The impact of investors' attention on new product introduction on stock returns based on Google trend search volume

Yueyang Ma[*][†], Yang Yang[‡], Longjie Li[§], Qingyu Luo[¶]

Apr, 2024

Abstract

This study utilizes Apple Inc. as a case study to investigate the influence of investor attention on the company's returns following new product announcements. The analysis incorporates Apple stock prices spanning from 2007 to 2023, the S&P 500 index, and Google search volume data within an 11-day window surrounding each announcement, which serves as a proxy for investor attention. Employing both event analysis and regression analysis methodologies, the following conclusions are drawn:

1. The impact of relatively fixed product introductions on stock returns is found to be statistically insignificant. Only when a product introduces substantial innovations that surpass investor expectations does it lead to abnormal returns for the company.

2. No significant correlation is observed between investor attention, as measured by Google search volume, and abnormal returns for Apple stock. The regularity of Apple's product announcements is thought to lessen the effect of attention elements, which explains the absence of association. Additionally, the influence of Google search volume is found to be limited in this context.

Key words: Product announcement, Google trend search counts, stock return, event analysis.

[*]School of International Business School, Tianjin University of Finance and Economics, Tianjin, 300222, China, Maried2003@126.com

[†]Corresponding author email: Maried2003@126.com

[‡]Nottingham University Business School, University of Nottingham Ningbo China, Ningbo, 315199, China, biyyy30@nottingham.edu.cn

[§]Alliance Manchester Business School, University of Manchester, Manchester, M1 5NR, United Kingdom, jie.nancy34@outlook.com

[¶]The college of Arts and Sciences, Kansas State University, Manhattan, 66506, United States, 2016605453@qq.com

1 Introduction

As one of the tech businesses that receives the greatest media and public attention worldwide, products launched by Apple Inc. generate significant interest from investors and the general public. However, the impact of these product launches on Apple's stock performance is not always remarkably significant. Some data indicates that in the days and weeks leading up to new product releases, Apple's stock performance often lags behind the broader market. Conversely, a number of studies have discovered that following the company's IPO, its performance has surpassed market expectations. These contradictory results could be explained by the fact that investor confidence frequently peaks before to the release of new products, which could cause the stock to become overvalued. Therefore, investor dissatisfaction and a significant stock sell-off may ensue if the product does not live up to these high expectations when it is released (Bresciani et al., 2021). Furthermore, the stock market may have fully priced in the anticipated benefits of the new product introduction, leaving limited possibility for further upside after the debut. As before, there is typically a surge in investor interest in Apple's stock prior to the release of a new product. It could be more difficult to assess the launch's underlying value impact on the stock price due to increased transaction volume and volatility brought on by this increased attention (Bresciani et al., 2021).

This study delves into the intricate connection between Apple's new announcements and the subsequent movement of its stock. Its objective is to determine whether the launch of new products affects the stock returns of the company in a statistically significant way, and if so, how this impact can be explained. It also investigates the role of investor attention in this situation.

A. **The following are the primary goals of this study:**

 a. To identify whether there exists a correlation between the introduction of new Apple products and the firm's stock returns.

 b. To evaluate the significance of investor attention, as measured by Google Trends search volume, in accounting for the variations in stock returns based on the introduction of new items.

B. **Research Significance**

Via an investigation of the case of Apple Inc, the present study is aimed at examining the correlation between new product launches and stock performance as well as search volume. To be specific, the current research will concentrate on whether there exists a link between the introduction of new Apple products and the company's stock returns, and whether the level of investor attention measured by Google Trends search volume makes a difference on the changes in stock returns.

2 Literature Review

A. Investor attention

Attention is a limited resource for humans, as highlighted by Kahneman (1973). Past research has explored how attention affects stock prices across various cross-sections, including Ben-Rephael, Da, and Israelsen (2017) and Peng and Xiong (2006). Peng and Xiong (2006) argue that constrained attention often leads investors to prioritize industry-level information over firm-level details, implying a connection between attention and stock returns. Furthermore, international corporations like Apple naturally attract substantial attention from both individual and professional investors, potentially amplifying the impact of actions, scandals, and other events. Interestingly, we have found that this effect is negligible for Apple. We will delve into possible reasons for this, including the fixed frequency of new product introductions.

