

How flash manufacturing PMI is affecting the U.S. stock market. An empirical study.



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This paper presents a comprehensive analysis of the relationship between the US Flash Manufacturing PMI news releases, returns, and volatilities of Russell 1000 and 2000 indexes. Using an autoregressive (AR) and generalized autoregressive conditional heteroskedasticity (GARCH) model, the study examines data from January 2015 to November 2022, encompassing both pre-pandemic, pandemic, and post-pandemic periods. The statistical analysis indicates that these news releases do not significantly influence stock returns, supporting the efficient market hypothesis. Various factors, including measurement errors and the unique circumstances of the Covid-19 pandemic, likely overshadowed the impact of PMI news releases. Additionally, the analysis finds no significant evidence to support the hypothesis that PMI news releases have an amplified impact on stock market volatilities during the pandemic compared to other periods. The study suggests considering other economic indicators, applying advanced time-series analysis techniques, conducting sector-specific analysis, exploring different stock markets, and extending the analysis over longer periods for a more comprehensive understanding. This research contributes to the understanding of the complex dynamics between economic indicators and stock market performance.



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1. INTRODUCTION

1.1 Background and significance of the problem

A stock market is an exchange where shares or stocks of companies that are listed publicly are traded. The stock market is crucial for the growth and establishment of a robust and competitive economy because it injects significant investments through IPOs. As a result, the stock market contributes to becoming a key to structural changes in every economy. The purchasing managers index, or PMI, is an abbreviation that serves as a standard for summarizing economic activity in the economies' manufacturing sector (de Bondt, 2019). The Purchasing Managers' Index (PMI) is a commonly used indicator of economic activity and is widely used for forecasting and business analysis by government agencies, financial institutions, and companies.

Studies have shown that PMI announcements can significantly impact securities markets, particularly in the European Union. Research has found that when the PMI is worse than expected, it can lead to negative stock returns (Hanousek & Kočenda, 2011). According to the research conducted by Graham, Nikkinen, and Sahlström (2003), it was found that the US and European stock markets react more strongly to announcements regarding the US Purchasing Managers' Index (PMI) compared to Asian markets. The study revealed that the US Manufacturing PMI has a notable negative impact on the US stock market volatilities, which was determined to be significant at a 1% level. On the other hand, the US Service PMI was found to have no significant effect on the volatilities of US stock market.

Nikkinen, Omran, Sahlström, and Äijö (2006) posits a positive association exists between alterations in the US Manufacturing PMI and the volatilities of US stock market, which has been established as significant at a 1% significance level. Conversely, the author states that the relationship between changes in the US Service PMI and the US stock market has been determined to be insignificant.

Johnson and Watson (2011) reached similar conclusions in their research and argued that changes in PMI can be utilized as a critical factor in predicting stock returns. Additionally, it has been observed that the effects of PMI announcements are more pronounced for stocks of smaller companies and in specific industries such as valuable metals, advancements in computing, fabrics, and vehicles.

While there is considerable evidence supporting the influence of Final PMI announcements on stock returns and volatilities in both the United States and Europe (Hanousek & Kočenda, 2011), further research is needed to investigate the relationship between Flash PMI announcements and stock returns and volatilities in the US. Specifically, a comparative study of the effects of monthly Flash Manufacturing PMI announcements reported in economics news on US's stock market is needed.

Based on the previous studies, this research will not consider the US Service PMI as it has been found to have no significant effect on the US stock market. Despite the monthly release of the US Manufacturing PMI, there is also the publication of the "Flash Manufacturing PMI Index," released by Institute for Supply Management, which provides an early glimpse into the expected state of the manufacturing industry one or two weeks ahead of the regular Manufacturing PMI release. The Final Purchasing Managers' Index (PMI) has a constraint where it solely captures data on business activity from the initial half of the month. This is because data collection and processing occur in the latter half of the month. As a result, any notable fluctuations in business activity taking place in the second half of the month are improbable to be included in the PMI of that particular month. However, these changes might become apparent in the PMI of the subsequent month (Harris, 1991).

