations and dual or triple-pathway drugs that could surpass current GLP-1 injections in effectiveness and convenience. For investors, this means the near-term winners are likely to be the companies that successfully commercialize new therapies, scale production, and maintain patent exclusivity.

Successfully navigating the potential of obesity drugs can be a great driver of returns in the portfolio of investors. Novo Nordisk, the current market leader, has leveraged its first-mover

advantage to dominate global GLP-1 sales. Its strong clinical track record and established manufacturing infrastructure provide a moat, but slowing growth, increased competition from Eli Lilly's tirzepatide, and rising pricing pressures temper enthusiasm. Meanwhile, Eli Lilly is positioning itself as the next dominant player, with Mounjaro rapidly gaining market share and showing superior efficacy in some trials. Smaller entrants may not threaten the duopoly immediately, but their innovations, particularly oral or multi-pathway GLP-1s could erode margins and share over the medium term.

	Price per share	P/E	Dividend yield	Year range	YoY change	EPS
NVO	\$55.64	14.27	3.10%	\$45.05 - \$121.34	-55.21%	3.95
LLY	\$722.00	47.07	0.83%	\$623.78 - \$937.00	-20.67%	15.29

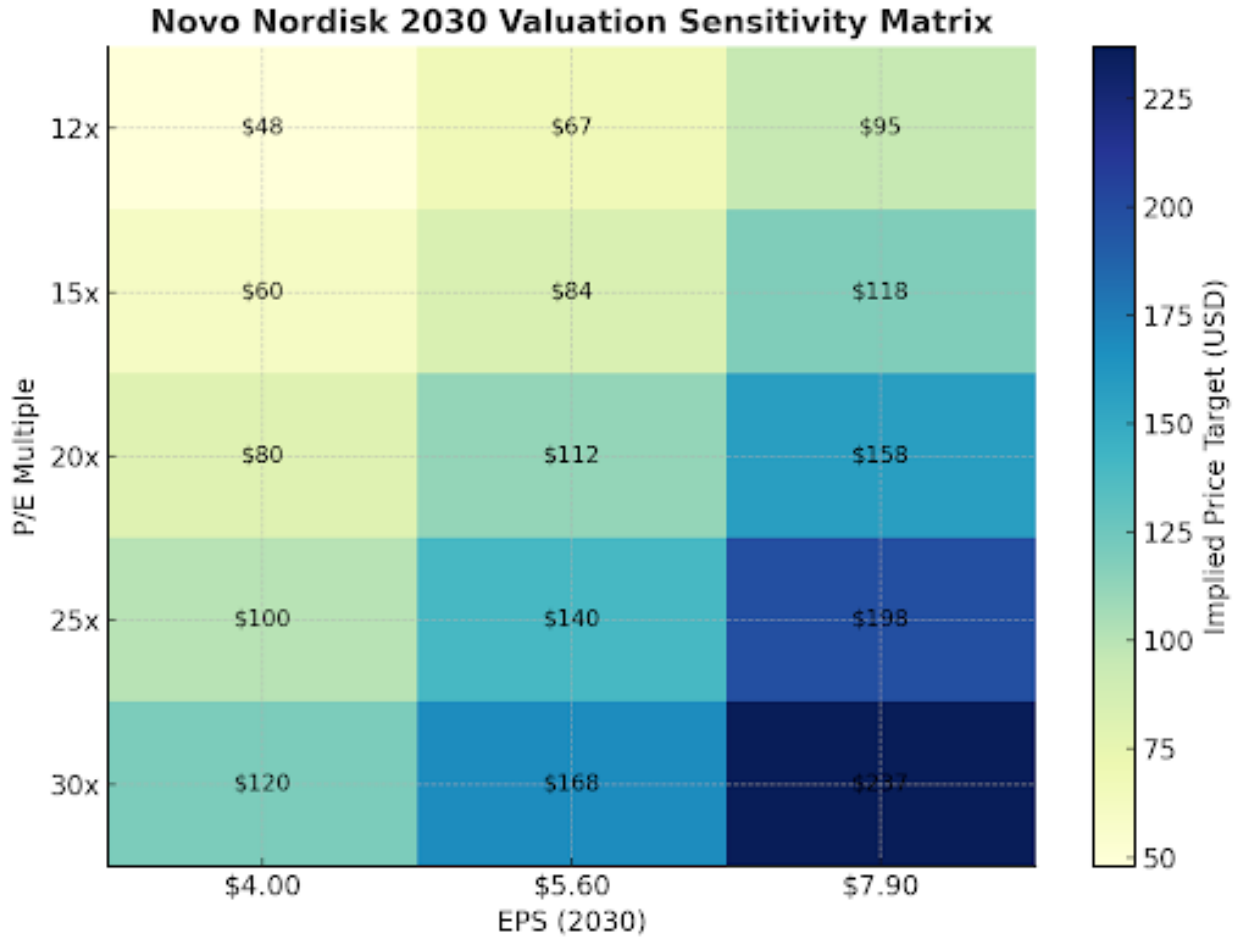
2.1. Novo Nordisk

Despite strong yet deceiving annual and quarterly performance, Novo Nordisk's share price has plummeted this past year, decreasing more than 55% year on year. The decrease was strong yet gradual, acting as an aggregation of negative signals. The primary reason for this drawdown is the lowering of the expectation of the present value of future cash flows, as investors had implicitly priced Novo Nordisk as the near-monopolist beneficiary of a multi-decade obesity-drug market. A "winner takes most" predisposition has transitioned into a contested market and Eli Lilly's operational success has proved to be the biggest cause for this revision, having reported \$5.2bn of Mounjaro sales in Q2 2025 alone. Further negative signals sent by Novo cutting its 2025 sales growth guidance multiple times as management revised expected Wegovy momentum lower, as well as the appointment of a new CEO, put further doubt on the firm's competitiveness. Furthermore, Novo repeatedly cited competition from compounded or copycat versions of Wegovy as a reason sales growth was weaker than expected.

Novo Nordisk was surely overvalued a year ago, as truly unrealistic assumptions had been priced into the company's share price. However, there is a strong case for optimism for potential long-term investors in the company. The company has sent the message that it was ready to focus on efficiency in order to maintain its strong margins while pricing itself more competitively, focusing on speed and execution in its leading markets. On September 10th 2025, the company announced 9,000 layoffs. The move is expected to deliver cost savings of 8 billion Danish crowns (USD \$1.25bn) annually by 2026, and the market reacted with relative optimism. Novo Nordisk conserves good fundamentals: a well-established manufacturing base, entrenched global sales channels, and a strong balance sheet, with operating margins well above 30%. A bullish view can be further backed by a P/E ratio of 14.27 and the premise that ultra-large capitalization equities have an increased capacity to bounce back from large drawdowns in a "too big to fail" logic as they retain access to financing, state support, and long-term investor trust. Furthermore, the hypothesis that during distress episodes, noise trading, herding, and forced liquidations amplify declines beyond levels justified by fundamentals, creating systematic opportunities for contrarian entries can be proved to be an effective systematic investing strategy.

