

ALGORITHMIC TRADING STRATEGY FOR AMAZON STOCK

Enhancing Performance Through Technical Indicators, Pair Trading, and Risk Management

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1. Introduction

This report outlines the development of a multi-layered algorithmic trading strategy for Amazon stock, incorporating research on stock behavior, the sector's financial market analysis, technical analysis, and fundamental analysis for price prediction.

Algorithmic trading strategies capitalize on historical data and quantitative models to drive systematic, real-time trading decisions. This research is designed to serve as a thorough guide for investors and analysts to explore opportunities in a stock that is highly diversified and deeply embedded in modern market trends. Amazon quickly comes to mind when considering these factors. Amazon's leadership across e-commerce, cloud computing, digital advertising, and logistics positions it uniquely in the current economic landscape. By examining Amazon through the lens of algorithmic strategies, this research provides insights into its price dynamics, growth potential, and the impact of sector and macroeconomic shifts, equipping investors with tools for informed, data-driven decision-making.

2. Strategy Integration

We employed strategies based on EMA and correlation between stocks. Google stock was the stock of choice

Data Sources: Historical (OHLC) data for Amazon stock were obtained from TradingView for technical and price action analysis.

Backtesting and Machine Learning Environment: The strategy was developed in Pine Script for TradingView (technical indicators and price action) to allow comprehensive testing and integration.

Trend-Following strategy: Exponential Moving Average (EMA):

Indicator Description: EMA is a weighted moving average that gives more significance to recent prices. For the Amazon stock, we used 6 moving averages that captured critical periods in the market like Amazon's stock valuation in 2018 which reached a significant peak because shares were trading at a historically high one-year forward price-to-sales (P/S) ratio of 2.42, exceeding the typical range (1.67-2.35) observed since 2015. Historically, when Amazon's P/S ratio exceeded 2.35, the stock price often saw a pullback, signaling potential overvaluation. Prices went down sharply during this phase. Another critical period when Amazon experienced a sharp 76% spike in price was in 2020 due to the COVID-19 pandemic which created a high demand for online retail services, causing prices to skyrocket. The short MAs are useful for the volatile Amazon stock because they approximate the average number of trading days in one or two months, the medium MAs captured a longer-period trend of about 3 to 4 months to confirm the direction of the market, given there are about 252 trading days. This makes it a suitable indicator for observing monthly and quarterly trends and capturing the stock's direction, which is useful for active traders and analysts monitoring Amazon's performance. It provides a balance between sensitivity to recent price changes and stability.

Application: In a long-only trade, a buy signal is generated when the short EMA crosses above the long EMA, indicating an uptrend; conversely an exit signal is triggered when the short EMA crosses below the long EMA.

Performance Metrics

Figure 1: Entry and exit signals from the EMA-indicator strategy shown on the Amazon stock. (Source: TradingView, 2024)



Figure 2: Performance metrics from the strategy on Amazon stock displayed in the overview (Source: TradingView, 2024)



Win Rate: 100% : **Average Profit:** 143.07% : **Maximum Drawdown:** 9.5% : **Period:** 9 years(2015-2024) : **Timeframe:** Daily

Pair Trading Strategy:

Objective: By exploiting temporary divergences in the prices of Amazon and Google, we assume that they will revert to their historical correlation.

Steps:

Historical Correlation Threshold: The historical average correlation between AMZN and GOOGL over a selected period (10 years) was evaluated to establish a baseline threshold. The results clearly showed that Amazon and Google have a significantly higher correlation compared with other stocks.

Table 1: Results of correlation between related stocks between 2014 and 2024

[*****100%*****] 12 of 12 completed

Ticker AMZN BABA EBAY ETSY GLBE GOOGL JMIA \

Ticker

AMZN 1.000000 0.358584 0.378402 0.409256 0.474157 0.634284 0.375523

BABA 0.358584 1.000000 0.308763 0.292088 0.336806 0.368432 0.341952

EBAY 0.378402 0.308763 1.000000 0.392643 0.364097 0.388722 0.303354

ETSY 0.409256 0.292088 0.392643 1.000000 0.485402 0.374823 0.410141

GLBE 0.474157 0.336806 0.364097 0.485402 1.000000 0.386259 0.451957

GOOGL 0.634284 0.368432 0.388722 0.374823 0.386259 1.000000 0.322599

JMIA 0.375523 0.341952 0.303354 0.410141 0.451957 0.322599 1.000000

MSFT 0.622746 0.349886 0.431113 0.370193 0.404299 0.704331 0.329054

SE 0.401201 0.429359 0.343263 0.402812 0.429620 0.382998 0.408789

SHOP 0.498241 0.367315 0.342010 0.468878 0.585680 0.434550 0.406110

SPY 0.615973 0.415169 0.527507 0.428240 0.495117 0.720295 0.400507

WMT 0.249750 0.120663 0.247940 0.161249 0.120473 0.268328 0.089428

Ticker MSFT SE SHOP SPY WMT

Ticker

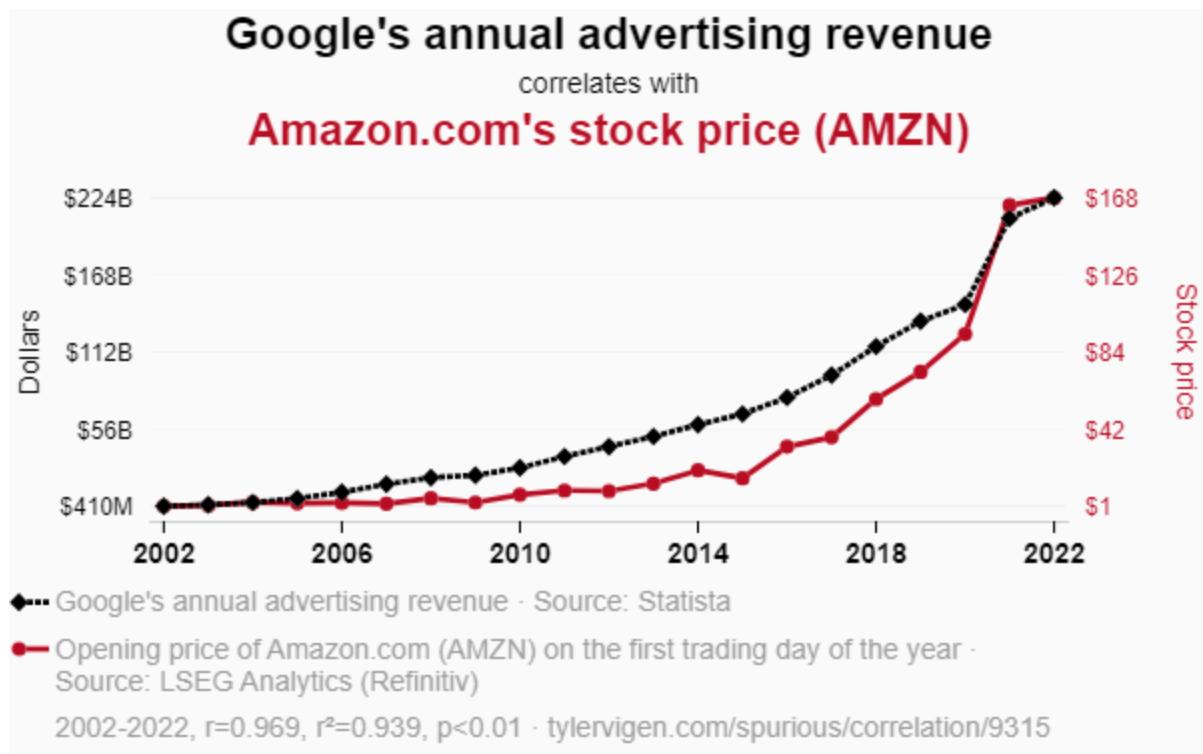
AMZN 0.622746 0.401201 0.498241 0.615973 0.249750