Flash Manufacturing PMI is more critical than the Final PMI because the insights of the PMI can address the experts to have insights with regards to the market situations and conditions as well as for them to identify the potential for economic recessions. Flash Manufacturing PMI is regarded as an approximation of the manufacturing for any economy, which is dependent on 85% to 90% of complete PMI (purchasing manager's index) survey responses every month (Estrada, Koutronas, &

Lee, 2020). Any outcome of the Flash Manufacturing PMI, which is more than 50, shows enhanced conditions, whereas when the result is below 50, it shows that the economy is deteriorating. The Flash Manufacturing PMI is a forward-looking approximation of a nation's production sector and is intended to address an accurate indication of the complete PMI. Moreover, the Final Manufacturing PMI surveys for over 40 countries are available, including those in the eurozone, with Flash Manufacturing PMI being published for the eurozone and only six countries, namely Japan, Germany, the UK, the US, France, and Australia. In this research, monthly release of US Flash Manufacturing PMI will be applied to explore the impact on US stock market.

1.2 Objectives

The research aims to analyze the impact of the US Flash Manufacturing PMI on the US stock market. The specific objectives of the research are as follows:

- To examine the significance of positive, negative, and neutral news releases related to the US Flash Manufacturing PMI on the Russell 1000 and 2000 indices' volatilities.
- To investigate the impact of positive, negative, and neutral news releases related to the US Flash Manufacturing PMI on the Russell 1000 and 2000 indices' returns.

1.3 Research hypothesis

The release of monthly US Flash Manufacturing PMI news can impact the stock index return of Russell 1000 and 2000 indices. The Flash Manufacturing PMI news can provide insights into the manufacturing sector's health and the overall economy, which can affect investor sentiments and market movements. The impact of Flash Manufacturing PMI news on stock index return can vary depending on whether the news is positive, negative, or neutral. Positive news can lead to an increase in investor confidence, resulting in a rise in stock index return. Conversely, negative news can lead

to a decrease in investor confidence, resulting in a fall in stock index return. Neutral news, on the other hand, may not have a significant impact on stock index return.

To investigate the impact of monthly release of positive, negative, or neutral US Flash Manufacturing PMI news on the Russell 1000 and 2000 indices' return, conditional mean model, AR process can be used. The AR process is a popular time series model used to predict future values based on past values. The Flash Manufacturing PMI news can be included as an explanatory variable in the AR process to see if it has a significant impact on the stock index return. Based on the hypothesis development above, the following research hypothesis can be formulated:

H₀: The monthly releases of positive, negative, or neutral US Flash Manufacturing PMI news have no significant impact on the returns of Russell 1000 and 2000 stock indexes.

H₁: The monthly releases of positive, negative, or neutral US Flash Manufacturing PMI news have a significant impact on the returns of Russell 1000 and 2000 stock indexes.

To provide a consistent research hypothesis, the direction of the impact is needed to specify. Thus, research hypothesis can further be refined as follows:

H_{1a}: Positive US Flash Manufacturing PMI news has a positive and significant impact on the returns of Russell 1000 and 2000 stock indexes.

H_{1b}: Negative US Flash Manufacturing PMI news has a negative and significant impact on the returns of Russell 1000 and 2000 stock indexes.

H_{1c}: Neutral US Flash Manufacturing PMI news has no significant impact on the returns of Russell 1000 and 2000 stock indexes.

H_{1a} and H_{1b} specify the direction of the impact of positive and negative US Flash Manufacturing PMI news, respectively. H_{2c} states that neutral US Flash Manufacturing PMI news has no impact on returns, which is consistent with the null hypothesis.

The research hypothesis can be tested by estimating an AR model with Flash Manufacturing PMI news as an explanatory variable and analyzing the statistical significance of the Flash Manufacturing PMI news coefficient. If the coefficient is statistically significant, we can reject the null hypothesis and conclude that Flash Manufacturing PMI news has a significant impact on the stock index return. Otherwise, we fail to reject the null hypothesis and conclude that there is not a significant relationship between the US Flash Manufacturing PMI news and the returns of Russell 1000 and 2000 indices.