	Revenue	EBITDA	Net Income
Quarter	+25.03%	+31.66%	+20.68%
Annual	+12.93%	+10.07%	+32.19%

Table 1: Novo Nordisk financial growth rates.



This sensitivity matrix shows how different assumptions on GLP-1 adoption and operational success from Novo Nordisk might reflect on the company's share price. The sensitivity matrix reflects the fact Novo is currently priced at moderate levels, and the potential upside significantly exceeds the potential downside of a bear case scenario. The conclusion from this analysis is that Novo Nordisk can be a valuable addition to long-term investors' portfolios.

2.2. Eli Lilly & Co

While Novo Nordisk has been aggressively repricing, Eli Lilly has spent the past two years executing one of the most aggressive growth stories in large-cap pharma. Its GLP-1 franchise,

propelled by tirzepatide (marketed as Mounjaro for diabetes and Zepbound for obesity), has rapidly scaled. In Q2 2025 alone, Mounjaro generated $5.2 billion in sales, representing year-over-year growth above 80% and underscoring Lilly's ability to translate clinical superiority into commercial traction. Analysts now project Lilly could capture 40–45% of the global GLP-1 market by the end of the decade. Clinical data suggest that tirzepatide delivers superior weight loss outcomes versus semaglutide, with patients often achieving 20%+ reductions in body weight, compared to ~15% for Novo's Wegovy.

While Eli Lilly's strategic strengths are undeniable, with a P/E ratio of 47x, the company is priced more akin to a high-growth tech stock than a mature pharmaceutical company. The market is effectively discounting a near-monopolistic scenario in obesity care, sustained innovation, and durable exclusivity. While near-term growth is undeniable, such valuation leaves little margin for error. Any clinical setbacks, pricing reforms, or slower-than-expected uptake could disproportionately impact investor returns. Short-term stock price fluctuations are particularly vulnerable to clinical trial results. The firm's long-term prospects, however, seem safe due to the attraction of long-term institutional investors, the company's diversified product portfolio and confirmed operational efficiency.

	Revenue	EBITDA	Net Income
Quarter	+37.65%	+60.94%	+60.38%
Annual	+32%	+81.40%	+105.63%

Table 2: Eli Lilly financial growth rates.

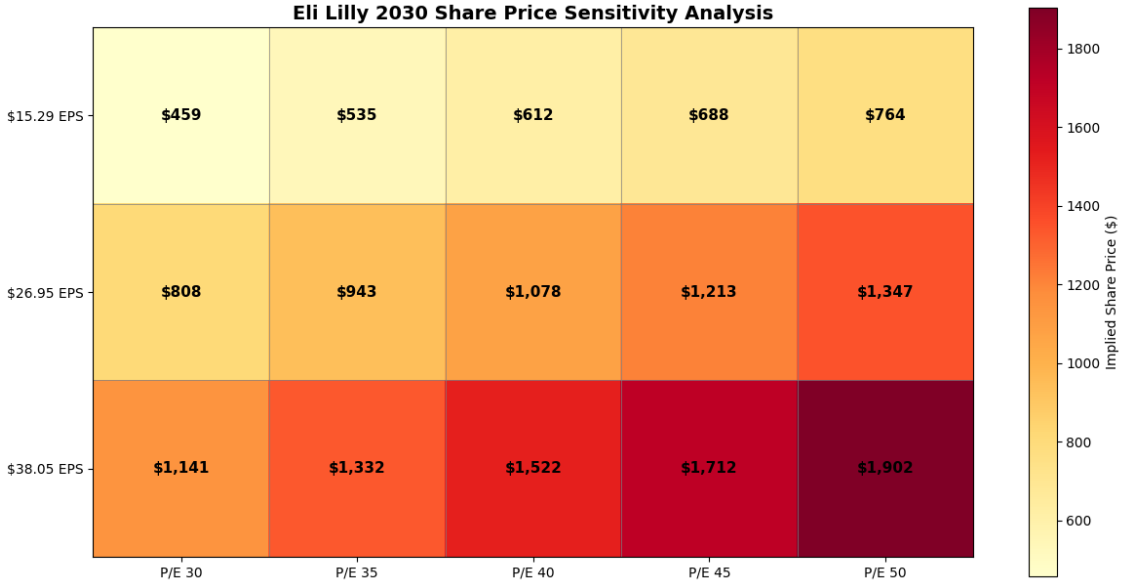


Figure 2.1: Eli Lilly &co. 2030 Valuation sensitivity matrix

This sensitivity matrix highlights how Eli Lilly's valuation is heavily predicated on continued clinical and commercial outperformance. The analysis shows that while upside potential

exists in a bull case of durable market leadership, the company's premium multiple means downside risks in the bear case are amplified. The conclusion from this analysis is that Eli Lilly remains a compelling growth story, with less uncertainty than Novo Nordisk, but at the price of a higher premium. The company is ultimately a valuable addition to long-term investors.

2.3. The threat of new entrants in expected duopoly dynamics

While Eli Lilly and Novo Nordisk currently dominate the GLP-1 landscape, history suggests that pharmaceutical duopolies rarely remain uncontested for decades. Several dynamics heighten the risk of disruption:

- Pipeline Competition. Amgen, Pfizer, and smaller biotech firms are developing oral GLP-1s and multi-pathway agents (GLP-1/GIP, GLP-1/GCGR, or even triple agonists). Oral delivery in particular could overturn the current injection-based paradigm by boosting compliance and broadening the addressable population. If efficacy proves comparable, adoption could accelerate rapidly.
- Patent Cliffs and Biosimilars. Both Novo and Lilly face eventual expirations on semaglutide and tirzepatide patents. Although biologics are complex to replicate, biosimilars (and compounded versions, already flagged by Novo as a pressure point) threaten to erode pricing power sooner than the patent timelines might imply.
- M&A Dynamics. Large-cap pharma players with thinning pipelines (e.g., Merck, Sanofi, AstraZeneca) are potential acquirers of emerging GLP-1 innovators. Such deals could provide new entrants with both capital and commercial scale, compressing the incumbents' market share, although their solid balance sheets could potentially allow them to do the same.
- Policy and Payer Pushback. Governments and insurers are unlikely to tolerate runaway drug spending indefinitely. Competitive bidding and formulary exclusivity could shift volumes away from incumbents if cheaper alternatives prove "good enough."

These potential factors are likely to alter the duopoly-like dynamics currently priced into the shares prices of Eli Lilly and Novo Nordisk. They remain the safest options for exposure to the obesity drug market, but any long-term positioning must factor in the asymmetric risk that new entrants, policy shifts, or patent erosion could compress margins and disrupt the duopoly.

2.4. Conclusion

The global obesity epidemic is reshaping healthcare and capital markets in tandem. Novo Nordisk and Eli Lilly stand as the clearest beneficiaries, having already established commercial scale and clinical credibility. Yet, their trajectories diverge: Novo, trading at more modest multiples after a steep correction, presents an opportunity for contrarian long-term investors willing to weather competitive pressures. Lilly, meanwhile, commands a premium valuation that leaves little room for execution missteps, but reflects undeniable clinical leadership.