In this subfield, the utilization of search volume data has boosted the study of attention. The majority of studies report a positive correlation between attention and returns. For example, positive returns can be predicted by increasing search volume, as indicated by Da et al. (2011). Conversely, a negative or inconsequential relationship is also found by a few studies, such as the negative correlation found by Bijl et al. (2016) . This effect is attributed to temporary price pressure, as explained by J. Chen et al. (2022).

The differences between findings may result from factors in research design, including country selection, sample construction, and specified search content. The choice of keywords may represent different kinds of attention. Regarding keyword selection, Bijl et al.

3

(2016) argued for the noise elimination function of stock tickers as the keyword. They pointed out that this approach can avoid the impact of irrelevant attention brought by non-investors. In our study, concerning attention from customers and other stakeholders, AAPL, which is the NASDAQ ticker symbol for Apple Inc., is chosen to more precisely stand for investor attention and eliminate bias.

The differences in findings can be attributed to variations in the countries under examination, sample construction methods, and keyword selection processes. The choice of the keyword may represent different facets of attention. While Bijl et al. (2016) opted to search for company names, asserting that tickers closely resemble company abbreviations, the use of tickers can help mitigate data noise stemming from non-investors merely searching for company products or services. In our study, AAPL, the NASDAQ ticker symbol for Apple Inc., has been selected to more accurately represent investor attention and alleviate potential biases.

B. Measurement

Past research has employed various methods to measure investor attention, including Google volume data, abnormal trading volume, and news coverage. In a study conducted by J. Chen et al. (2022), they utilized 12 distinct proxies to measure investor attention. Among these proxies, the choice of internet search volume has been considered as the most prevalent in the existing literature, and alternative proxies are considered indicators of passive attention.

Da et al. (2011) contribute to attention measurement, suggesting that Google's reported search volume is a valid reflection of the search behavior of the general population. Different from alternatives, they propose that Google search frequency can accurately and directly measure investor attention.

However, it's important to acknowledge the limitations of using Google search volume. It has constraints, including limited precision and data noise. Moreover, other influential factors, such as information from social media, news outlets, and financial reports, can significantly impact investor attention, which Google search volume may not fully capture. Additionally, the mere fact that an article was published on a specific date does not guarantee

4

that all relevant events took place on that exact date, as noted by Kim (2020).

Understanding the precise relationship between Google search volume and its representation of investor attention warrants further investigation, both in direct and indirect terms.

C. New Product Introduction

While the marketing literature extensively explores the process of planning, evaluating, listing, and announcing new products, the impact of new product announcements on stock markets, as noted by Chaney, Devinney, and Winer (1993) , remains relatively uncharted territory. This gap in research can be attributed to the disconnect between the fields of marketing and finance. Given that new product introductions are inherently attention-grabbing activities, understanding how they influence stock returns holds strategic significance, particularly in terms of product launch frequency.

The introduction of new products is a delicate yet vital aspect of maintaining a firm's competitive edge and long-term viability. With the exponential growth of new product launches each year, the significance of this process cannot be overstated. Some studies, such as Chaney, Devinney, and Winer (1993), reveal a positive relationship, while others, like Eddy and Saunders (1980) , find an insignificant effect.

Markovitch et al. (2015) delved into the correlation between the stock market's immediate reactions to new products, suggesting that the stock market does not strongly react to announcements of product introductions, especially in markets assumed to be highly efficient.

These contradictory findings underscore the need for a careful examination of factors influencing the impact of new product announcements. Investor attention, as an intermediary, may offer valuable insights and explanations for this phenomenon.

3   Data and Methodology

A. Overall Explanation

In this section, we discuss our data collection method and two different regression models.

B. Data collection method

The main data include Apple stock daily return, S&P 500 index daily return and Google trend search volume.

Below is the summary of the data information used in the regression analysis:

Table 1: Summary Statistics of Variables

Variable Name	Number of observations	Mean	Variance	Max
Close stock return	4190	0.001	0.000	0.139
Close market return(S&P500)	4190	0.000	0.000	0.116
Risk-free return(One-Month US Treasury Bills)	4190	0.056	0.287	13.333
Risk-free return(13-week Treasury bill close return)	4190	0.046	0.272	12.143

1) *Apple stock daily return*

Hypothesis: The stock price's ups and downs, as well as the stock return that follows, can be an indicator of reactions of shareholders to the product launch. Yahoo (https://finance.yahoo.com/) provides stock data for Apple over the years. Daily data are from January 2007 to October 2023, and the stock return formula is used to produce the Apple company's daily return.