The monthly release of US Flash Manufacturing PMI news is an important economic indicator that provides information about the manufacturing sector's performance. Positive PMI news suggests an expansion in manufacturing activity, while negative PMI news indicates a contraction in the sector. On the other hand, neutral PMI news suggests that there is no significant change in the sector's performance. The release of such news can have an impact on the stock market's volatility, as investors adjust their expectations of future economic conditions based on the news. The previous empirical research that demonstrates the significance of PMI announcements and their reflection in stock prices and volatilities, this forms the basis of our research hypothesis, which pertains to the effect of US Flash Manufacturing PMI news on the US stock market. The research hypothesis for the impact of monthly release of positive, negative, or neutral US Flash Manufacturing PMI news on the Russell 1000 and 2000 indices' volatility by using GARCH is:

H_0 : There is no significant relationship between the monthly release of positive, negative, or neutral US Flash Manufacturing PMI news and the volatility of the Russell 1000 and Russell 2000 stock indexes.

H₂: There is a significant relationship between the monthly release of positive, negative, or neutral Flash Manufacturing PMI news and the volatility of the Russell 1000 and Russell 2000 stock indexes.

To provide a consistent research hypothesis, the direction of the impact is needed to specify. Thus, research hypothesis can further be refined as follows:

H_{2a}: The release of positive US Flash Manufacturing PMI news increases the volatilities of Russell 1000 and 2000 stock indexes.

H_{2b}: The release of negative US Flash Manufacturing PMI news increases the volatilities of Russell 1000 and 2000 stock indexes.

H_{2c}: The release of neutral US Flash Manufacturing PMI news has no significant impact on the volatilities of Russell 1000 and 2000 stock indexes.

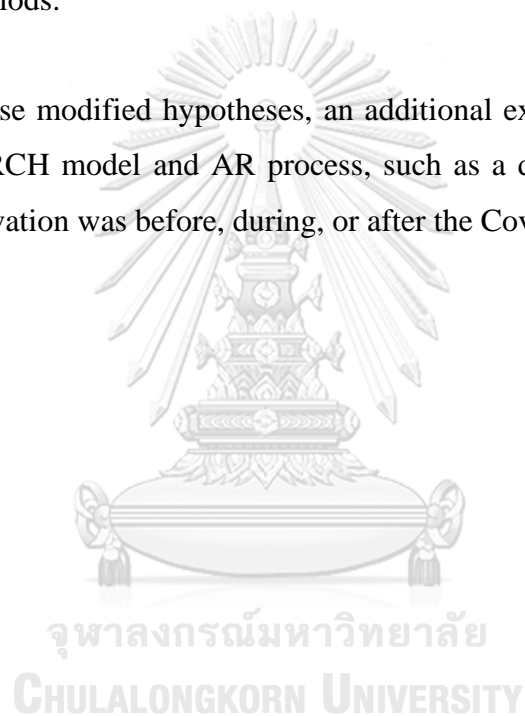
These hypotheses suggest that the release of positive or negative US Flash Manufacturing PMI news is likely to affect stock index volatility of Russell 1000 and 2000 indices, while neutral Flash Manufacturing PMI news is not expected to have a significant impact. To test these hypotheses, a GARCH model can be estimated with an additional explanatory variable for the monthly change in Flash Manufacturing PMI news and the coefficients of the monthly change in Flash Manufacturing PMI news can be used to evaluate the impact of the news on stock index volatility of Russell 1000 and 2000 indices.

To incorporate the market response to the Covid-19 pandemic into the research hypothesis, the original hypotheses mentioned above can be modified to include this factor. The release of the monthly US Flash Manufacturing PMI index has a significant impact on the volatilities and returns of the Russell 1000 and 2000 stock indexes, and these impacts are further amplified by the market response to the Covid-19 pandemic. Modified hypotheses are as follows:

H_{1.1}: The impact of the releases of the monthly positive, negative, or neutral US Flash Manufacturing PMI index on the returns of the Russell 1000 and 2000 stock indexes is amplified during the Covid-19 pandemic compared to pre-pandemic and post-pandemic periods.

H_{2.1}: The impact of the releases of the monthly positive, negative, or neutral US Flash Manufacturing PMI index on the volatilities of the Russell 1000 and 2000 stock indexes is amplified during the Covid-19 pandemic compared to pre-pandemic and post-pandemic periods.

To test these modified hypotheses, an additional explanatory variable will be added to the GARCH model and AR process, such as a dummy variable indicating whether the observation was before, during, or after the Covid-19 pandemic.