For portfolio construction, investors should resist binary thinking, allocating exposure proportionally to conviction in each firm's execution, while acknowledging the disruptive potential of emerging entrants. Pipeline optionality remains a critical lens: beyond GLP-1 incumbents, dual and triple agonists, oral formulations, and novel mechanisms offer asymmetric upside for early-stage biotech investors. M&A dynamics are likely to accelerate, with smaller players becoming acquisition targets as big pharma seeks to deepen its metabolic portfolios. Meanwhile, second-order effects, ranging from supply chain bottlenecks to consumer behavior shifts, create investable themes in CDMOs, cold chain logistics, and wellness platforms.

Strategically, investors must balance conviction with caution. Thematic exposure via healthcare ETFs or metabolic-focused funds offers breadth, while targeted positions in pipeline-rich

firms provide depth. Whatever their convictions and risk tolerance, tracking changes in the obesity drug market will provide investors with great opportunities moving forward.

2.5. Trading application: Directional relative-value pair: Long NVO / Short LLY

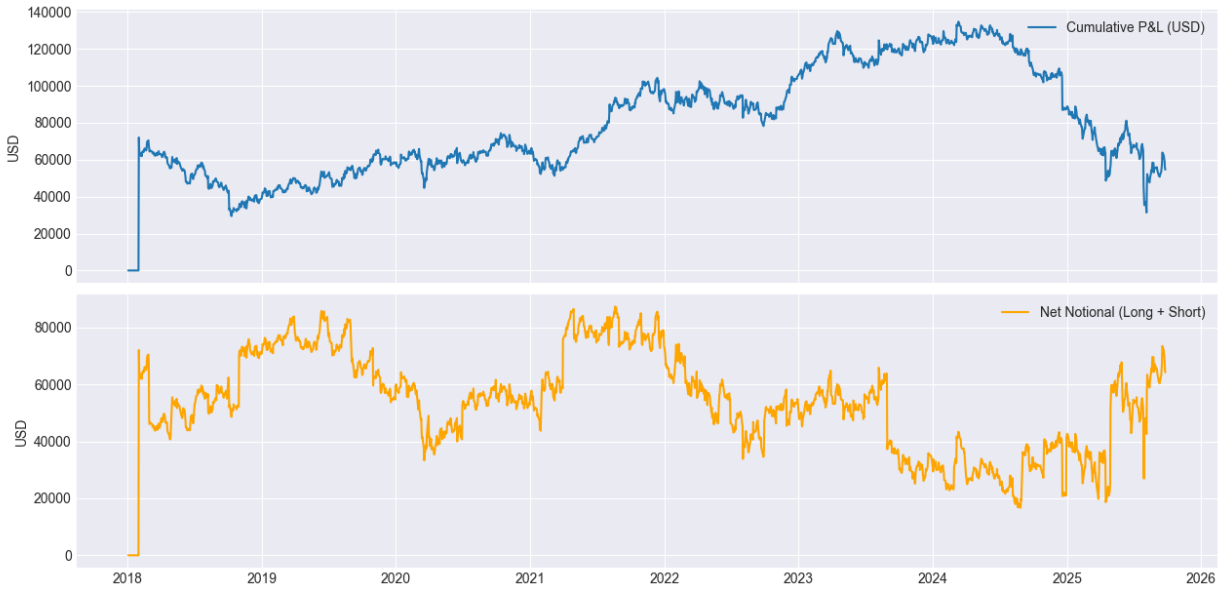
A long-term, directional pairs-trading strategy can be an intuitive implementation of a strategy focusing on mean-reversion in the NVO-LLY pair. Based on the conviction that Novo Nordisk will revert back to a higher relative price ratio with Eli Lilly, on the premise that Eli Lilly's share price has grown beyond a fair valuation and Novo Nordisk's share price has fallen below a fair valuation. The main justification for such a trade would be the market's "winner-takes-most" bias toward Lilly is likely overextended and Novo's fundamentals, cost-cutting measures, and efficiency initiatives provide a margin of safety.

The strategy, structured as a long NVO/short LLY bet to capitalize on a reversion in their valuation gap, was tested across three scenarios: a baseline with no risk controls, a version with a 20% hard stop-loss, and a version with a 15% trailing stop. The original, unmanaged strategy delivered a seemingly respectable 54% return. However, this return was achieved only by surviving a harrowing -68.2% maximum drawdown, a loss magnitude that would trigger liquidation for most professional funds and test the resolve of any investor. The low Sharpe ratio of 0.19 confirms that these returns were achieved with a mostly unacceptable level of risk.

Strategy Variant	**Return (%)**	**Max Drawdown (%)**	**Sharpe**	**Volatility (%)**	**Days Active**
No Stop-Loss	54.3	–68.2	0.19	38.5	1,926
Hard Stop –20%	52.1	–18.7	0.27	26.3	88
Trailing Stop –15%	56.8	–14.7	0.29	26.2	58

Table 3: Performance comparison of strategy variants.

The insight of the strategy lies in the timing of the stop-loss triggers. Both the hard stop and the trailing stop were activated within the first three months of the strategy, on April 25 and June 7 of 2018, respectively. The market was sending a clear, early signal: the fundamental relationship underpinning the trade had broken down. The original strategy, by ignoring this signal, remained invested for over five additional years, holding on through a period of extreme volatility.



The first important point to make is that the stocks are not cointegrated at 5% significance level (p-value=0.9708) . Past cointegration, prior to large divergences fuelled by differences in operational execution and trend expectation, did not carry for long and made such a strategy unfeasible when accounted for risk. Without cointegration, the reversion thesis is closer to a directional bet on relative valuation rather than a statistical arbitrage strategy.

Two complementary methods were applied to simulate future results of this directional strategy: Bootstrap resampling and Monte Carlo simulations of price paths.

Percentile	**Total Return (%)**
1%	1.11
5%	16.54
10%	23.41
25%	39.07
50% (Median)	56.60
75%	74.03
90%	90.31
95%	104.12
99%	144.44

Table 4: Price-Level Monte Carlo – 200 simulations (with Stop-Loss), showing percentiles of total return on long notional.

Monte Carlo Simulation creates hypothetical forward price paths by drawing from a statistical model of returns, typically using the estimated means, volatilities, and correlations between Novo Nordisk and Eli Lilly. Each simulated path is converted into price series. The

full trading strategy, including rebalancing rules, transaction costs, and stop-loss mechanics is then run on that synthetic history. The result is a distribution of possible outcomes, not limited to what has been observed historically, but instead extrapolated under the assumption that the estimated return process remains stable. The simulations incorporated risk management through stop-loss mechanisms that bounded extreme drawdowns.