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EBAY 0.431113 0.343263 0.342010 0.527507 0.247940

ETSY 0.370193 0.402812 0.468878 0.428240 0.161249
GLBE 0.404299 0.429620 0.585680 0.495117 0.120473
GOOGL 0.704331 0.382998 0.434550 0.720295 0.268328
JMIA 0.329054 0.408789 0.406110 0.400507 0.089428
MSFT 1.000000 0.404341 0.459357 0.786491 0.339693
SE 0.404341 1.000000 0.478676 0.447775 0.176397
SHOP 0.459357 0.478676 1.000000 0.485388 0.164028
SPY 0.786491 0.447775 0.485388 1.000000 0.432963
WMT 0.339693 0.176397 0.164028 0.432963 1.000000

Figure 3: Google's Annual advertising revenue vs Amazon's stock prices (Photo credit: Tyler Vigen,
Source: Google.com)



Divergences: z -score was used to identify when the prices diverge beyond a certain threshold ± 1 standard deviation from the mean spread

$$Z\text{-score} \quad \text{Calculation:} \quad (Z = Price_{amazon} - \beta * Price_{google}) / Standard Deviation of Spread$$

where β is the hedge ratio (calculated as the historical average ratio of AMZN to GOOGL prices).

Mean spread is the mean of ($Price_{amazon} * Price_{google}$) over a chosen period.

Standard Deviation of spread is the standard deviation of ($Price_{amazon} * Price_{google}$) over the same period.

Trade Execution:

Long-Short Position: When the z-score of the spread is above the 1.5 threshold, the overperforming stock should be shorted ie. AMZN while the underperforming stock should be bought i.e. GOOGL, expecting the prices to revert.

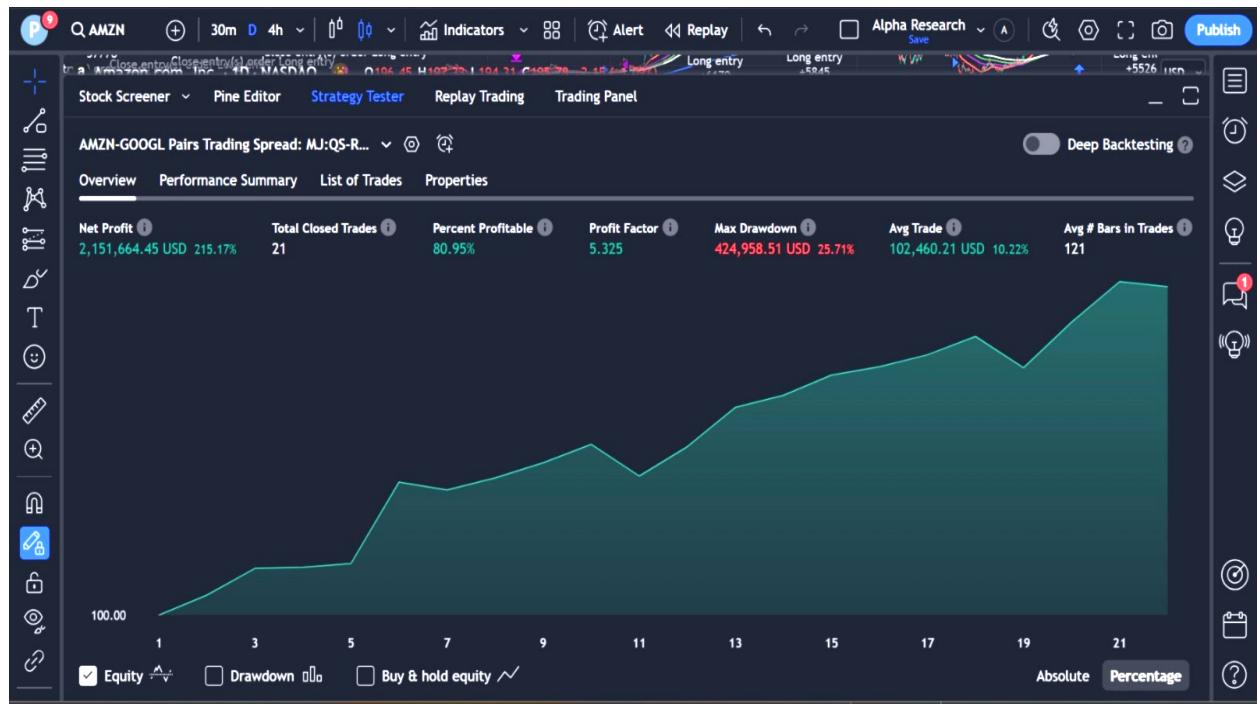
Exit Criteria: The trade should be closed when the z-score returns close to zero, or when the spread moves back within a normal range.

Performance Metrics

Figure 4: Entry and exit signals from the pair-trading strategy shown on the Amazon stock (Source: TradingView, 2024)



Figure 5: Performance metrics from the strategy on Amazon stock displayed in the overview
 (Source: TradingView, 2024)



Win Rate: 80.95% : **Average Profit:** 215.17% : **Maximum Drawdown:** 25.71% : **Period:** 19 years (2005-2024) : **Timeframe:** Daily

Risk Management

Stop-Loss: Implement stop-loss limits for each strategy to cap losses if the divergence continues rather than reverting.

Correlation Monitoring: Continuously monitor the correlation between Amazon and Google. If the correlation drops significantly, it may indicate that the relationship has weakened, and the strategy should be re-evaluated.

Regular Rebalancing: *Rebalance the portfolio periodically to ensure the hedge ratio is aligned with the changing dynamics of Amazon and Google.*

Observations and Optimization

A maximum drawdown of at most 10% is the ideal threshold for a low-risk investment strategy, therefore adjustments to indicator parameters, time frames, and fundamental filter thresholds will be made based on the backtesting results shown above to refine the strategy further.