2. LITERATURE REVIEW

2.1 Financial markets and macroeconomics news

Various theories propose different explanations for how news announcements, particularly those related to macroeconomics, can impact the volatility of returns. Nofsinger and Prucyk (2003) delve into these theories, which rely on distinct assumptions and forecast contrasting reactions. One theory, proposed by Kim and Verrecchia (1994), assumes that traders are unable to obtain non-public information prior to an official announcement. This limitation results in heightened levels of volatility in the market until a general agreement or consensus is reached among traders. Another theory, proposed by Kim and Verrecchia (1991a), assumes that traders possess the ability to obtain non-public information and engage in trading activities based on their personal judgments prior to public announcements. The resulting alterations in prices are influenced by the unforeseen aspects of the news. In yet another theory, proposed by Kim and Verrecchia (1991b), traders gather confidential data and forecast upcoming news events, and the level of uncertainty decreases as the accuracy of the information improves.

Ederington and Lee (1996) present a hypothesis using a theoretical framework in which investors acquire non-public information, but there remains some ambiguity prior to the release of news. Their research, focusing on options markets, demonstrates that implied volatilities exhibit an upward trend leading up to the news announcement, followed by a subsequent decline as market participants resolve the uncertainty. These findings align with the observed pattern of realized volatility, which tends to increase following the dissemination of news, as demonstrated by Ederington and Lee (1996).

In recent years, there has been a notable rise in empirical studies examining the effects of macroeconomic news releases on financial markets. These research endeavors have reached a consensus, indicating that the announcement of such news has a substantial impact on asset prices and exchange rate market volatilities (Andersen & Bollerslev, 1998), fixed income markets (Balduzzi, Elton, & Green, 2001; Fleming

& Remolona, 1997, 1999), and security markets (Buckle, Ap Gwilym, Thomas, & Woodhams, 1998; Chang, Pinegar, & Ravichandran, 1998; McQueen & Roley, 1993; Steeley, 2001; Veronesi, 1999) are influenced by the release of important economic information, making them announcements that have implications across the entire market. These studies indicate that the levels of GARCH or other time-series volatilities are elevated on significant days when important news announcements are made as seen in studies (Bollerslev, Cai, & Song, 2000; Ederington & Lee, 1993, 1995; Flannery & Protopapadakis, 2002; Jones, Lamont, & Lumsdaine, 1998).

Previous research has suggested that specific macroeconomic news publications, such as the report on employment, the index of employment costs, the indices for producer and consumer prices, and the final purchasing managers' index (PMI) figures, possess significant importance as comprehensive indicators of the economy. These releases have been observed to cause significant changes in the processes that generate asset prices, as demonstrated by various studies such as (Bollerslev et al., 2000; Christie–David, Chaudhry, & Koch, 2000; Ederington & Lee, 1996; Fleming & Remolona, 1999; Graham et al., 2003; Nikkinen & Sahlström, 2004).

2.2 Purchasing managers' index (PMI)

There has been extensive research on various macroeconomic factors and their influence on stock markets. However, there is a notable absence of studies investigating the connection between Flash Manufacturing PMI and stock market volatilities. This report seeks to bridge this gap by examining the effects of the US Flash Manufacturing PMI on the US stock market.

A recent research conducted by Afshar, Arabian, and Zomorrodian (2011) employed the commonly used Granger causality test and discovered compelling evidence indicating that the Purchasing Managers' Index (PMI) demonstrated superior predictive capabilities for Gross Domestic Product (GDP) compared to the Consumer Confidence Index. This assertion was substantiated by Tsuchiya (2011), who concluded

that the Purchasing Managers' Index (PMI) constituted a dependable metric for gauging fluctuations in industrial manufacturing and gross domestic product (GDP).

There are some earlier studies that investigate how PMI affects GDP growth: According to Dasgupta and Lahiri (1993), PMI can be used to forecast changes in GDP. Studies by Banerjee and Marcellino (2006); Dasgupta and Lahiri (1992); Kauffman (1999); Koenig (2002); Lindsey and Pavur (2005) all presented similar findings. A few more recent studies also offer proof in favor of the earlier investigations. For instance, Zhu and Li (2012) conducted a study in which they examined the dynamic correlation between the Final Manufacturing Purchasing Managers' Index (PMI) and the growth rate of the United States Gross Domestic Product (GDP). They employed the SCC-MVGARCH model to analyze the relationship between these variables. The authors found that there was a statistically significant association between the two variables. In a more recent study conducted by Zhang, Xiao, Yang, and He (2015), they expressed a similar claim regarding the capacity of the Final Manufacturing Purchasing Managers' Index (PMI) to forecast Gross Domestic Product (GDP).