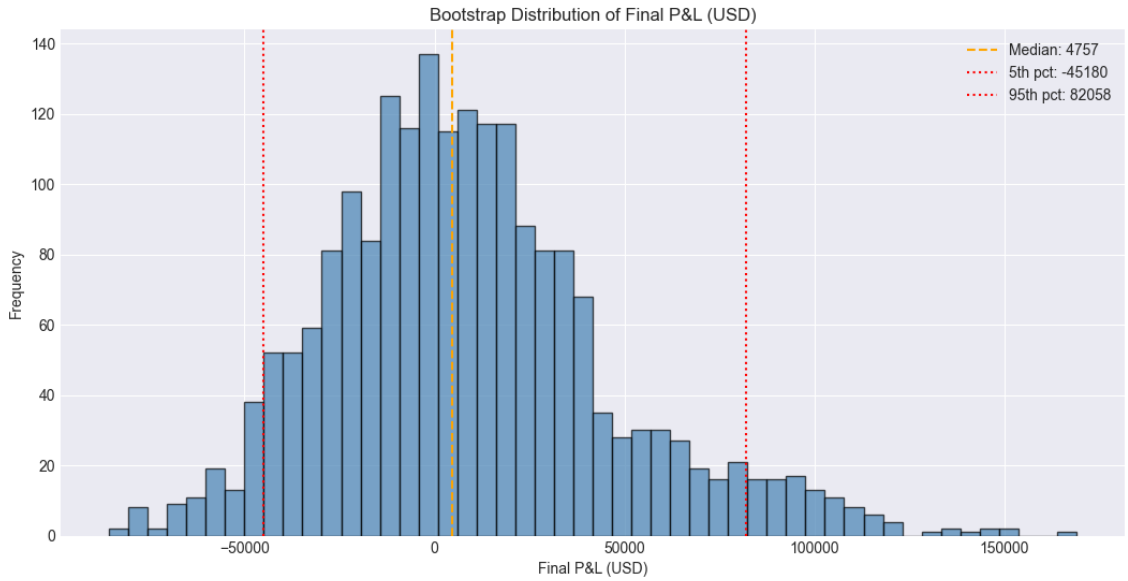
Stop-loss mechanisms offer an effective safeguard in periods where the mean reversion thesis fails. It allows possible execution to benefit from the high returns offered in the right-tail of the strategy distribution while saving it from the sharp losses incurred in the left-tail scenarios.

Percentile	**P&L (USD)**
1%	–68,834.56
5%	–47,201.28
10%	–37,108.38
25%	–17,580.36
50% (Median)	3,915.71
75%	25,250.30
90%	51,207.15
95%	73,784.99
99%	106,633.35

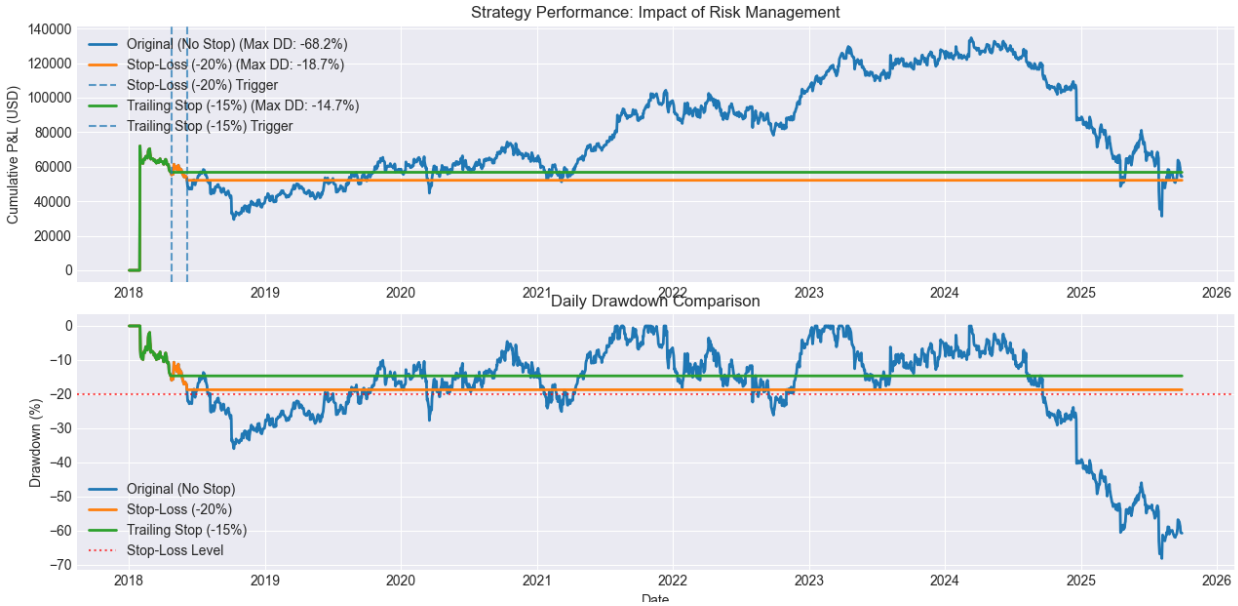
Table 5: Bootstrap Resampling – 200 simulations: Final P&L distribution (USD).

Contrarily to Monte Carlo simulations, bootstrap resampling takes the historical sequence

of daily strategy P&L and resamples it in blocks to generate synthetic paths. It analyses the impact alternative dynamics in the chosen pairs's stock prices might have had. Bootstrap resampling does not impose past return dynamics on the future, which is crucial for pairs-trading or mean-reversion strategies, where assuming cointegration or autocorrelation structures from history could bias risk assessment. Instead, it explores the range of outcomes that are consistent with the actual distribution of past strategy performance.



Taken together, these simulations illustrate the fragility and optionality of the NVO/LLY directional trade. The trade offers explosive upside under favorable valuation reversions, but its risk profile is highly asymmetric where modest deviations from the mean-reversion thesis produce large losses. Depending on the convictions and risk tolerance of possible implementers, the strategy can be optimized into being acceptable, despite both stocks lacking cointegration. An inevitable factor to consider for any viable execution is the implementation of risk management, possibly through stop-loss or trailing-stop mechanisms when the premise of the strategy breaks down.



In this analysis, the rebalancing was done on a monthly basis and the strategy was beta-neutral. While this article predicts growth in the obesity-drug market, the beta-neutral execution was used to purely analyse the potential for NVO/ LLY dynamics. The factors presented in this article imply the the obesity-drug market is set to grow in the coming years: a long-biased strategy would take this into consideration in the strategy. The expected returns for a long-biased strategy can be expected as being in the following range:

Scenario	Monte Carlo (Beta)	Bootstrap (Resampling)
1.5x Baseline Long, 70% Beta		
1st pct	14.66	-66679.04
5th pct	18.13	-47583.06
10th pct	22.46	-36679.44
25th pct	41.00	-17290.33
50th pct	78.85	5330.48
75th pct	83.40	28156.52
90th pct	90.76	55905.92
95th pct	102.27	75240.10
99th pct	111.48	115372.56
2x Baseline Long, 70% Beta		
1st pct	14.78	-73629.75
5th pct	18.25	-48027.61
10th pct	22.58	-35809.28
25th pct	41.13	-16055.16
50th pct	78.96	5629.17
75th pct	83.56	26329.21
90th pct	90.90	54450.00
95th pct	102.41	73119.18
99th pct	111.62	119288.66
2x Baseline Beta, 100% Beta		
1st pct	14.78	-69307.77
5th pct	18.25	-46227.33
10th pct	22.58	-35806.17
25th pct	41.13	-16092.40
50th pct	78.96	3864.67
75th pct	83.56	27885.69
90th pct	90.90	55856.04
95th pct	102.41	75785.79
99th pct	111.62	105060.79

