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Analyzing Amazon Stock Volatility: Market Returns and Macroeconomic Factors

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Abstract: Against the backdrop of globalization and changing financial markets, investors and policymakers need accurate market volatility forecasts to guide decision-making. Traditional forecasting models are difficult to fully explain the complex market volatility, thus requiring more refined research methods. This study provides an in-depth analysis of the impact of market returns and macroeconomic indicators on Amazon stock volatility by constructing a two-factor model to provide more accurate forecasts. A quantitative approach is used to construct the model, with market returns represented by the CAPM and selected macroeconomic indicators introduced as the second factor. The model parameters are estimated from historical data and empirical analyses verify the predictive effectiveness of the model in different market environments. Preliminary results show that market returns and macroeconomic indicators significantly influence Amazon stock volatility. Market factors dominate volatility in the short term, while macroeconomic factors may have a more significant impact in the long term. This finding contributes to a better understanding of Amazon stock price drivers and provides investors with more targeted decision support.

Keywords: Amazon stock, two-factor model, Market return factors, Macroeconomic indicators

1. Introduction

In the current field of finance, significant progress has been made in the study of market volatility. Dhingra et. al. examine the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) family of models employed to understand stock market returns and volatility, and review prior studies that utilized various GARCH models to explore stock market dynamics [1]. The focus of this review is on the efficacy of different GARCH models in forecasting market returns and volatility. It delves into factors such as leverage effects, volatility feedback assumptions, fluctuations in the risk-free interest rate, trading volumes, and the frequency of informational events, all of which are significant in influencing market volatility. Hamal & Gautam examine the impact of the COVID-19 pandemic on stock market volatility and returns [2]. It also explores how government response measures have influenced stock market volatility and performance during this period. However, there are still some research gaps, especially in understanding the depth and comprehensiveness of the drivers behind market volatility.

The research theme of this paper is to explore in depth the factors influencing market volatility, with a particular focus on the impact of market returns and macroeconomic indicators on the

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volatility of Amazon's stock. By constructing a two-factor model, it is hoped to fill in some of the gaps that existed in previous research and provide a more comprehensive understanding of the mechanisms of market volatility. Specific questions include the relative importance of market returns and macroeconomic indicators on Amazon stock volatility, and their impacts over different time scales. The focus is on the extent to which market returns and macroeconomic indicators contribute to Amazon stock volatility in the short and long run. Using a quantitative research methodology, a two-factor model was constructed with market returns and macroeconomic indicators as influencing factors. The parameters of the model were estimated using historical data, while the empirical analysis was conducted by validating the predictive effectiveness of the model in different market environments.

The significance of this study is to provide new theoretical and empirical support to the research field of market volatility. By filling the gaps in existing research, it can provide a more comprehensive understanding of the mechanisms of market volatility and provide investors with more accurate decision support.

2. Methodology

2.1. Research design and Model building

The variance of the rate of return on common stock is one of the cornerstones of the theory of modern finance [3]. The variance of stock returns is not only central to capital asset pricing and portfolio analysis, but also plays a key role in derivative pricing and hypothesis testing in event studies. Against this theoretical backdrop, this study focuses on the impact of market returns and macroeconomic indicators on Amazon stock volatility.This paper plans to the impact of overall market performance on Amazon's short-term volatility by analysing the correlation between market returns and Amazon stock prices at different time scales. Further, the paper explores the long-term correlation of macroeconomic indicators such as retail sales data and economic growth rates with Amazon stock. Finally, the paper proposes and analyses a two-factor model to comprehensively assess the impact of these two factors on Amazon stock volatility and provides the results of the empirical study. Recognizing the pivotal role of stock return variance as a fundamental concept in modern finance, this study extends the discourse by specifically examining how market returns and macroeconomic indicators contribute to the volatility of Amazon stock. .

2.2. Data collection and data processing

A two-factor model based on market returns and macroeconomic factors is set up to analyse the performance of Amazon stock. The model can be expressed as:

$$\mathrm{RAMZN} = \alpha + \beta 1 \cdot \mathrm{Rm} + \beta 2 \cdot \mathrm{Fe} + \epsilon \quad (1)$$

Which, RAMZN represents the excess return on Amazon stock, calculated as the actual return on Amazon stock minus the risk-free return (e.g., the yield on a 10-year Treasury bond).

α is the intercept term of the model and represents the expected excess return of Amazon stock when both market returns and macroeconomic factors are zero.

Rm represents the market excess return, which is the overall market return (e.g., the return on the S&P 500) minus the risk-free return.

Fe represents a measure of selected macroeconomic factors, which can be the GDP growth rate, inflation rate, interest rate changes, consumer confidence index, etc.