3. Price Action Analysis

To refine trade timing and filter false signals, the strategy uses key price action components:

Support and Resistance Levels

Description: *Significant price zones where buying or selling interest historically causes reversals were identified.*

Application: *Trade entries and exits are aligned with support and resistance levels to capture trend reversals or continuations.*

Candlestick Patterns

Description: *Patterns such as dojis, hammers, and engulfing candles provide clues about market sentiment changes. However, the clues are sometimes different in all market segments. For example, a doji candle(which signifies indecision) at the very low of the market does not have the same meaning as a doji amid an upward-trending market.*

Application: *Specific patterns near support or resistance levels are used as additional confirmation of entry or exit points, enhancing the reliability of signals from technical indicators. This was particularly useful in the trend-following strategy where the assumption was made that prices would reach higher lows and higher highs. Candlestick patterns like the bullish engulfing as well as three white soldiers are more prevalent in recent years.*

Observations and Optimization

Adjustments to indicator parameters, time frames, and fundamental filter thresholds will be noted based on the backtesting results to refine the strategy further.

4. Recognizing Patterns

Figure 6



The chart above shows Amazon's historical daily closing price, capturing its price evolution over time. This baseline visualization reveals several key insights:

1. **Long-Term Trend:** There is a clear upward trajectory over the years, reflecting Amazon's substantial growth.
2. **Price Cyclicalities:** Noticeable periods of consolidation and correction are interspersed with strong uptrends, likely influenced by broader market conditions and company-specific events.
3. **Volatility Events:** Significant price spikes and drops indicate periods of increased volatility, possibly around earnings reports or major economic news.

Next, a more detailed trend analysis was conducted by adding moving averages to assess underlying trend strength and direction.

Figure 7:



This chart above includes the 20-day and 50-day Simple Moving Averages (SMAs) overlaid on Amazon's closing price, providing insights into short- and medium-term trend dynamics:

Why does Amazon highly correlate with Google?

Amazon (AMZN) and Google (GOOGL) exhibit a high correlation of 0.634284 in ten years from 2014 to 2024 due to several factors:

Common Drivers:

Cloud Computing: Both Amazon Web Services (AWS) and Google Cloud Platform (GCP) are leading cloud infrastructure providers.

Advertising: Amazon and Google compete in digital advertising, with Amazon's growing ad business challenging Google's dominance.

E-commerce: Google's search engine drives traffic to Amazon's platform, while Amazon's advertising and e-commerce capabilities impact Google's revenue.

Artificial Intelligence (AI): Both companies invest heavily in AI research and applications.

Shared Macro-Economic Factors:

Interest Rates: Changes in interest rates affect both companies' borrowing costs and consumer spending.

Global Economic Trends: Economic growth, inflation, and trade policies influence both companies' revenues.

Technological Advancements: Advancements in fields like AI, blockchain, and the Internet of Things (IoT) impact both companies.

Industry Overlaps:

Digital Media: Amazon's streaming services (Prime Video) and Google's YouTube compete for user attention.

Hardware: Amazon's Echo devices and Google's Home devices compete in the smart speaker market.

Gaming: Amazon's Twitch and Google's Stadia compete in the gaming industry.

Financial Performance:

Revenue Growth: Both companies exhibit strong revenue growth.

Profitability: Both companies maintain high profitability.

Market Sentiment:

Investor Confidence: Investors often view both companies as leaders in their industry.

Sector Rotation: Changes in investor sentiment towards the tech sector impact both companies.

5. Quantitative Analysis:

Spearman Rank Correlation Test:

Spearman Correlation: 0.6781710134921949

Use Case: The Spearman correlation value of approximately 0.68 between Google and Amazon suggests a strong monotonic relationship, capturing potential non-linear dependencies between the two stocks. Unlike Pearson correlation, Spearman's method relies on rank order, making it less sensitive to outliers and ideal for identifying consistent directional movements even in non-linear relationships.

Granger Causality Test:

Table 2:

[*****100%*****] 2 of 2 completed

Granger Causality

number of lags (no zero) 1

ssr based F test: F=6.4774 , p=0.0110 , df_denom=2511, df_num=1

ssr based chi2 test: chi2=6.4851 , p=0.0109 , df=1

likelihood ratio test: chi2=6.4768 , p=0.0109 , df=1

parameter F test: F=6.4774 , p=0.0110 , df_denom=2511, df_num=1

Granger Causality

number of lags (no zero) 2

ssr based F test: $F=3.4511$, $p=0.0319$, $df_{denom}=2508$, $df_{num}=2$

ssr based chi2 test: $\chi^2=6.9159$, $p=0.0315$, $df=2$

likelihood ratio test: $\chi^2=6.9064$, $p=0.0316$, $df=2$

parameter F test: $F=3.4511$, $p=0.0319$, $df_{denom}=2508$, $df_{num}=2$

Granger Causality

number of lags (no zero) 3

ssr based F test: $F=5.3341$, $p=0.0012$, $df_{denom}=2505$, $df_{num}=3$

ssr based chi2 test: $\chi^2=16.0471$, $p=0.0011$, $df=3$

likelihood ratio test: $\chi^2=15.9961$, $p=0.0011$, $df=3$

parameter F test: $F=5.3341$, $p=0.0012$, $df_{denom}=2505$, $df_{num}=3$

Granger Causality

number of lags (no zero) 4

ssr based F test: $F=4.0034$, $p=0.0031$, $df_{denom}=2502$, $df_{num}=4$

ssr based chi2 test: $\chi^2=16.0713$, $p=0.0029$, $df=4$

likelihood ratio test: $\chi^2=16.0201$, $p=0.0030$, $df=4$

parameter F test: $F=4.0034$, $p=0.0031$, $df_{denom}=2502$, $df_{num}=4$

Granger Causality

number of lags (no zero) 5

ssr based F test: $F=3.1946$, $p=0.0070$, $df_{denom}=2499$, $df_{num}=5$

ssr based chi2 test: $\chi^2=16.0434$, $p=0.0067$, $df=5$

likelihood ratio test: $\chi^2=15.9924$, $p=0.0069$, $df=5$

parameter F test: $F=3.1946$, $p=0.0070$, $df_{denom}=2499$, $df_{num}=5$

Lag 1:

- *P-Value:* 0.0110
- *Interpretation:* Since the p-value (0.0110) is below 0.05, we reject the null hypothesis. This means that Google's values from 1 day ago contain information that significantly predicts Amazon's next-day returns.

Lag 2:

- *P-Value:* 0.0319
- *Interpretation:* The p-value (0.0319) is also below 0.05, indicating that Google's values from the past 2 days significantly help in forecasting Amazon's returns over the next day.

Lag 3:

- *P-Value:* 0.0012
- *Interpretation:* With a p-value of 0.0012, which is much lower than 0.05, the test shows strong evidence that Google's past 3-day values contribute significant predictive information for Amazon's returns.

Lag 4:

- *P-Value:* 0.0031

-
- *Interpretation:* Again, with a p-value of 0.0031, Google's returns from the past 4 days continue to provide significant predictive power for Amazon's future returns.