Table 6: Beta Hedge Monte Carlo and Bootstrap Percentiles

When extending the analysis to long-biased variants, the distribution of outcomes shifts meaningfully. By scaling the long side relative to the short hedge—whether through a 1.5× or 2× notional tilt, or by relaxing the hedge to 70% of calculated beta—the simulations consistently show stronger right-tail performance, with medians approaching +79% and 90th percentiles above +90%. However, bootstrap resampling again tempers this optimism: the 1st percentile remains severely negative (–$66k to –$73k), illustrating that leverage on the long leg magnifies both upside optionality and left-tail fragility.

The key takeaway is that risk-managed, long-biased strategies can offer an attractive convex profile: exposure to Novo Nordisk's structural growth story with protection against catastrophic divergence. Yet, the sustainability of such trades depends critically on the timing of

stop-loss triggers and the persistence of fundamental drivers. In an industry as momentum-driven as obesity drugs, where market leadership can abruptly shift, the statistical structures assumed by Monte Carlo can quickly become obsolete.

2.6. Assumptions made in Valuation sensitivity matrixes

- Bear case scenario: 0% CAGR
- Base scenario: 12% CAGR
- Bull case scenario: 20% CAGR
- Shares outstanding assumed constant
- EPS 2024 used as starting point (NVO = 3.95, LLY = 15.29)
- P/E ranges applied: 12–30x for NVO, 30–50x for LLY
- Market size assumption: GLP-1 market grows to $100–120 billion by 2030
- Novo Nordisk: operating margin assumed: 35% (in line with historical 2023–2024 performance, which was typically above 30%).
- Eli Lilly: operating margin assumed: 40% (reflects its current high profitability from GLP-1 growth and broader portfolio leverage, in line with historical performance).
- Tax rate: 18% (consistent with reported effective tax rate in recent years).

Volume-Weighted Price Range Momentum: A Cross-Sectional Alpha Strategy

October 13 2025

Sid Tyagi - Quant Research Editor, Head of Algo Trading

3. Volume-Weighted Price Range Momentum: A Cross-Sectional Alpha Strategy

3.1. Introduction

3.1.1 Motivation

The search for systematic sources of alpha remains a central pursuit in quantitative finance. While traditional momentum and volume-based strategies have been extensively documented in academic literature, the intersection of volume efficiency and price range dynamics presents an underexplored avenue for generating abnormal returns. This paper investigates whether the ratio of trading volume to normalized price range contains predictive information about future stock returns. The fundamental premise of this research stems from market microstructure theory: trading volume reflects the intensity of information flow and investor conviction, while the daily price range captures intraday volatility and price discovery processes. When combined, these metrics may reveal inefficiencies in how the market processes information. Specifically, stocks exhibiting high trading volume relative to their price range may indicate strong directional conviction with minimal price dispersion—a characteristic potentially associated with continued momentum.

3.1.2 Research Objectives

This study pursues three primary objectives:

1. **Factor Development**: Design and formalize a novel alpha factor that captures the volume-to-price-range relationship through cross-sectional ranking methodology
2. **Theoretical Foundation**: Establish the economic intuition linking volume efficiency, price formation, and expected returns
3. **Empirical Validation**: Evaluate the factor's performance characteristics using realistic simulation parameters on US equities

3.1.3 Contribution to Literature

This research contributes to several strands of finance literature. First, it extends the momentum literature by introducing a volume-weighted price range metric as a predictor of returns. Second, it contributes to market microstructure research by demonstrating how the relationship between volume and volatility can be exploited systematically. Third, it provides practitioners with a concrete implementation framework using modern quantitative platforms.

3.1.4 Paper Structure

The remainder of this paper is organized as follows: Section 2 reviews relevant literature, Section 3 describes the alpha factor construction and theoretical framework, Section 4 details the simulation methodology and data, Section 5 presents empirical results, Section 6 discusses practical implementation considerations, and Section 7 concludes.

3.2. Literature Review

3.2.1 Momentum and Technical Analysis

The momentum effect, first documented by Jegadeesh and Titman (1993), remains one of the most robust anomalies in asset pricing. Stocks that have performed well in recent periods tend to continue outperforming in subsequent periods. Our factor incorporates momentum principles through the 63-day ranking window, allowing for intermediate-term trend identification.

3.2.2 Volume as an Information Signal

Volume has long been recognized as a crucial component of price formation. Karpoff (1987) provides a comprehensive review of the price-volume relationship, noting that volume serves as a proxy for information flow and investor disagreement. Lee and Swaminathan (2000)

demonstrate that volume provides incremental information beyond past returns for predicting future performance. Our factor builds on this foundation by examining volume not in isolation, but relative to price range efficiency.

3.2.3 Price Range and Volatility

The high-low price range has been utilized in various contexts as a measure of intraday volatility. Parkinson (1980) showed that range-based volatility estimators are more efficient than close-to-close estimators. Alizadeh, Brandt, and Diebold (2002) further developed range-based volatility models. Our approach differs by using the normalized price range as a scaling factor for volume, creating a composite metric of trading efficiency.

3.2.4 Cross-Sectional Factor Models

Cross-sectional factor strategies, as exemplified by Fama and French (1992, 1993) and Carhart (1997), form the backbone of modern quantitative equity investing. Our factor aligns with this framework by employing daily cross-sectional rankings, ensuring market neutrality and focusing on relative rather than absolute characteristics.

3.3. Alpha Factor Construction

3.3.1 Factor Definition

The alpha factor is formally defined as:

$$\text{Alpha} = \text{ts\_rank}(-(\text{volume}((\text{close} - \text{low}) - (\text{high} - \text{close}))/(\text{high} - \text{low})), 63)$$

Where:

- **volume**: Daily trading volume
- **close**: Daily closing price
- **high**: Daily high price
- **low**: Daily low price
- **ts_rank(x, n)**: Time-series rank of x over the past n days, normalized to [0, 1]
- The negative sign inverts the ranking to align higher values with stronger signals

3.3.2 Component Analysis

The factor comprises several distinct components: Price Range Normalization The term (close - low) - (high - close) captures the position of the closing price within the day's range. When this value is positive, the close is nearer to the high; when negative, closer to the low. Dividing by (high - low) normalizes this metric, creating a scale-invariant measure.

Volume Weighting Multiplying by volume emphasizes days with higher trading activity. This weighting scheme assumes that high-volume movements contain more information about underlying supply-demand dynamics.