2) *S&P 500 index daily return*

Hypothesis: Using the S&P 500 index as the market model to regress Apple company's return.

The S&P 500 Index, is a stock market index measuring the stock performance of the 500 largest firms listed on U.S. stock exchanges, comprising 503 commonly seen stocks issued by 500 large-cap firms (Kenton (2023)). The index represents around 80 percent of the USA equity market by capitalization (S&P Dow Jones Indices, 2023).

6

Additionally, it is weighted by free-float market capitalization, with more valuable firms occupying comparatively more weight in the index. Apple is one of the largest companies in the index's reference list. We selected the S&P 500 index from a variety of indexes since it encompasses a wider range of markets and we are interested in evaluating how the broader market index responds to the product launch information.

With the purpose of calculating stock returns, we obtained specific data on the S&P 500 index from 2007 to the present from MarketWatch (https://www.marketwatch.com/)

3) *Google trend search volume*

Hypothesis: Overall search volume on Google measures investor attention directly and transparently. Individual investors initiate stock-related searches when they have an interest in potential investments, and such searches also serve as an important indicator when existing shareholders monitor company dynamics.

We aim to utilize Google trend search volume (SVI) as an alternative measure to investors' attention in explaining the portion of Apple that generates excess market-adjusted revenue following the release of new products. On the Google Trends website, the search term used is the Apple stock code, AAPL (https://trends.google.com/trends/). The concept of Google search volume refers to the proportion of searches conducted for a specific term relative to the overall number of searches within a predefined geographic area and time frame (R. P. Lee and Q. Chen (2009)). The search volume data is normalized on the website between 0 and 100, with changes indicating shifts in the popularity of the search term rather than absolute search volume (R. P. Lee and Q. Chen (2009)). The study focuses on the United States, examining the Google search volume for the Apple stock code, AAPL, five days before and following the date of the new product news release (a total of 11 days of event windows).

To direct attention towards Apple's investors, we decide to utilize Apple's stock code (AAPL) as our search term instead of the names of the specific new products debuted by Apple. A comparison of AAPL's shifting trends and product names (e.g. iPhone 15) as search phrases validates our hypothesis. The search volume for product names (such as iPhone 15) is not separated between working days and weekends, using

7

the product information release date as the node to illustrate smooth variations over time. However, the AAPL search volume curve in Google Trends shows a considerable decrease on weekends, indicating that the search volume on weekdays is significantly higher than on holidays. This suggests that product-name searches do not align with Apple's investor attention because investor reactions should focus on dates when the stock market is open, excluding weekends when the stock market is closed, etc. Product-name searches are more likely to originate from consumers and competitors who are more concerned with the worth of the product itself rather than the impact of stock movements on Apple. Therefore, their concerns should be excluded from the scope of our study. Using Apple's stock code as the search phrase is able mitigate this sort of impact by rendering it more focused and specific to the object of our study.

C. Research Methodology

1) Market model

The data analysis for the first model is grounded in the Event Study Methodology. Twenty separate market models are constructed to investigate whether new product announcements have an impact on Apple stock returns. According to Brown and Warner (1980, 1985) , the event study methodology consistently employs a market model to examine excess yield, as

$$R_t = \alpha + \beta R_{mt} + \epsilon_t \tag{1}$$

where R_t =returns for Apple Inc in period t, R_{mt} =returns on the market in period t, and σ_t =error terms (i.e., $N(0, \sigma^2)$). Therefore, according to formula (1), the abnormal return can be computed as

$$AR_t = R_t - (\hat{\alpha} + \hat{\beta} R_{mt}) \tag{2}$$

where $\hat{\alpha}, \hat{\beta}$ =estimated intercept and slop. Then, the daily abnormal returns are summed up across the event window to obtain a cumulative abnormal return (CAR).

$$\text{CAR} = \sum_{t=-T}^{T} AR_t \tag{3}$$

where T=the scope of per event window.

In this paper, the assumption is that the iPhone release has no impact on stock returns. Recent studies on the sensitivity of outcomes have indicated that estimation window lengths should be at least over 100 days (Armitage, 1995; Park, 2004). In the present study, the data for each iPhone release period is calculated as follows: using 150 days beginning 15 days before the Apple Inc announcement to estimate the market model. Based on Holler (2014), the event window length is 11 days centred symmetrically around the announcement.