Along with the parameters indicated above, PMI is discovered to have an effect on a few other factors. According to a study by Harris (1991), PMI exercises dominion over the anticipation of industrial undertakings for the identical time span, and it exemplifies the Ultimate PMI as a potent and ever-changing indicator of macroeconomic conditions. Zhao and Yun (2012) discovered a noteworthy finding regarding the relationship between Industrial Value Added (IVA) and the Final Purchasing Managers' Index (PMI). Their study revealed a substantial correlation between these two variables, implying a strong association between them. Furthermore, they reached a consensus that PMI has the ability to forecast changes in industrial value added.

Koenig (2002) demonstrated that the PMI served as a valuable gauge of progress in both the manufacturing sector and the overall economy. Smirnov (2010) determined that the PMI was an indication of an impending crisis in Russia, while Harris (1991) proposed that the PMI was better suited for confirming recent alterations

rather than foretelling them. According to a study conducted by Kauffman (1999), it was discovered that the Purchasing Managers' Index (PMI) possessed significant utility as a means of comprehending alterations in economic activity within the United States. As a result, it was recommended that the PMI be duly considered when formulating strategic purchasing decisions.

2.3 Stock markets and PMI

The stock market serves as a dependable platform for institutions to enhance their capital reserves and offers investment opportunities for individuals. It plays a crucial role in facilitating economic growth by facilitating the flow of substantial financial resources within an economy. The fluctuations in the stock market are expected to have significant implications on the economy, either positive or negative, as it constitutes a substantial component of the overall economic system. As a result, several studies have been conducted to examine the relationship between the Purchasing Managers' Index (PMI) and the performance of stocks.

Additional investigation is imperative concerning the correlation between the Purchasing Managers' Index (PMI) and the value of stocks. A research conducted by Wang (2012) pertaining to the Shanghai Composite Index discovered indications of a durable and co-integrated connection between the Purchasing Managers' Index (PMI) and stock prices. This indicates that the PMI can serve as a valuable tool for examining and forecasting trends in the stock market. Collins (2001) found, utilizing Granger causality tests, it was determined that the Purchasing Managers' Index (PMI) does not exhibit consistent reliability as an indicator for forecasting the performance of the stock market in the United States. This conclusion was drawn based on the analysis of empirical data.

However, Johnson and Watson (2011) conducted a study spanning from January 1973 to December 2009, aiming to evaluate the link between fluctuations in the Final Purchasing Managers' Index (PMI) and stock returns. Their objective was to analyze the impact of these variations on the US economy. By employing time-series

regression analysis, the authors presented evidence indicating that changes in PMI can serve as predictors of stock returns. Their research demonstrated a robust and statistically significant correlation between any alterations in PMI and subsequent stock performance during periods of economic expansion. Conversely, the correlation was found to be less pronounced during economic recessions. Furthermore, the studies indicated that small-cap equities displayed a stronger association between PMI and stock performance compared to large-cap stocks. Consequently, the literature remains undecided on the matter of whether the PMI affects stock prices and volatilities.

When conducting research, it is crucial to comprehend the primary factors that constitute the Purchasing Managers' Index (PMI). The PMI is a combined indicator comprising five diffusion indices. Augmenting the importance of the PMI can be accomplished by employing the suitable combination and proportions of these variables. According to Dasgupta and Lahiri (1993), the utilization of diffusion measures has the potential to enhance the capacity to forecast transitions in the business cycle. Previous research has indicated that particular weightings were deliberately selected to optimize the correlation between the Purchasing Managers' Index (PMI) and actual growth in gross domestic product (GDP), as reported in studies by Kauffman (1999); Lindsey and Pavur (2005); Torda (1985).

In a study conducted by Cho and Ogwang (2006) they investigated the process of selecting important variables for the Principal Components Variable Selection Strategy in the context of the PMI proposed by Jolliffe (1972, 1973). Their discoveries questioned the traditional method of giving the greatest importance to "New Orders" and the least importance to "Inventories." Instead, they suggested that a more straightforward Purchasing Managers' Index (PMI) based exclusively on the Employment Diffusion Index could be employed with similar precision. Similarly, Dasgupta and Lahiri (1993) discovered that the exclusive utilization of inventory dispersion proved to be a reliable indicator for anticipating shifts in the economy. The ongoing discussion surrounding the constituents of the Purchasing Managers' Index (PMI) holds significant importance as it underscores the possibility of enhancing

forecast precision by carefully choosing a reduced number of highly informative predictors (Bai & Ng, 2008).