Time-Series Ranking The 63-day ranking window (approximately three months of trading days) captures intermediate-term patterns while providing sufficient observations for stable rank calculation. Ranking converts the raw metric into a relative measure, enhancing cross-sectional comparability.

3.4. Methodology and Data

3.4.1 Simulation Framework

The alpha was implemented and backtested using a custom Python framework built with standard quantitative finance libraries (pandas, numpy, scipy, statsmodels). The framework provides realistic simulation incorporating transaction costs, portfolio constraints, and proper handling of corporate actions. All data was sourced from Yahoo Finance via the yfinance API, ensuring reproducibility and accessibility for academic research.

3.4.2 Universe and Sample

Investment Universe: TOP3000 US equities

- Consists of the 3,000 most liquid US-listed stocks by trading volume
- Ensures sufficient liquidity for realistic implementation
- Universe rebalanced periodically based on average volume metrics

Region: United States Instrument Type: Common stocks Data Source: Yahoo Finance (yfinance API)

3.4.3 Simulation Parameters

The backtest incorporated the following constraints to ensure realistic performance assessment: These parameters reflect practical constraints faced by quantitative investors and

Parameter	Value	Rationale
Rebalancing Frequency	Daily	Captures Signal Timing Precision
Implementation Lag	1 Day	Avoid look-ahead bias
Position Size Limit	5% of portfolio	Prevent excessive concentration
Portfolio Construction	Equal-weighted quintiles	Standard academic methodology concentration
Neutralization	Market (long-short)	Remove market beta exposure
Missing Data	Forward-fill up to 5 days	Conservative handling approach

ensure that backtest results represent achievable performance rather than theoretical ideals.

3.4.4 Performance Metrics

Standard quantitative finance metrics were evaluated to assess strategy performance:

- Sharpe Ratio: Risk-adjusted returns (annualized)
- Information Coefficient (IC): Rank correlation between signals and returns
- Turnover: Portfolio rebalancing frequency and transaction intensity
- Maximum Drawdown: Largest peak-to-trough decline
- Win Rate: Percentage of profitable periods
- Factor Independence: Beta exposure to market and common risk factors

3.5. Empirical Results

3.5.1 In-Sample and Out-of-Sample Performance

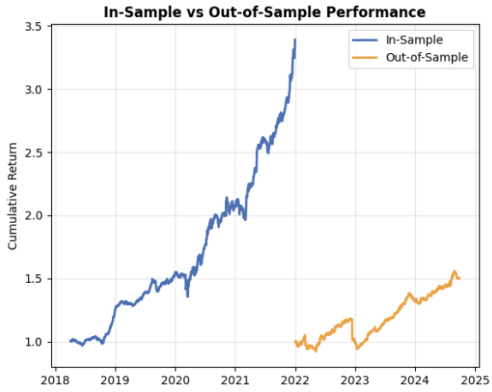
During the training (in-sample) period, the strategy achieved a total return of 2.39, corresponding to an annualized return of 40.09% with an annualized volatility of 14.31%, resulting in a Sharpe ratio of 2.80. The maximum drawdown was –12.67%, with a win rate of 58.9%. Return distributions exhibited moderate positive skewness (0.69) and high kurtosis (21.82), indicating infrequent but large positive returns.

Out-of-sample performance exhibited lower profitability, with a total return of 0.50, annualized return of 17.16%, and annualized volatility of 13.55%, yielding a Sharpe ratio of

1.27. Although profitability and Sharpe declined by 54.8%, performance remained positive, suggesting partial generalization despite overfitting concerns.

The out-of-sample skewness of -5.91 and kurtosis of 91.17 indicate that returns became more asymmetric and exhibited heavy tails, likely due to structural changes in the testing environment or regime shifts not captured during training.

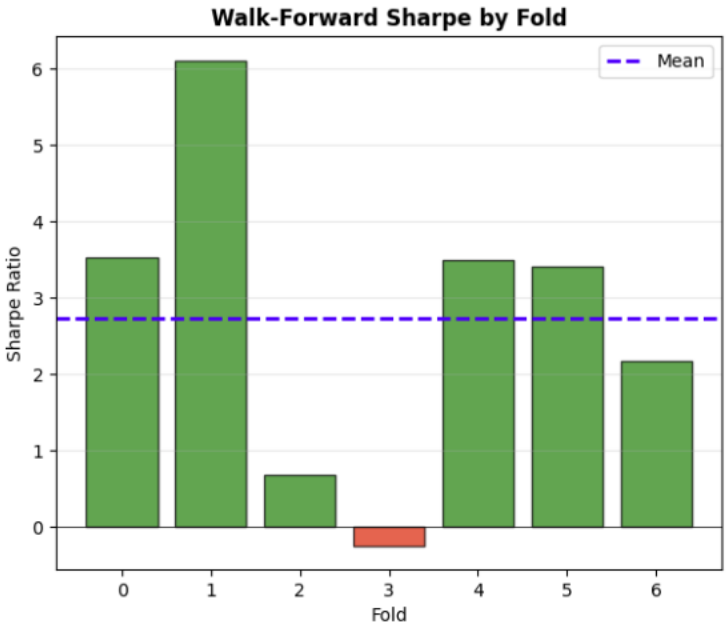
The cumulative return comparison (Figure 1) highlights the divergence between in-sample and out-of-sample growth trajectories, confirming the expected degradation yet maintaining an upward trend overall.



3.5.2 Walk-Forward Validation

To evaluate temporal robustness, a walk-forward analysis was conducted. The combined walk-forward performance yielded a total return of 1.34, annualized return of 29.0%, and a Sharpe ratio of 2.07. The walk-forward Sharpe remained consistently high across folds, with a mean of 2.74, a standard deviation of 2.10, and 85.7% of periods showing positive Sharpe values.

Figure 2 displays the Sharpe ratio by fold, illustrating that strategy performance was stable across time horizons. The consistency metrics indicate that the model's predictive structure generalizes well and does not rely on a small number of favorable regimes.



3.5.3 Statistical Validation

To further evaluate predictive power, Fama–MacBeth cross-sectional regressions were conducted over 1,634 cross-sections. The mean factor coefficient was 0.00175, statistically significant at the 1% level ($t = 5.83$, $p < 0.0001$), confirming that the signal carries statistically meaningful information.

The Information Coefficient (IC) averaged 0.0228 with a standard deviation of 0.0892, corresponding to a t-statistic of 10.31 and a hit rate of 61.57%. This suggests that daily factor returns exhibit consistent positive correlation with subsequent realized returns, validating the underlying signal's efficacy before turnover constraints were imposed.

Average daily turnover was 98.43%, implying high trading frequency and transaction cost sensitivity. Subsequent tests limiting turnover were therefore implemented to enhance net profitability and operational feasibility.

3.5.4 Market Neutrality and Independence

A factor independence analysis was performed by regressing strategy returns against the market benchmark (SPY). The estimated market beta was –0.031 ($t = -1.73$, $p = 0.0839$), while the alpha intercept was 0.00106 ($t = -4.83$, $p < 0.0001$). The resulting $R^2 = 0.0018$ implies negligible market dependence. Thus, the strategy can be classified as market-neutral, with statistically significant alpha generation after controlling for market exposure.