2) *Regression analysis*

In the statistical methodology of linear regression, its purpose is to explain the degree of change in the dependent variable based on the interpretation of explanatory variables in a linear function (Seber and A. J. Lee, 2012).

Thus, in the present study, linear regression is used to explore the relationship between statistically significant abnormal returns (AR), the summing up of AR and investors' attention (SVI), as

$$\text{AR} = a + b \times \text{SVI} \tag{4}$$

where AR = the AR with significance is calculated through the market model, and SVI=Google trend search volume. The linear regression assumes that the investors' attention has no impact on the abnormal returns of Apple Inc. with the market model chosen.

4 Empirical analysis

Market model

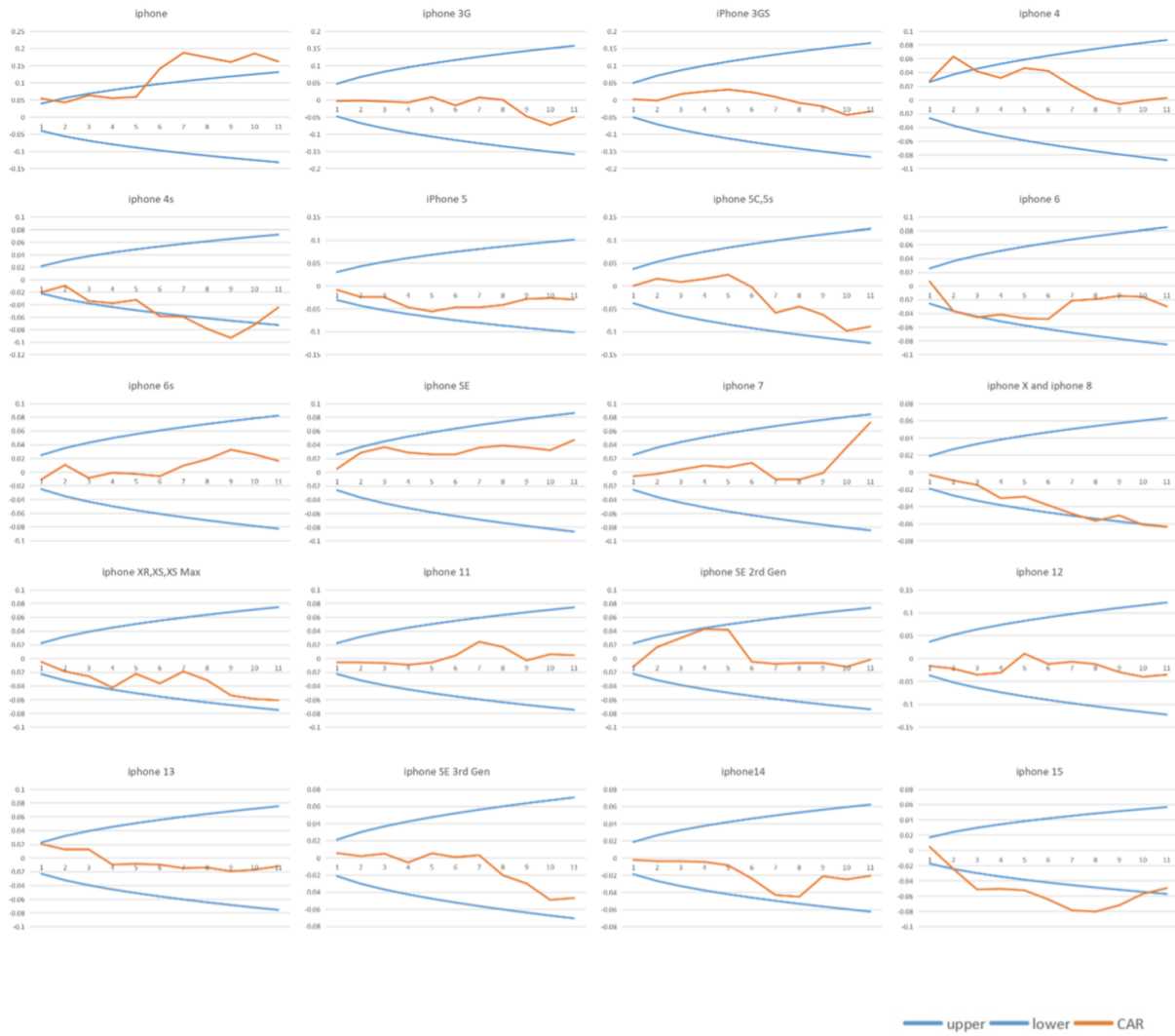Figure 1. Confidence intervals for different generations of iPhone announcements