Moreover, research conducted by Graham et al. (2003); Nikkinen et al. (2006) have found that a noteworthy correlation between fluctuations in the US Manufacturing Purchasing Managers' Index (PMI) and volatilities in the US stock market. However, these studies did not find a significant relationship between changes in the US Service PMI and stock market volatility. Hence, the main objective of this study is to empirically examine the degree of interconnectedness between the US stock market and the dissemination of news regarding the US Flash Manufacturing PMI.



3. DATA

Based in the US, this study US, uses eight years of daily close-adjusted returns data of the Russell 1000 and 2000 indices the from the Bloomberg database, spanning from January 2015 to November 2022. The Russell 1000 Index is a market capitalization-weighted index that tracks the performance of the largest 1000 publicly traded companies in the United States. The index is maintained by FTSE Russell, a subsidiary of the London Stock Exchange Group. The index is designed to be a benchmark for large-cap U.S. stocks, and it includes companies from a wide range of industries, including technology, healthcare, finance, and consumer goods. The Russell 1000 Index is considered a more stable and less volatile index compared to the Russell 2000 Index. The companies in the index are typically larger and more established, with a market capitalization of over \$10 billion. As a result, these companies are often more mature, and their stock prices tend to be less volatile compared to smaller companies.

The Russell 2000 Index is also a market capitalization-weighted index that tracks the performance of the smallest 2000 publicly traded companies in the United States. Like the Russell 1000 Index, the Russell 2000 Index is maintained by FTSE Russell. The index is designed to be a benchmark for small-cap U.S. stocks and includes companies from a range of industries. The companies in the Russell 2000 Index are typically smaller and less established, with a market capitalization of under \$2 billion. As a result, these companies are often more volatile, and their stock prices can fluctuate significantly compared to larger companies. Overall, the Russell 1000 Index and Russell 2000 Index are both important benchmarks for the U.S. stock market. While the Russell 1000 Index is considered more stable and less volatile, the Russell 2000 Index provides investors with exposure to smaller companies that can potentially offer higher returns but also come with higher risks.

The study has collected the US Flash Manufacturing PMI data records from Bloomberg database as well. The US Flash Manufacturing PMI is a closely watched economic indicator published monthly by Institute for Supply Management. The PMI is a leading economic indicator that provides insight into the health of the US

manufacturing sector. It is based on a survey of 300 purchasing managers at manufacturing companies across the United States. The analysis utilized the monthly Flash Manufacturing PMI index from January 2015 to November 2022, based on the information available. There are 45 positive news, 46 negative and 4 neutral news, a total of 95 US Flash Manufacturing PMI news have been released.