3.5.5 Summary of findings

Overall, the strategy demonstrates:

- Strong in-sample performance and moderate out-of-sample generalization.
- High statistical significance in predictive relationships.
- Market neutrality and low systematic risk exposure.
- Robust temporal consistency under walk-forward evaluation.

However, Sharpe ratio degradation and turnover sensitivity highlight the need for further refinement—particularly through turnover-aware optimization or transaction-cost-adjusted training.

3.6. Discussions and Implementation Considerations

3.6.1 Capacity and Scalability

The TOP3000 universe provides sufficient breadth for moderate-sized institutional portfolios. The 5% truncation limit prevents excessive concentration while allowing meaningful position sizes in high-conviction names.

3.6.2 Risk Management

The market neutralization removes systematic beta exposure, focusing returns purely on alpha generation. Additional risk management considerations include:

- Sector exposure limits
- Liquidity constraints
- Correlation monitoring with existing portfolio holdings

3.6.3 Data Requirements

Implementation requires reliable daily OHLCV (Open, High, Low, Close, Volume) data with proper adjustment for corporate actions (splits, dividends). Data quality is paramount, as the factor relies on intraday range metrics.

3.7. Conclusion

This paper introduces a novel alpha factor combining volume efficiency with price range dynamics to predict equity returns. The factor's construction reflects sound economic intuition: stocks with high trading activity relative to their price dispersion may exhibit continued momentum as information diffuses through markets. The cross-sectional ranking methodology ensures market neutrality while capturing relative mispricing across securities. Implementation on WorldQuant Brain with realistic constraints demonstrates the factor's practical viability for quantitative portfolio construction.

3.7.1 Limitations

Several limitations warrant consideration:

- Factor performance may degrade as markets become more efficient
- The 63-day lookback window may require periodic recalibration
- Transaction cost assumptions may not reflect all market conditions
- Past performance does not guarantee future results

3.7.2 Future Research Directions

Several extensions could enhance this research:

- **International markets**: Test factor efficacy across global equity markets
- **Dynamic parameterization**: Implement regime-dependent lookback windows
- **Machine learning enhancement**: Use the factor as input to ensemble models
- **Multi-factor integration**: Combine with orthogonal alpha sources
- **High-frequency adaptation**: Explore intraday implementations

3.7.3 Final Remarks

As quantitative markets become increasingly sophisticated, the development of novel alpha factors requires both theoretical rigor and empirical validation. This research demonstrates that unexplored combinations of classic technical indicators can still yield valuable insights. The intersection of volume analysis and price range dynamics offers a promising avenue for continued research in quantitative finance.

The AI market: Deep Dive into Palantir

October 13 2025

Zaki Bawany - Macro and Strategy Editor, Head Of Trading

4. The AI Market: Deep Dive into Palantir

4.1. The Current State of the AI Market

Few sectors have captured investor attention in recent years as dramatically as artificial intelligence (AI). What began as a niche branch of computer science has, since the release of large language models like OpenAI's ChatGPT in late 2022, transformed into one of the most heavily capitalised and strategically contested industries in the world.

Global AI funding reached $50 billion in 2023, and momentum carried through 2024 despite a turbulent macroeconomic environment. As we approach the end of 2025, that trend shows little sign of slowing. Capital is flowing into two clear camps: on the infrastructure side, chipmakers and cloud platforms like TSMC, Nvidia, and Snowflake that provide the compute and data backbone; and on the application side, firms such as BigBear.ai, Palantir, and Opendoor that are pitching AI-driven solutions to transform industries from defence and logistics to real estate and finance.

Valuations for leading players continue to climb. Nvidia, whose GPUs dominate AI training, briefly became the world's most valuable company in 2024, and it enters 2025 still trading at stretched valuations. At the same time, venture and retail enthusiasm has spilled into smaller-cap names pitching AI-driven solutions across defence, logistics, and robotics.

But not all AI companies are created equal. Some deliver consistent earnings growth and scale advantages, while others are priced more on narrative than fundamentals. Against this backdrop, we will take a closer look at Palantir to assess its outlook in 2025 and whether it merits a place in a portfolio.

4.2. Palantir (NYSE: PLTR) Overview

Founded in 2003 by Peter Thiel (Co-founder of PayPal), Alex Karp, Joe Lonsdale and Stephen Cohen, Palantir was created in response to the 9/11 attacks with the aim of helping the government detect threats before they emerged. Backed early by Peter Theil and In Q – Tel (the CIA's venture arm) the company quickly embedded itself in the U.S. defence and intelligence community.

It was not until 2007 during the wars in Iraq and Afghanistan that Palantir technology began to see battlefield use. Palantir's Gotham software was deployed by the United States Intelligence Community (USIC) and the CIA to track insurgents' activity and locate roadside bombs.

By 2009, Palantir had expanded into the commercial sector. One of its first major corporate clients being JP Morgan Chase, using its tools to detect financial fraud by tracking employee communications, browser history, GPS locations on company issued smartphones and even recording phone conversations to flag potential insider threats. These capabilities, however, raised serious ethical and privacy concerns surrounding the technology.

Palantir's involvement with Immigrations and Customs Enforcement (ICE) to track undocumented immigrants sparked protests from employees and privacy advocates, but did not hinder the company's ability to secure large, often no-bid, government contracts that became a foundation of its revenue base.

In 2016, Palantir broadened its offerings with Apollo, a platform that allows software to be deployed and updated across different environments, as well as Foundry, its flagship product for commercial clients, used by companies such as Morgan Stanley and Airbus to integrate and analyse their data.

Palantir went public on the NYSE in 2020 via a direct listing, debuting with a valuation of $15.8 billion. The rapid rise of large language models has since helped position the company at the forefront of enterprise AI. That same year, Palantir introduced its Artificial Intelligence Platform (AIP), designed to integrate advanced AI into customer workflows. By 2023, the company reported its first full year of profitability, generating $2.23 billion in revenue, up 16.8% from 2022. Growth accelerated in 2024, with revenues reaching $2.87 billion, a 28.8% year-on-year increase.