Lag 5:

- *P-Value:* 0.0070

Interpretation: At a 5-day lag, Google's past values still hold predictive information for Amazon's returns, as indicated by the p-value (0.0070).

Across all tested lags (1 through 5 days), the p-values are consistently below 0.05. This result suggests that Google's past returns significantly Granger-Cause Amazon's returns over the short term, meaning that Google's past performance holds valuable predictive information for Amazon's stock price.

Impulse Response Function:

Summary of Regression Results

Model: VAR

Method: OLS

Date: Sun, 10, Nov, 2024

Time: 09:01:42

No. of Equations: 2.00000 BIC: -16.2919

Nobs: 2510.00 HQIC: -16.3244

Log likelihood: 13409.4 FPE: 7.98616e-08

AIC: -16.3430 Det(Omega_mle): 7.91662e-08

Results for equation AMZN

	coefficient	std. error	t-stat	prob
<hr/>				
const	0.001113	0.000420	2.651	0.008
L1.AMZN	0.028604	0.026057	1.098	0.272
L1.GOOG	-0.081024	0.030961	-2.617	0.009
L2.AMZN	-0.011629	0.026058	-0.446	0.655
L2.GOOG	0.017149	0.030995	0.553	0.580
L3.AMZN	0.016356	0.026006	0.629	0.529
L3.GOOG	-0.091929	0.030988	-2.967	0.003
L4.AMZN	0.002035	0.025997	0.078	0.938
L4.GOOG	-0.004589	0.031026	-0.148	0.882
L5.AMZN	0.008880	0.025992	0.342	0.733
L5.GOOG	-0.007212	0.031033	-0.232	0.816

Results for equation GOOGL

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	coefficient	std. error	t-stat	prob
<hr/>				
const	0.000870	0.000353	2.464	0.014
L1.AMZN	0.018443	0.021918	0.841	0.400
L1.GOOG	-0.066631	0.026043	-2.559	0.011
L2.AMZN	-0.014179	0.021918	-0.647	0.518
L2.GOOG	-0.000715	0.026071	-0.027	0.978
L3.AMZN	0.015183	0.021875	0.694	0.488
L3.GOOG	-0.039606	0.026065	-1.520	0.129
L4.AMZN	0.009868	0.021867	0.451	0.652
L4.GOOG	-0.033199	0.026097	-1.272	0.203
L5.AMZN	0.029995	0.021862	1.372	0.170
L5.GOOG	-0.036910	0.026103	-1.414	0.157

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Correlation matrix of residuals

AMZN	GOOG
AMZN	1.000000 0.640943

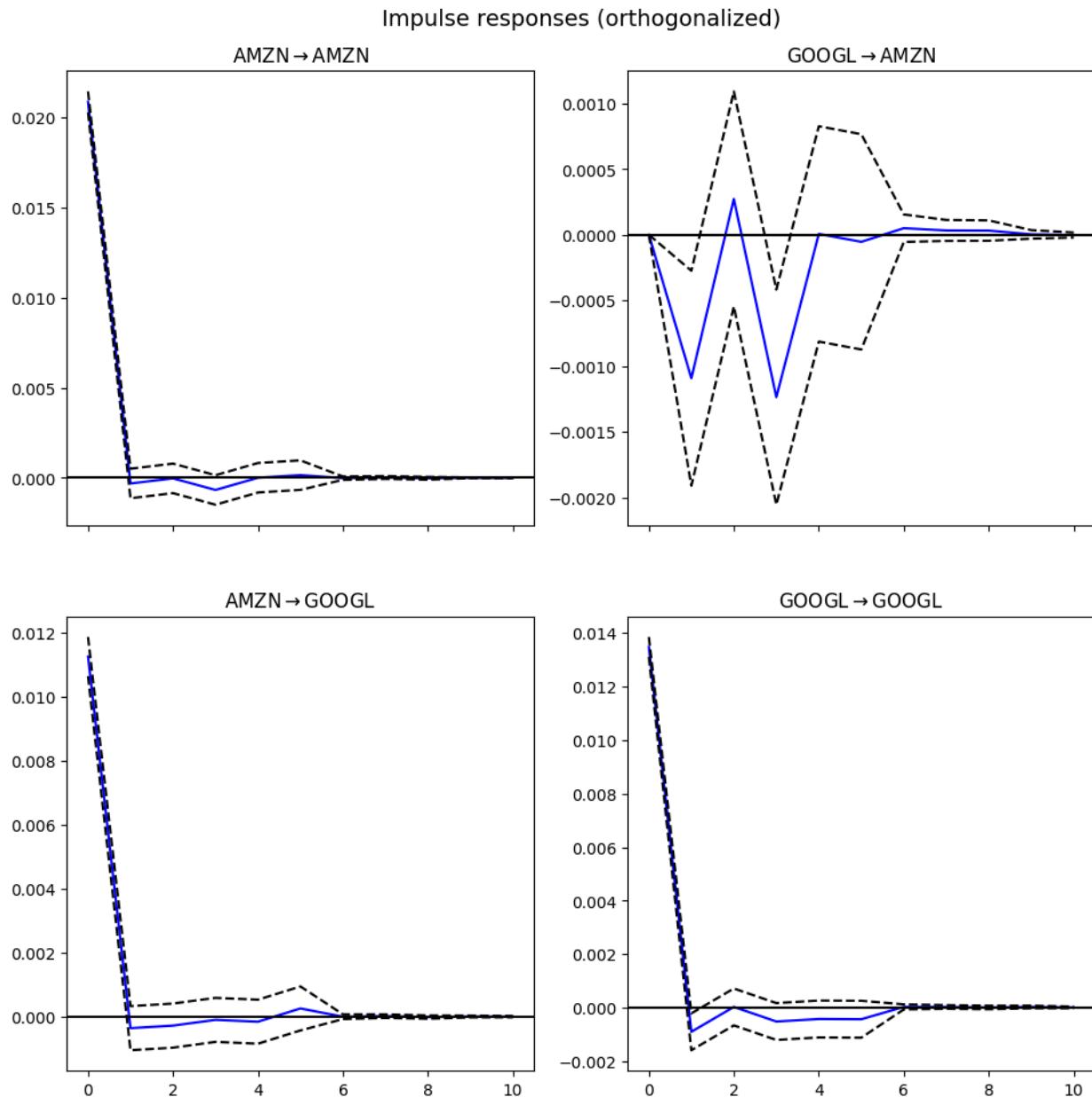
GOOGL 0.640943 1.000000

Practical Implication:

The VAR model results show that Amazon's returns are influenced by Google's one- and three-day lagged returns with a significant negative effect, while Google's returns exhibit a short-term negative autocorrelation. The constant terms for both stocks suggest a small positive drift. No significant predictive power is found in Amazon's returns on Google. The residual correlation of 0.64 between AMZN and GOOGL indicates a strong unexplained relationship, possibly due to external factors or shared market influences. This suggests Google's returns could be used to forecast Amazon's short-term movements.