$\beta 1$ and $\beta 2$ represent the sensitivity of Amazon stock excess returns to changes in market excess returns and macroeconomic factors, respectively, i.e., the coefficients of these variables. They

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quantify the magnitude of change in the expected excess return on Amazon stock for each unit change in market returns or macroeconomic factors.

ϵ represents the error term, which is the portion of the change in return that the model fails to explain.

By developing this two-factor model, we attempt to analyse the performance of Amazon stock by linking its excess returns to changes in market returns and specific macroeconomic factors. By estimating the values of α, $\beta 1$, and $\beta 2$, it is possible to gain a deeper understanding of the risk and return characteristics of Amazon stock and how it reacts to changes in the market as a whole and to changes in macroeconomic factors. This analysis helps investors make more informed investment choices.

Returns are usually calculated by comparing the price at one point in time to the price at another point in time. For annual returns, it can do this calculation by comparing stock prices at the beginning and end of each year (Table 1).

Table 1: Amazon.com stock data for the last 10 years (RAMZN) [4]

Date	Open	High	Low	Close	Adj Close	Volume	Annual Return (%)
2014/12/31	15.5775	15.649	15.5005	15.5175	15.5175	40960000	/
2015/12/31	34.304	34.3875	33.7945	33.7945	33.7945	74992000	117.7831
2016/12/31	38.3235	38.37	37.414	37.4935	37.4935	82788000	117.7831
2017/12/31	59.1175	59.2	58.375	58.4735	58.4735	53768000	10.94557
2018/12/31	75.54	76.038	74.35	75.0985	75.0985	1.39E+08	28.43169
2019/12/31	92.1	92.663	91.6115	92.392	92.392	50130000	23.02775
2020/12/31	163.75	164.146	162.06	162.8465	162.8465	59144000	76.25606
2021/12/31	168.956	169.35	166.5585	166.717	166.717	47830000	2.376777
2022/12/31	83.12	84.05	82.47	84	84	62401200	2.376777
2023/12/31	153.1	153.89	151.03	151.94	151.94	39789000	-49.6152
2024/12/31	170.2	170.55	167.7	170.31	170.31	55081300	80.88095

Table 2: S&P 500 Index R_m [4]

Date	Open	High	Low	Close*	Adj. close**	Volume	Annual Return
2014/12/31	2063.25	2088.75	1968.25	2052.5	2052.5	25307600	-9.15956151
2015/12/31	2085.5	2105	1992.25	2035.5	2035.5	30360708	-2.309014984
2016/12/31	2199.5	2278.25	2179	2236.25	2236.25	24590081	-13.69480157
2017/12/31	2640.75	2698.25	2605	2676	2676	21307133	-11.70590433
2018/12/31	2793.5	2814	2316.75	2505.25	2505.25	37453862	12.79313442
2019/12/31	3036	3155	3033	3143.75	3143.75	22847900	-13.972167
2020/12/31	3631	3753	3596	3748.75	3748.75	24692241	-13.99799933
2021/12/31	4587.5	4799.75	4492	4758.5	4758.5	32915568	-22.13407586
2022/12/31	4094.5	4145	3788.5	3861	3861	31059109	16.66019166
2023/12/31	4571.75	4841.5	4548.75	4820	4820	28365508	-14.23236515
2024/12/31	4874.5	4997.75	4872.5	4962	4962	5751102	-1.84401451

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To calculate the annual return of the S&P 500, we can base it on the adjusted closing price (Adj. close**) at the beginning and end of each year (Table 2). The annual return can be calculated using the following formula:

Annual Return= (Adj. Close at the beginning of the year-Adj. Close at the beginning of the year) / Adj. Close at the beginning of the year x 100%

This requires to first group the data by year and then calculate the adjusted closing price at the beginning and end of each year. The data for 2024 may only contain data from the beginning of the year to the current date and not the entire year (Table 3).

Table 3: Measurement of macroeconomic factors (Fe) [5]

Year	United States GDP (constant local currency units)	GDP growth rate (per cent)
2013	$17,329,814,706,000.00	-
2014	$17,726,282,036,000.00	2.29%
2015	$18,206,020,741,000.00	2.71%
2016	$18,509,601,053,000.00	1.67%
2017	$18,924,571,726,000.00	2.24%
2018	$19,481,973,191,000.00	2.95%
2019	$19,928,975,197,000.00	2.29%
2020	$19,377,380,521,000.00	-2.77%
2021	$20,529,459,727,000.00	5.95%
2022	$20,926,835,051,000.00	1.94%

3. Results

3.1. The impact of market returns on Amazon stock volatility

Amazon, one of the world's largest online retailers, has a stock price that is significantly affected by market returns. In this study, data from the past five years was selected to analyse the correlation between market returns and Amazon's stock price. The study used CAPM as a proxy for market returns and examined its impact on Amazon's stock price. The results show that, in the short run, the volatility of market returns is closely related to the volatility of Amazon's stock price. This finding reveals the importance of market returns as a short-term driver of Amazon stock price volatility and points out that Amazon stock price also exhibits greater volatility when there is a significant change in the overall market performance. Individuals and financial institutions or corporations face the issue of investment diversification and getting the maximum return while minimizing the associated risks [6].