Figure 1

Figure 1 depicts the confidence interval of twenty product releases calculated by the market model. It is evident that only six announcements, namely iPhone, iPhone 4, iPhone 4s, iPhone 6, iPhone X, and iPhone 8, iPhone 15, have Cumulative Abnormal Returns (CAR) exceeding the confidence interval and the null hypothesis is rejected. This suggests that the releases of these specific iPhone products have statistically significant impact on Apple's stock price, resulting in an abnormal return for the company.

The results of the first model indicate that most product announcements have little effect on the company's returns. Some scholars have also noted this trend, arguing that new electronic

goods launch announcements may not significantly benefit firms (e.g., Eddy and Saunders, 1980). Additionally, in large organizations, systematic procedures for Research and Development (R&D) have been established for new products, and investors may have become accustomed to expecting regular launches compared to smaller firms (Chaney, Devinney, and Winer, 1993). For Apple Inc., the public has come to anticipate new product releases every autumn, and the impact of the new product release news window has already been incorporated into investor expectations. The likelihood of further fluctuations in Apple's stock return is reduced if the business simply meets or falls short of investor expectations.

Examining all significant results through Figure 1, the release of the iPhone and iPhone 4 resulted in significant positive abnormal returns for the company in the short term, while the release of the iPhone 4s, iPhone 6, iPhone X, iPhone 8, and iPhone 15 had the opposite effect.

Analysing the significant positive abnormal returns in conjunction with the impact of the product announcement on society at that time reveals that when the company invests a significant amount of money in research and development, resulting in a product with great innovation that exceeds investor expectations. Investors recognize the potential and make subsequent substantial investments. This causes a sharp rise in the corporation's stock price and significant profits for the company, while competitors suffer statistically significant negative abnormal returns (Zantout and Chaganti, 1996). For example, the iPhone 4 featured significant design adjustments, such as a front and rear double glass design that give the phone a robust and slim appearance, along with numerous updates in functionality and Apple's independently developed iOS system, and created a seamless integration of product hardware and software. Consequently, the sales record of iPhone 4 surpassed 1.7 million in three weeks and 30 million in half a year, far exceeding other mobile phones at that time.

Significant negative abnormal returns need to be analysed in conjunction with Apple's stock trends. Based on Apple's press conferences over the years, the company's stock price typically rises due to market speculation on the trading day before the conference and in pre-market trading on the same day. However, on the day of each launch, the shares generally decline after the press conference as market expectations are released. Additionally, critiques from pundits regarding aspects of the new iPhone, such as being too overpriced or having screen size and feature flaws,

11

contribute to a brief decline in Apple's stock price. Overall, Apple's stock usually outperforms in the months following the release of a new iPhone. Consequently, Apple's stock price has historically fallen within a week of the conference but rebounds in the subsequent months.