Subplots and Interpretation

Figure 8: The IRFs illustrate how an unexpected change to one variable affects itself and the other variable over a 10-day period. Each sub-plot represents a different impulse-response relationship:



-
1. *Top Left (AMZN → AMZN):*
 - This plot shows the response of AMZN to its own shock.
 - *Interpretation:* A shock to AMZN has an immediate positive impact on itself, which rapidly decays to near zero within a few days. This indicates that the effect of an AMZN-specific shock on its own returns is short-lived, stabilizing quickly.
 2. *Top Right (GOOGL → AMZN):*
 - This plot shows the response of AMZN to a shock in GOOGL.
 - *Interpretation:* A shock to GOOGL initially causes a small negative impact on AMZN, followed by oscillations around zero before stabilizing. This indicates a slightly volatile and complex relationship where a shock in GOOGL causes AMZN to initially decrease, with the effects dying out after a few days.
 3. *Bottom Left (AMZN → GOOGL):*
 - This plot shows the response of GOOGL to a shock in AMZN.
 - *Interpretation:* A shock in AMZN has a small initial positive effect on GOOGL, which quickly decays. This suggests a limited and short-term impact of AMZN on GOOGL, with the effect stabilizing within a few days.
 4. *Bottom Right (GOOGL → GOOGL):*
 - This plot shows the response of GOOGL to its own shock.
 - *Interpretation:* Similar to AMZN's self-response, a shock to GOOGL has an immediate positive impact on itself, which rapidly declines and stabilizes near zero within a few days. This suggests that GOOGL's response to its own shocks is also short-lived.
 - 5.

Amazon (AMZN) and Google (GOOGL) often exhibit strong correlation due to several factors

Sector Alignment: Both companies are part of the large-cap technology sector and are classified as "mega-cap" stocks. This sectoral alignment means they tend to move similarly in response to broader tech market trends and macroeconomic factors affecting large tech companies, such as interest rate changes, regulatory concerns, and investor sentiment.

Revenue Streams in Digital Advertising and Cloud Services: While Amazon is primarily known for e-commerce, a significant portion of its revenue comes from Amazon Web Services (AWS) and digital advertising. Google is the global leader in digital advertising and a major player in cloud computing (Google Cloud). These shared revenue sources mean that changes in the digital advertising landscape or cloud computing industry impact both companies similarly.

Influence of Macroeconomic Factors: Amazon and Google, as part of the FAANG stocks (Facebook, Amazon, Apple, Netflix, Google), are sensitive to macroeconomic factors like inflation, consumer spending trends, and economic growth. When investors make broad changes in tech or growth stock allocations, Amazon and Google often experience similar buying or selling pressures.

Investor Behavior and Sentiment: Large institutional investors view Amazon and Google as "safe" high-growth stocks in the tech sector. As such, they may react similarly to market sentiment changes, such as optimism about tech innovation or concerns over regulatory scrutiny, which affect large-cap tech companies as a group.

ETF and Index Influence: Both Amazon and Google are heavily weighted in major indices (e.g., S&P 500, NASDAQ-100) and are popular in tech-focused ETFs. Buying or selling pressure on these indices or ETFs can cause both stocks to move in tandem, strengthening their correlation.

Figure 9:

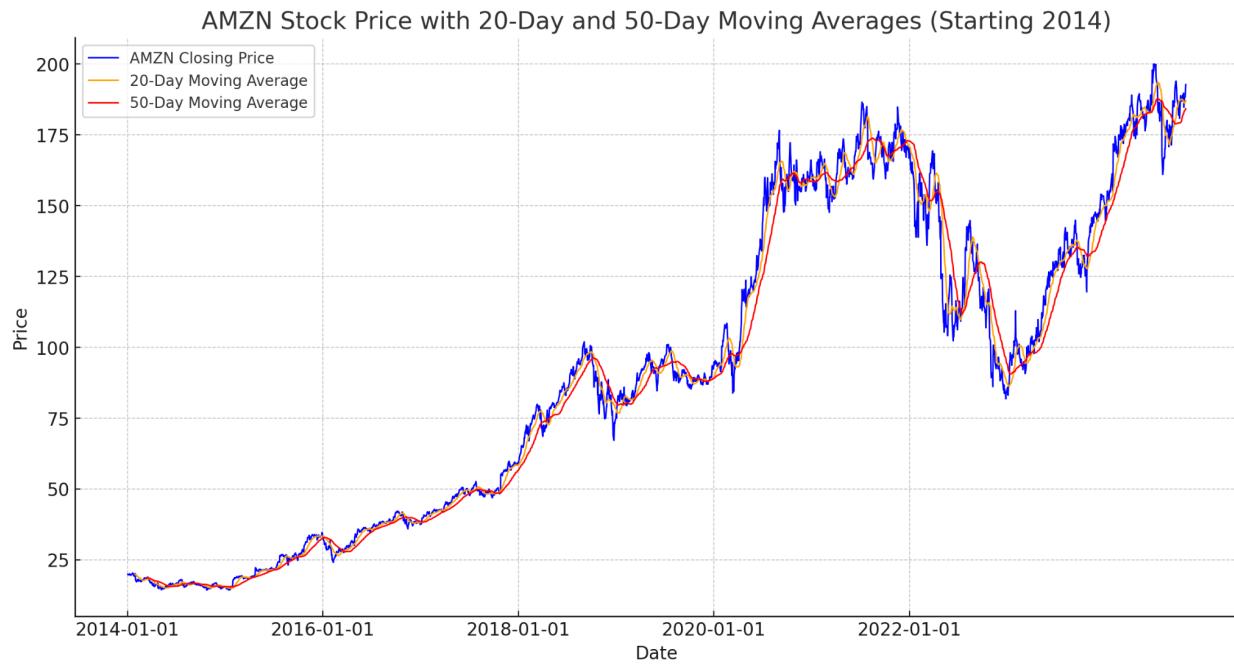
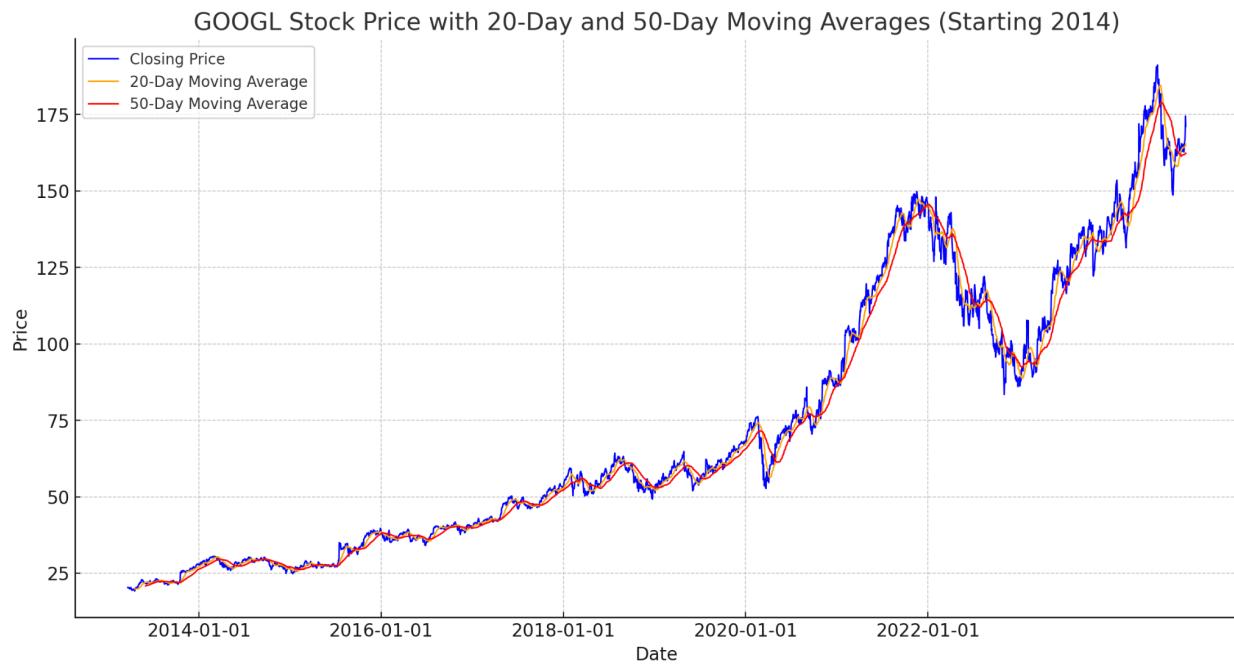