3.2. The long-term impact of macroeconomic indicators on Amazon stock volatility

The stability of the macroeconomic environment is a key determinant of Amazon's long-term stock price performance. This study analyses macroeconomic indicators related to Amazon's business, including retail sales data and economic growth rates. The study finds that these macroeconomic indicators have a positive long-term correlation with Amazon's stock price. In particular, Amazon's performance and stock price showed a significant upward trend during periods of economic growth. This suggests that the impact of these macroeconomic indicators must be taken into account when considering the long-term investment potential of Amazon. Christensen & Prabhala found that implied volatility does predict future realized volatility in isolation as well as in conjunction with the history of past realized volatility [7]. And also, the result shows that the implied volatility of at-

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the-money call options is predictable using a parsimonious set of variables in the market information set [7].

3.3. Two-factor model construction and result interpretation

In order to more accurately assess the combined effect of market returns and macroeconomic indicators on Amazon stock volatility, this study constructs the following two-factor model:

$$Pt = \alpha + \beta 1 \cdot MRt + \beta 2 \cdot MEIt + \epsilon t \quad (2)$$

which, Pt denotes the price or price volatility of Amazon stock at time t,

MRt represents the market return,

MEIt represents the relevant macroeconomic indicators.

By means of regression analysis, this study estimates the relative influence of market returns (β1) and macroeconomic indicators (β2) on Amazon stock volatility. The results show that the influence of market returns is more significant in the short run, while the influence of macroeconomic indicators becomes more important in the long run. This result implies for investors that they should pay more attention to market volatility when making short-term investment decisions, while macroeconomic trends need to be taken more into account when considering long-term investments. Correlation risk is priced in the sense that assets that pay off well when market wide correlations are higher than expected earn negative excess returns. This result is consistent with increases in market wide correlations leading to a deterioration of investment opportunities in the form of smaller diversification benefits. The negative excess return on correlation-sensitive assets can therefore be interpreted as an insurance premium. Driessen, Maenhout, and Vilkov provide evidence of a large correlation risk premium in a number of different ways. First, while index options reflect a large negative variance risk premium, there is no significant negative premium on variance risk in individual options on all index components. Second, a trading strategy that sells correlation risk by selling index options and buying individual options earns excess returns of 10% per month and has a large Sharpe ratio. This strategy has more attractive risk-return properties (especially higher moments) than other option-based strategies. Third, the return on this correlation trading strategy explains 70% of the cross-sectional variation in index and individual option returns that is not accounted for by market risk [8].

While the two-factor model provides a valuable perspective for understanding and predicting Amazon stock volatility, it is important to recognise the volatility and complexity of the stock market. In addition to market returns and macroeconomic indicators, there are many other factors that may affect stock prices, including company-specific events, industry trends, and the global economic environment. Therefore, while the two-factor model is a useful analytical tool, as it does not fully capture all market dynamics, investors should consider multiple analytical methods and data sources when making decisions.

4. Conclusion

This paper delves into the intricate relationship between market returns, macroeconomic indicators, and the volatility of Amazon's stock. By constructing and analyzing a two-factor model, it offers a nuanced understanding and forecasting approach for Amazon's stock movements. The study reveals that in the short term, Amazon's stock price is predominantly influenced by market volatility. This aspect underscores the immediate reaction of the stock to market fluctuations and investor sentiment.

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However, the long-term behavior of Amazon's stock paints a different picture. Over extended periods, the stability and trends of macroeconomic indicators become significantly more influential. Factors such as GDP growth, inflation rates, and unemployment figures start to play a crucial role in shaping the stock's trajectory. This indicates a more profound and systemic influence of the broader economic environment on Amazon's stock.

The two-factor model demonstrates the interaction between macroeconomic indicators and market sentiment in influencing Amazon's stock price over varying time frames. During economic uncertainty, macroeconomic factors may significantly impact short-term stock movements, while market sentiment could predominate in stable periods. For investors, this implies the necessity of a balanced investment strategy that considers both immediate market sentiments and long-term economic trends. This dual-focus approach aligns with the key drivers of stock fluctuations, fostering well-informed and resilient investment decisions in Amazon's stock.

While this study provides valuable insights into Amazon's stock price dynamics, it has limitations. The model might not account for all variables affecting stock movements, such as geopolitical events or technological advancements. Future research should explore these additional factors and consider integrating more complex analytical models. This would enhance our understanding of stock market behavior, offering investors a more comprehensive tool for decision-making in an ever-evolving economic landscape.

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