Regression analysis

The launch of six new Apple products—the iPhone 15, iPhone X/8, iPhone 6, iPhone 4, iPhone 4s, and iPhone 1—has resulted in significant market-adjusted abnormal returns, as per the study of the market model. dates of the first market information releases for these items are, in order, 12/09/2023, 12/09/2017, 09/09/2014, 04/10/2011, 07/06/2010, and 09/01/ 2007. To regress the Abnormal Returns (AR) determined by the market model, data from Google Trend Search Volume (SVI) for five working days prior to and following these dates (11-event window) are gathered. The following are the regression curves using Formula (4).
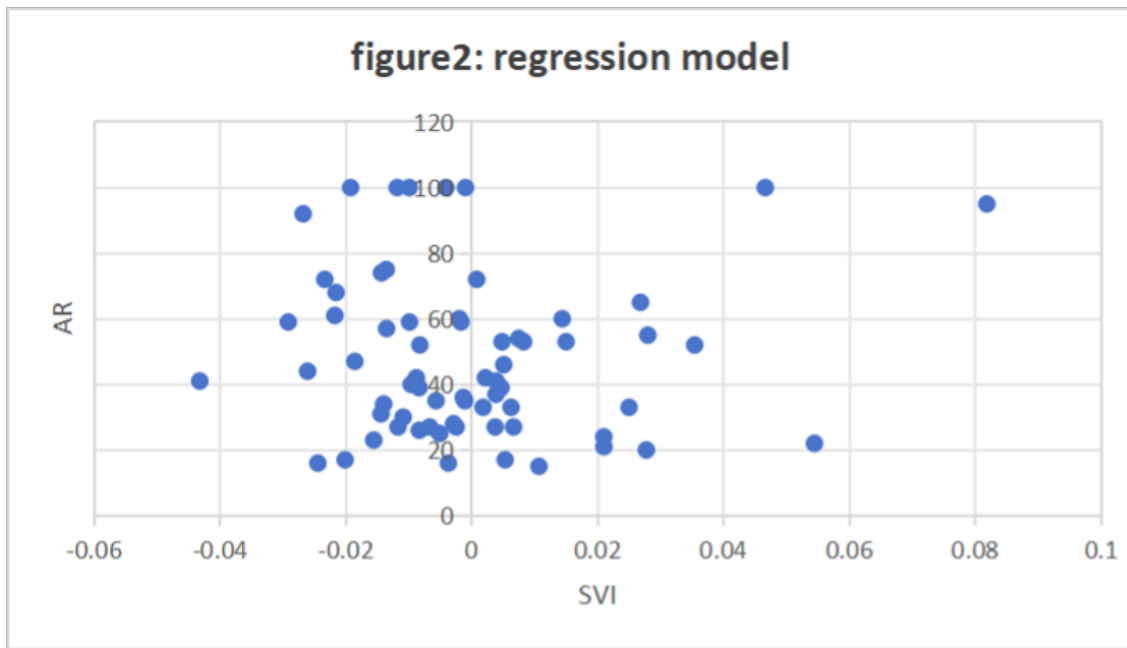

Figure 2

Excel is used for data regression, and the results show that the R-square for the regression is only 0.000425, and the correlation coefficient between AR and SVI is 0.0000172. The regression equation has relatively little ability to describe the original data, based on the regression data. This suggests that it is inaccurate to attribute abnormal stock returns caused by the introduction of new products solely to investor interest. We conducted additional hypothesis testing on the correlation

coefficient of the variables based on Formula (4) to more rigorously assess the potential relationship between them.

Establish the hypothesis:

Null Hypothesis: b=0

Alternative Hypothesis: b≠0

We reach the following results using Excel's data analysis algorithm: The correlation coefficient (b) has a t-statistic of 0.16501, and the P-value is 0.86945. The correlation coefficient is statistically insignificant at a 95% confidence level, indicating that these data do not provide enough evidence to reject the null hypothesis. As a result, it is concluded that there is no evidence to prove there is a relationship between AR and SVI. In conclusion, we find from the regression model research that investor interest, as replaced by Google trend search volume, is unable to sufficiently clarify the abnormal returns created by Apple's announcement of new products.

Limitation

However, does this conclusion imply that investor attention is absolutely incapable of explaining the abnormal stock returns caused by the release of new products? The answer is no. First of all, it is not comprehensive to use Google Trend Search Volume to directly and completely replace investor attention, which means that our assumption about Google Trend Search Volume in the data collection part is not valid. Investor attention is difficult to quantify, and using the search volume of a specific search term instead may conceal the true level of investor interest in the company (Akarsu and Süer, 2022). Furthermore, its drivers include not only variations in search volume but also changes in stock trading volume and potential variances in investor attention (Scheinkman and Xiong, 2003).

SVI data were optimized in the study conducted by Akarsu and Süer (2021). They used multivariate equations to apply limiting and supplemental constraints to Google Trend data, resulting in Abnormal Trading Volume (AVOL) as an alternative indicator of investor interest. AVOL can better substitute investor attention to refer to its association with stock abnormal returns after appropriate data processing and removal of time patterns and low-frequency seasonality.

Another topic to consider is whether it is practical to assume a linear link between Google Trend Search Volume (SVI) and stock returns, even if SVI can directly serve as a good estimator of

investor attention. In their 2015 study, Zhong et al. utilized the panel quantile regression model to examine the nonlinear connection between investor interest and stock returns, ultimately yielding results with increased relevance for future research.

In general, we discovered that there is no specific association between Google Trend Search Volume and Apple stock abnormal return through data research. More research is needed to determine how to assess investor attentiveness and the precise relationship between it and stock volatility.