Figure 10:



6. Amazon: Quantitative Research Point of View

1. Diverse Revenue Streams and Market Leadership

E-commerce: According to Forbes (March 28, 2024), Amazon holds a dominant 37.6% share of the U.S. e-commerce market, securing its position as the leader in online retail. This substantial market share places Amazon well ahead of its closest competitors, with Walmart capturing 6.4%, Apple at 3.6%, and eBay at 3%. Amazon's leadership is reinforced by its vast logistics infrastructure, which allows the company to offer faster and more reliable delivery services than most other retailers. This logistics network not only supports Amazon's operations domestically but also strengthens its international reach, enabling it to serve customers across various regions with efficiency. Additionally, Amazon's investment in customer-centric innovations, such as one-day and same-day delivery through Amazon Prime, has further solidified its competitive advantage, making it a preferred choice for online shoppers worldwide. This robust infrastructure and commitment to fast, convenient service underscore Amazon's unparalleled position in the global e-commerce landscape, a position that few rivals have the resources or capacity to challenge effectively.

Amazon Web Services (AWS): Often credited as the pioneer of modern cloud services, AWS has been the dominant player in the cloud computing market since its inception in 2006 due to its robust infrastructure, extensive service offerings, and rapid growth. Around 2013-2014, AWS had a substantial lead in the market especially after large enterprises began adopting its services. Over the years, AWS has continuously expanded its services across multiple domains—compute, storage, AI/ML, and data analytics—making it highly versatile for a broad range of industries. This makes it maintain a significant market share despite facing competitors like Microsoft Azure and Google Cloud Platform. Its leadership and robustness attract a large community of users, partners, and support networks, further enhancing its position in the market.

Figure 11: Amazon Maintains Cloud Lead as Microsoft Edges Closer (Statista, Nov 1, 2024)

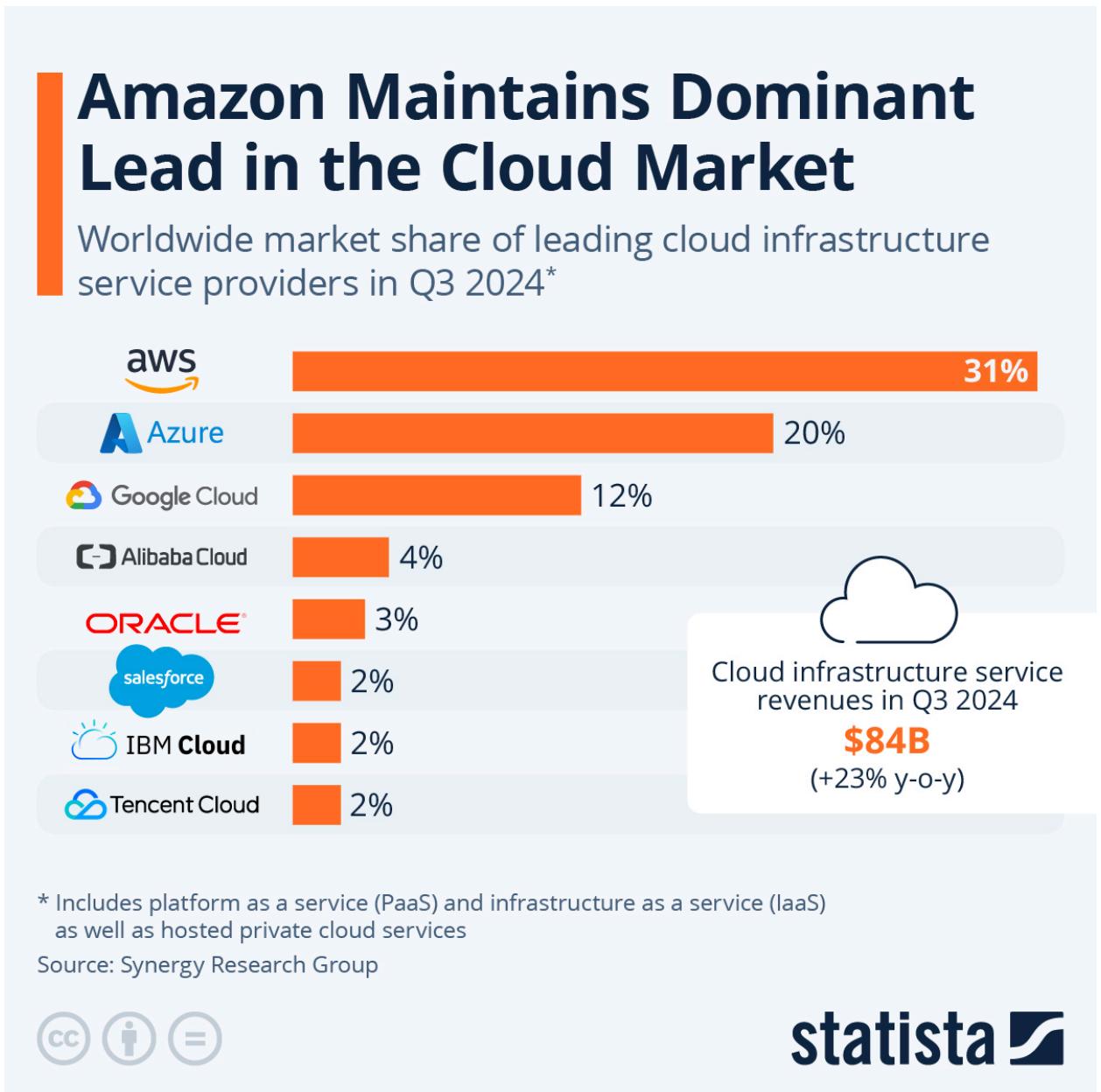
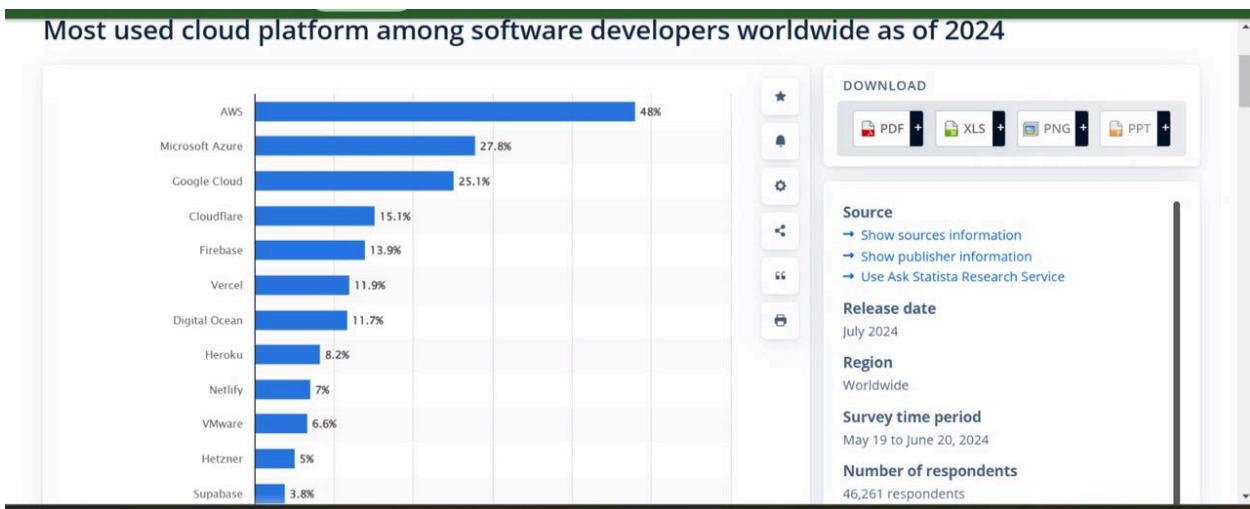