4.3. Fundamental Analysis

Revenue and Growth:

- Annual Revenue (2024): $2.87 billion
- Quarterly Revenue: $1.004 billion (48% year-on-year growth)

- Year-on-year growth: +29%
- Growth in U.S. defence Sector (Year-on-year): 45.7%

Profitability:

- Gross Margin: 80.2%
- Operating Margin: 20.8%
- Net Income (GAAP): $462.2 million
- Earnings per Share (EPS): $0.32

Cash Flow:

- Free Cash Flow (FCF): $1.709 billion
- FCF Margin: 39.7%

Balance Sheet:

- Cash & Cash Equivalent: $6.00 billion
- Total Debt: $237.81
- Current Ratio: 6.32

Valuation:

- Price-to-Sales (P/S): 126x
- Price-to-Earnings (P/E): 577x
- EBITDA: $0.276 billion
- PEG Ratio: 8.57

Palantir's financial profile shows both remarkable strengths and glaring risks when set against industry standards in the enterprise software and AI sector. Revenue in 2024 reached $2.87 billion, with quarterly revenue surpassing the $1 billion mark for the first time - a 48% year-on-year increase - far outpacing the software industry's typical 10 - 15% growth rate. Much of this strength has come from its government and defence work, where U.S. contracts alone grew nearly 46% year-on-year, providing a stable revenue base that most commercial-focused software firms lack. Profitability metrics also stand out: with a gross margin of 80% and

an operating margin of 21%, Palantir operates more efficiently than most SaaS firms, which average closer to 70% and 17% respectively. The company's free cash flow margin of nearly 40% is extremely high, almost double the 20 - 25% norm, highlighting an ability to convert sales into cash at a rate few competitors can match. Palantir also boasts a strong balance sheet, with $6 billion in cash reserves, minimal debt, and a current ratio above 6, liquidity is a non-issue.

The weakness in Palantir's fundamentals lies in its valuation. At a price-to-sales multiple of 126x versus the sector's typical 10–15x, and a P/E ratio above 500x compared to industry averages of 35x pricing it well ahead of industry norms, even by growth-tech standards. Its PEG ratio of 8.6x further suggests the market is pricing the company far ahead of its actual growth trajectory. In other words, while Palantir is fundamentally stronger than most of its peers in terms of growth, profitability, and cash generation - and supported by the stability of long-term defence contracts - it is also one of the most expensive stocks in the sector, making Palantir, despite its strengths, clearly overvalued in today's market when looking at its fundamentals.

4.4. Macroeconomic Analysis

Palantir's ties to the U.S. defence establishment have only deepened in recent years. In July 2025, it secured a contract worth up to $10 billion, consolidating more than 70 agreements to give the U.S. Army streamlined access to its software across intelligence, logistics, and battlefield operations. This followed a $480 million Department of Defence contract in 2024 for the Maven Smart System, part of Project Maven's AI-driven intelligence initiative. Palantir is also a partner in the Next-Generation Command & Control (NGC2) program, though early testing raised concerns over security vulnerabilities. With rising global tensions - from the war in Ukraine, to the instability in the Middle East and growing friction between the U.S and China over Taiwan – defence budgets are rising rapidly. With the U.S. already spending more on defence than the next nine countries combined, growth in Palantir's defence revenue looks likely.

Yet the company refuses to be exclusively defined by its military and intelligence ties. Palantir has sought to grow its commercial arm aggressively, targeting industries such as healthcare, energy, and finance. Its partnership with Oura Ring, which uses Palantir Foundry to analyse biometric health data, is an example of this shift. In the healthcare sector, the company also supports Merck in drug development. In the energy sector, BP and other multinationals rely on Palantir's platforms to model supply chains and emissions. Even in aviation, Airbus has deployed Foundry for predictive maintenance and manufacturing efficiency.

Palantir has also deepened its governmental ties across the Atlantic, securing a £75 million contract with the UK Ministry of Defence aimed at accelerating decision-making, military planning, and targeting through AI-enabled software. Beyond defence, the company has embedded itself in the U.K. public sector more broadly. It plays a central role in NHS England's

£330 million Federated Data Platform, has supported law enforcement in Leicestershire to combat organised crime, and even provides AI tools in Coventry City Council, where its software helps transcribe and analyse social worker case notes.

Their aim is clear: Palantir is not just a defence contractor, but as a multifaceted AI platform, capable of operating in multiple industries. For investors, this diversification is critical. It reduces reliance on defence budgets and government cycles, demonstrates growth prospects outside of government contracts, and creates a pathway for more durable long-term revenue growth - provided adoption in the commercial segment continues to scale.

For investors, Palantir offers exceptional growth potential. Its defence arm is deeply entrenched within the U.S. and allied governments, with multi-billion-dollar contracts, providing reliable long-term revenues at a time when global defence spending is growing rapidly. Major government contracts in both the U.S. and UK emphasis just how central Palantir has become to national security infrastructure. At the same time, its commercial expansion into healthcare, energy, and aviation highlight the diversity of its platforms and the potential to scale far beyond defence. But the risks are equally present. Heavy reliance on politically sensitive government work means Palantir is vulnerable to policy shifts or public backlash, while diversification into commercial sectors remains a work in progress rather than a fully proven growth engine.

5. What to look out for this Week

5.1. Events this week

- Monday should see the release of Israeli hostages from Palestinian territories. Once those hostages are freed, Israel will release almost 2,000 Palestinian prisoners. If all goes to plan, this would allow the implementation of the second phase of Donald Trump's plan. The successful implementation of the plan could spread a wave of optimism in the markets.
- Javier Milei is set to meet Donald Trump in the White House on Tuesday.
- JP Morgan Chase, Goldman Sachs, Wells Fargo, Citigroup and BlackRock will report earnings on the Tuesday 14th October. Bank of America, ASML, and Morgan Stanley will report earnings on Wednesday, while TSMC will do so on Thursday. Net interest margin guidance, credit loss provisions, and capital return plans can provide useful information on risk sentiment and the overall macro environment.
- The IMF and World Bank Annual Meetings continue through the week in Marrakesh. Investors will closely monitor remarks from central bank governors and finance ministers on debt sustainability, fiscal coordination, and emerging market vulnerabilities. Any consensus on coordinated fiscal support or climate financing could influence EM currencies and global bond yields.
- The Federal Reserve's Beige Book will be released on Wednesday, providing qualitative insights into regional U.S. economic conditions ahead of the FOMC meeting on October 29. Markets will watch for signs of easing wage pressures or weakening consumer demand.
- Nvidia, Amazon, and Alphabet are scheduled to participate in the U.S. Senate hearing on AI regulation on Thursday. Testimonies could shape the evolving regulatory landscape for big tech, influencing valuation sentiment in the AI and semiconductor sectors.
- Energy traders will watch Thursday's U.S. Energy Information Administration (EIA) crude oil inventory report closely, following last week's unexpected drawdown. Persistent tightness in inventories could sustain higher oil prices and affect inflation expectations globally.
- On Friday, the University of Michigan will release its preliminary U.S. Consumer Sentiment Index for October. Sentiment trends will be key in gauging whether consumer resilience can withstand higher borrowing costs and policy uncertainty going into Q4.

5.2. Key economic and Company report:

- Monday: OPEC monthly oil market report, IMF and World Bank Annual Meetings Week begins.
- Tuesday: IMF publishes its latest World Economic Outlook report. IEA monthly oil market report. Germany: September Consumer Price Index (CPI) and Harmonised Index of Consumer Prices (HICP) inflation rate data. UK: October labour market figures.
- Wednesday: China: September CPI and producer price index (PPI) inflation rate data. EU: August industrial production figures Japan: revised August industrial production and retail sales figures.
- EU: August industrial production figures. Japan: revised August industrial production and retail sales figures.
- Friday: EU: September Harmonised Index of Consumer Prices (HICP) inflation rate data. UK: September insolvency figures. US: September new residential housing starts.