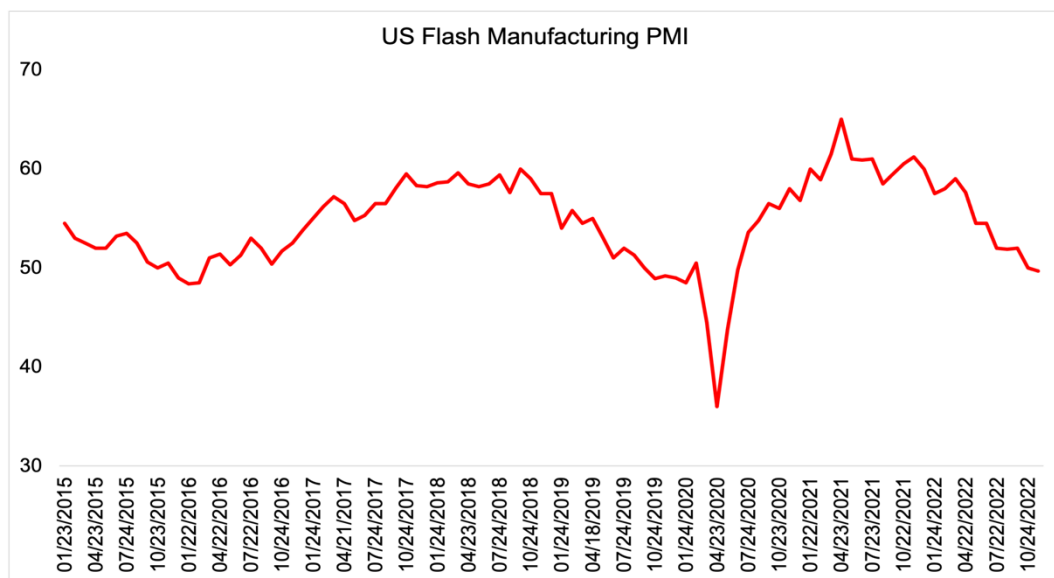


Figure 3.1. Monthly Positive, Negative and Neutral Releases of US Flash Manufacturing PMI

4. METHODOLOGY

4.1 GARCH model and AR process

The Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model is a well-known and commonly used framework for representing the changing volatility of financial returns over time. This model has gained significant popularity in the field of financial econometrics, and numerous research works have explored its theoretical foundations and practical effectiveness through empirical analysis. The original GARCH model proposed by R. F. Engle (1982) assumes that the conditional variance of a time series is determined by a mathematical function involving the squared errors from previous time points and the previous conditional variances. This model is capable of capturing both the tendency for volatility to persist over time and the tendency for volatility to cluster together. Empirical evidence suggests that this model produces more accurate predictions of volatility compared to conventional approaches like ARCH models (R. Engle, 2001).

Several extensions and variants of the GARCH model have been proposed in the literature. For example, the EGARCH model introduced by Nelson (1991) allows for the asymmetric response of volatility to positive and negative shocks. The IGARCH model proposed by Baillie and Bollerslev (1989) allows for the framework that incorporates the potential existence of persistent memory in the process governing the conditional variance.

Empirical studies have provided evidence of the usefulness of the GARCH model for financial applications. For example, Bollerslev (1986) found that the GARCH model exhibited superior performance compared to alternative volatility models when it came to predicting the conditional variance of stock returns. Christoffersen (1998) demonstrated that the GARCH model exhibited the capability to accurately depict the fluctuations in volatility within exchange rates, surpassing alternative models when it came to calculating Value-at-Risk (VaR).

Despite its empirical success, some criticisms have been raised regarding the GARCH model. For example, R. F. Engle and Bollerslev (1986) noted that the GARCH model may not be suitable for modeling very high-frequency data due to the large number of parameters required. Additionally, R. F. Engle and Patton (2001) argued that the GARCH model may not capture all the relevant features of financial time series, such as jumps and non-normality.

In summary, the GARCH model is a powerful framework for modeling the time-varying volatility of financial returns. Its underlying theory has been extensively studied, and empirical evidence suggests that it provides accurate forecasts of volatility. Therefore, this paper aims to explore the significance of positive, negative, and neutral news releases related to the US Flash Manufacturing PMI on the Russell 1000 and 2000 indices' volatilities by using GARCH model.

The autoregressive (AR) process is a popular time series model used in econometrics and finance to analyze the behavior of a time series. The AR process assumes that a variable at a certain time point is linearly related to its own past values. Several studies have used the AR process to analyze the effect of macroeconomic news on the arena where investors and traders engage in buying and selling financial instruments. For instance, Wu (2016) used an AR model to investigate the effect of economic news releases on the Chinese security market. Their results showed that there is a significant relationship between the news releases and the stock returns, with the magnitude of the impact varying depending on the type of news. Similarly, Chen (2020) used an AR model to examine the effect of economic news releases on the US security market. They found that the PMI news had a significant impact on stock returns, with positive news leading to higher returns and negative news leading to lower returns.

Other studies have used more advanced models, such as the vector autoregression (VAR) model, to analyze the effect of economic news on the realm of finance where various instruments and assets are bought and sold. For example, Balcilar (2020) used a VAR model to analyze the impact of the PMI news on stock returns in several emerging markets. Their results showed that there is a significant relationship

between the news releases and the stock returns, with the magnitude of the impact varying across countries.

In conclusion, the AR process is a useful tool for analyzing the impact of economic news on financial markets, including stock index returns. Several studies have used the AR model to examine the impact of the PMI news on stock returns, with consistent evidence of a significant impact. Therefore, in this research, it aims to investigate the impact of US Flash Manufacturing PMI news on stock index return of Russell 1000 and 2000 indices using the AR process.