Figure 12: Most utilized cloud platform by developers globally in 2024 (Statista, Oct 22, 2024)



Digital Advertising: Amazon's advertising business has grown rapidly, leveraging its data-rich platform to offer targeted ads. This high-margin business segment supports profitability even when retail margins are thin.

2. Strong Financials and Cash Flow

Revenue Growth: Amazon has shown consistent revenue growth over the years, even during challenging economic times. Its diversified business model allows it to weather downturns and capitalize on growth trends.

Heavy Cash Flow: Amazon's ability to generate substantial cash flow supports reinvestment in strategic Amazon has consistently maintained a competitive edge by embracing innovation and making strategic investments that set it apart from other e-commerce and tech giants. These investments not only enhance its core services but also enable Amazon to expand into new markets, reducing risk and creating diversified revenue streams initiatives like AWS, logistics, and acquisitions, driving long-term value creation.

3. Innovation and Strategic Investments

Logistics and Delivery:

One of Amazon's most transformative investments has been in its logistics and delivery infrastructure. By developing an extensive network of fulfillment centers, acquiring its fleet of planes, and using advanced technology in warehousing and order processing, Amazon has achieved an unparalleled ability to fulfill orders quickly and efficiently. Key elements of Amazon's logistics innovation include:

Same-Day and One-Day Delivery: Amazon's investment in logistics has allowed it to offer premium services like same-day and one-day delivery for Prime members. This capability enhances customer satisfaction and loyalty, as customers are more likely to choose Amazon over competitors if they can receive their purchases faster.

Amazon Prime Air: Amazon has been experimenting with drone delivery through Prime Air, aiming to reduce delivery times further, especially for small packages. Though still in the testing phase, Prime Air could be a game-changer, especially in urban areas.

Expanded Delivery Network: Beyond warehouses, Amazon has built an intricate last-mile delivery network by partnering with local businesses and hiring drivers through its Amazon Flex program. This last-mile efficiency is a crucial factor in Amazon's ability to deliver quickly, even in remote locations.

These logistics investments enable Amazon to offer services that competitors find challenging to replicate, strengthening customer loyalty and giving Amazon a significant competitive advantage.

Expanding into New Markets:

Amazon's "innovate or die" mentality drives it to continuously explore and enter new markets, making it more than just an e-commerce company. By diversifying its offerings, Amazon not only taps into new revenue sources but also mitigates risks associated with being overly reliant on any single market. Some key examples include:

Healthcare: Amazon has made strategic moves into healthcare, acquiring online pharmacy PillPack and launching Amazon Pharmacy. This enables Amazon to provide prescription delivery services, challenging traditional pharmacies and positioning itself as a player in the massive healthcare market. Amazon is also exploring telemedicine and healthcare data services.

Entertainment: Through Amazon Prime Video and its acquisition of MGM Studios, Amazon has established a strong presence in the streaming and entertainment industry. Prime Video, included with a Prime subscription, enhances Amazon Prime's value proposition, while MGM's extensive content library adds to its competitive edge against other streaming giants. By diversifying into entertainment, Amazon competes directly with platforms like Netflix and Disney+.

Artificial Intelligence and Cloud Computing: Amazon Web Services (AWS) is a dominant force in the cloud computing industry, powering businesses across various sectors. AWS generates substantial revenue and profit for Amazon, helping offset the lower margins of the e-commerce business. AWS also drives Amazon's capabilities in artificial intelligence (AI), machine learning, and data analytics, areas that have applications across all of Amazon's business units.

Financial Services: Amazon has ventured into financial services, with offerings like Amazon Pay and Amazon Lending. By enabling seamless online transactions and providing capital to sellers on its platform, Amazon strengthens its ecosystem and retains merchants who rely on its financial services for growth.

Strategic Impact: Amazon's strategic investments in new markets support its long-term growth by diversifying its revenue base and creating synergies across business units. For instance, AWS provides the infrastructure for Amazon's e-commerce operations and Prime Video streaming, while healthcare and financial services align with its mission to improve customer experience.

4. Resilience to Economic Changes

Consumer Staples and Discretionary Mix: Amazon offers a range of products, from essential household items to luxury goods, allowing it to remain relevant in both economic booms and downturns.