Conclusion

In this study, we examined the effect of investor attention on stock returns on the company-specific level and extended the literature on investor attention to new product introductions, which are mainly examined at marketing and strategic levels. We also discussed the effectiveness of Google search volume as the measure of investor attention.

Based on previous work, we used the Google search volume of the stock ticker to measure investor attention and examined the relationship between the abnormal returns during the period of product announcements and investor attention.

Our results show that relatively fixed product introductions have an insignificant effect on stock returns, aligning with many previous findings. However, the product pivots, such as iPhone 4s, market reactions to products, and company expenses on R&D would lead to more significant stock reactions. Moreover, an insignificant association between investor attention and Apple stock abnormal return through data research has been found. The reasons behind this can also be explained by the more routine behaviour of Apple, which lowers the effect of the attention factor. Also, the attention of more professional rather than individual investors might be less explained by internet search volume. The natural limitation of the use of Google search volume and the ignorance of other correlated factors also caused bias when creating the model.

References

Akarsu, Sergen and Ömür Süer (2022). "How investor attention affects stock returns? Some international evidence". In: *Borsa Istanbul Review* 22.3, pp. 616–626.

Armitage, Seth (1995). "Event study methods and evidence on their performance". In: *Journal of economic surveys* 9.1, pp. 25–52.

Ben-Rephael, Azi, Zhi Da, and Ryan D Israelsen (2017). "It depends on where you search: Institutional investor attention and underreaction to news". In: *The Review of financial studies* 30.9, pp. 3009–3047.

Bijl, Laurens et al. (2016). "Google searches and stock returns". In: *International Review of Financial Analysis* 45, pp. 150–156.

Bresciani, Stefano et al. (2021). "Digital ecosystems". In: *Digital Transformation Management for Agile Organizations: A Compass to Sail the Digital World*. Emerald Publishing Limited, pp. 153–165.

Brown, Stephen J and Jerold B Warner (1980). "Measuring security price performance". In: *Journal of financial economics* 8.3, pp. 205–258.

— (1985). "Using daily stock returns: The case of event studies". In: *Journal of financial economics* 14.1, pp. 3–31.

Chaney, Paul K, Timothy M Devinney, and Russell S Winer (1993). "The impact of new product introductions on the market value of firms". In: *Insurance: Mathematics and Economics* 12.1, pp. 82–83.

Chen, Jian et al. (2022). "Investor attention and stock returns". In: *Journal of Financial and Quantitative Analysis* 57.2, pp. 455–484.

Eddy, Albert R and George B Saunders (1980). "New product announcements and stock prices". In: *Decision sciences* 11.1, pp. 90–97.

Holler, J (2014). "Event-study methodology and statistical significance". In: *Event-study methodology and statistical significance* 1, pp. 5–10.

Kahneman, Daniel (1973). *Attention and effort*. Vol. 1063. Citeseer.

Kenton, Will (2023). "S&P 500 Index: What It's for and Why It's Important in Investing". In: *Investopedia, Investopedia* 22.

Lee, Ruby P and Qimei Chen (2009). "The immediate impact of new product introductions on stock price: the role of firm resources and size". In: *Journal of Product Innovation Management* 26.1, pp. 97–107.

Markovitch, Dmitri G et al. (2015). "Behavioral reasons for new product failure: Does overconfidence induce overforecasts?" In: *Journal of Product Innovation Management* 32.5, pp. 825–841.

Ni, Zhong-Xin, Da-Zhong Wang, and Wen-Jun Xue (2015). "Investor sentiment and its nonlinear effect on stock returns—New evidence from the Chinese stock market based on panel quantile regression model". In: *Economic Modelling* 50, pp. 266–274.

Park, Namgyoo K (2004). "A guide to using event study methods in multi-country settings". In: *Strategic Management Journal* 25.7, pp. 655–668.

Peng, Lin and Wei Xiong (2006). "Investor attention, overconfidence and category learning". In: *Journal of Financial Economics* 80.3, pp. 563–602.

Seber, George AF and Alan J Lee (2012). *Linear regression analysis*. John Wiley & Sons.

Zantout, Zaher and Radha Chaganti (1996). "New product introductions, shareholders' wealth, and first-mover advantages". In: *Journal of financial and strategic decisions* 9.3, pp. 49–61.