Growth in Cloud Services and Digital: AWS and advertising are less affected by consumer discretionary spending, providing stability even when retail may experience headwinds.

5. Potential for Long-Term Appreciation

Compounding Growth: Amazon has a strong track record of reinvesting in high-growth areas. Its focus on long-term growth rather than short-term profits often rewards long-term investors.

Stock Splits and Accessibility: Recent stock splits make Amazon shares more accessible to retail investors, which can drive demand and liquidity, potentially boosting stock value.

6. Positioned to Benefit from Key Trends

E-commerce Adoption: As e-commerce grows globally, Amazon is well-positioned to capture an outsized share.

Cloud Computing Expansion: The shift to cloud computing is expected to grow, and AWS is a primary beneficiary.

Digital and Targeted Advertising: Amazon's advertising segment is becoming increasingly competitive with platforms like Google, enabling Amazon to tap into the high-margin digital ad market.

Risks to Consider

Regulatory Scrutiny: Amazon faces ongoing regulatory and antitrust pressures, especially in the U.S. and Europe. (CNBC, April 2023).

High Valuation: Amazon's growth-oriented valuation reflects high expectations, making it sensitive to growth slowdowns or economic downturns.

Numerous key news events have affected Amazon's stock over the years. Here are some of the most impactful historical events and announcements:

1. Quarterly Earnings Reports

Earnings Surprises (Positive and Negative): Amazon's quarterly earnings reports have frequently led to significant stock movement. Surprising revenues, profit margins, or guidance can cause large price shifts. For example, strong earnings in the early 2010s often propelled the stock, while weaker-than-expected profits due to high investment spending caused declines.

2. Launch of Amazon Prime (2005) and Expansion of Prime Services

Introduction of Amazon Prime: The launch of Amazon Prime and its subsequent expansions (Prime Video, Prime Music, and one-day shipping) turned Amazon into a subscription-based business, adding a steady revenue stream. News about these expansions positively affected Amazon's stock, reinforcing its competitive advantage and increasing customer loyalty.

3. AWS Growth Announcements

Launch and Growth of AWS (2006 onwards): AWS has been a massive growth driver for Amazon, contributing significantly to profits. Announcements of AWS revenue growth in quarterly earnings reports often led to positive stock movement, as AWS consistently outperformed expectations and became a market leader in cloud computing.

AWS Outages: Periodic AWS outages, affecting many companies and websites, occasionally negatively impacted Amazon's stock, as they highlighted potential weaknesses in its cloud infrastructure.

4. COVID-19 Pandemic (2020)

Surge in E-Commerce Demand: The pandemic accelerated the shift to online shopping, significantly boosting Amazon's revenues and stock price in 2020. News related to increased e-commerce demand, record-breaking holiday sales, and expanded fulfillment centers led to Amazon reaching new all-time highs.

Operational Challenges: Although overall positive, reports of pandemic-related challenges (e.g., employee health and safety, increased costs for sanitization and logistics) sometimes created downward pressure on the stock.

5. Regulatory Scrutiny and Antitrust Investigations

US and EU Antitrust Investigations: Amazon has faced multiple regulatory investigations, especially from the U.S. and European Union, around its competitive practices, use of third-party seller data, and influence in e-commerce(FTC, September 2023). News about these investigations sometimes caused stock volatility due to fears of potential fines, regulatory actions, or business restrictions.

Calls for Amazon's Breakup: Political discussions and regulatory proposals about breaking up big tech companies, including Amazon, led to negative sentiment, affecting stock prices, especially around 2019-2021.

6. Leadership Transition (2021)

Jeff Bezos Steps Down as CEO: In early 2021, Amazon announced that Jeff Bezos would step down as CEO, transitioning the role to Andy Jassy, the head of AWS. This leadership change initially caused some stock volatility as investors speculated about future company direction and Jassy's leadership.

7. Mergers and Acquisitions

Acquisition of Whole Foods (2017): Amazon's \$13.7 billion acquisition of Whole Foods marked a major step into physical retail and grocery. The announcement caused Amazon's stock to rise as it diversified the business and solidified Amazon's competitive stance in the grocery industry.

Other Acquisitions: Purchases like MGM Studios (2021) and PillPack (2018) furthered Amazon's expansion into entertainment and healthcare. These acquisitions were met with mixed investor reactions but generally supported the perception of Amazon as a versatile, growth-focused company.

8. Stock Splits

1998, 1999, and 2022 Stock Splits: Amazon has executed stock splits multiple times in its history, including a 20-for-1 split in 2022. Stock splits often increase demand among retail investors by making shares more affordable, contributing to positive momentum.

9. Macroeconomic Events

Interest Rate Announcements and Inflation Concerns: Amazon, as a growth-oriented tech stock, is sensitive to macroeconomic factors like interest rates and inflation. News of rising interest rates has

negatively impacted Amazon's stock as investors shift to safer or income-generating assets. Similarly, inflation concerns affecting consumer spending have caused fluctuations in Amazon's price.

10. Unionization and Labor Issues

Unionization Efforts (2020-2022): Reports about Amazon employees pushing for unionization in fulfillment centers, especially in the U.S., affected Amazon's stock by raising concerns about labor costs and operational challenges.

Labor Shortages and Wage Increases: Announcements of wage increases, hiring plans, and bonuses during labor shortages led to increased operational costs, impacting investor sentiment.

7. Summary and Key Takeaways

This paper develops a multi-layered algorithmic trading strategy for Amazon (AMZN), combining technical indicators, pair trading, and risk management to capture Amazon's dynamic price movements and correlations with Google (GOOGL).

EMA-Based Trend-Following Strategy: The Exponential Moving Average (EMA) strategy, utilizing six EMAs for different timeframes, was chosen for its responsiveness to recent price changes, capturing both short- and medium-term trends. Backtesting showed a 100% win rate and a 143.07% average profit, proving effective in navigating Amazon's price volatility.

Pair Trading with Google (GOOGL): Leveraging a strong historical correlation (0.63) between Amazon and Google, the pair trading strategy exploits temporary price divergences, with an 80.95% win rate and a 215.17% average profit. This model benefits from the two stocks' shared industry drivers, allowing for mean-reversion-based trades.

Risk Management: The strategy incorporates stop-loss limits, drawdown controls, and continuous correlation monitoring to mitigate risks and adapt to changing relationships between Amazon and Google, ensuring stability and long-term profitability.

Rationale for Model Selection

EMA: EMA was selected for its ability to capture Amazon's volatile short- and medium-term price trends.

Pair Trading with Correlation: The model uses the Amazon-Google correlation to identify profitable, mean-reverting opportunities.

Risk Controls: Rigorous risk management measures were added to handle Amazon's volatility and maintain model robustness.

In summary, this strategy demonstrates how integrating trend-following, correlation-based pair trading, and strong risk controls can yield high returns from Amazon's stock. Future work may focus on refining the model with additional predictive factors to further enhance performance.

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