Step 1: Obtain the historical daily closing prices of the Russell 1000 and 2000 indexes and the monthly US Flash Manufacturing PMI index data over a period covering from January 2015 to November 2022.

Step 2: For each trading day, calculate the percentage change in the index value from the previous day using the following formula:

$$DR_{i,t} = \ln\left(\frac{P_{i,t}}{P_{i,(t-1)}}\right) \quad (4.1)$$

Where, $DR_{i,t}$ is the daily return for stock index i , at time t , $P_{i,t}$ is the stock index value at time t and $P_{i,(t-1)}$ is the stock index value at the previous trading day. After that, the result is multiplied by 100 to obtain the daily return as a percentage. The daily returns capture the daily price movements of the stock index and are an important input for financial modeling, such as GARCH modeling.

Step 3: Compute the monthly changes in the US Flash Manufacturing PMI index by subtracting the previous month's Flash Manufacturing PMI index value (PMI_{t-1}) from the current month's Flash Manufacturing PMI index value (PMI_t).

$$\Delta PMI_t = PMI_t - PMI_{t-1} \quad (4.2)$$

Step 4: Compute the stock index return due to the impact of monthly release of positive, negative, or neutral US Flash Manufacturing PMI news by using the conditional mean model, an autoregressive AR (1) process. Here is the formula for the conditional mean model with the monthly Flash Manufacturing PMI change indicator variable:

$$R_t = \mu + \sum_{i=1} \beta_1 R_{t-1} + \gamma_{pos} * I_{t,pos} + \gamma_{neg} * I_{t,neg} + \varepsilon_t \quad (4.3)$$

Where, R_t is the stock index return at time t , μ is the intercept, β_1 is the coefficient of the one-lagged returns, R_{t-1} is the one-lagged returns, γ_{pos} represents the additional effect of a positive Flash Manufacturing PMI news release on the conditional mean, relative to the effect of a neutral Flash Manufacturing PMI news, holding all else constant, γ_{neg} represents the effect of a negative Flash Manufacturing PMI news release, $I_{t,pos}$ is the dummy variable for a positive Flash Manufacturing PMI news release at time t , $I_{t,neg}$ is the dummy variable for a negative Flash Manufacturing PMI news release at time t , and ε_t is the residual error term at time t .

Step 5: Calculate the volatility of the stock index as the square root of the conditional variance by applying the following model formula GARCH (1,1) with mean equation:

$$Y_t = \mu + \sum_{i=1} v_1 Y_{t-1} + \varepsilon_t \quad (4.4)$$

$$\sigma_t^2 = \omega + \sum_{i=1}^p \alpha_1 \varepsilon_{t-1}^2 + \sum_{j=1}^q \delta_1 \sigma_{t-1}^2 + \theta_{pos} * S_{t,pos} + \theta_{neg} * S_{t,neg} \quad (4.5)$$

Where, Y_t is the observed stock index return at time t , v_1 is the coefficient of one-lagged returns from mean equation, Y_{t-1} is the one-lagged returns, σ_t^2 is the conditional variance of the stock index return at time t , ω is the constant term or intercept, α_1 is the coefficient of one-lagged squared residual, δ_1 is the coefficient of one-lagged conditional variance, θ_{pos} represents the additional effect of a positive Flash Manufacturing PMI news release on the conditional variance, relative to the effect of a

neutral Flash Manufacturing PMI news, holding all else constant, θ_{neg} represents the effect of a negative Flash Manufacturing PMI news release, $S_{t,pos}$ is the dummy variable for a positive Flash Manufacturing PMI news release at time t , and $S_{t,neg}$ is the dummy variable for a negative Flash Manufacturing PMI news release at time t . Note that the time subscript t refers to the last observed value of the Flash Manufacturing PMI news release dummy variable.

To incorporate the market response to the Covid-19 pandemic, the AR (1) process and GARCH (1,1) model with an additional explanatory variable could be written as:

$$R_t = \mu + \sum_{i=1} \beta_i R_{t-i} + \gamma_{pos} * I_{t,pos} + \gamma_{neg} * I_{t,neg} + \gamma_{pre-pan} * PreCovid_t + \gamma_{post-pan} * PostCovid_t + \varepsilon_t \quad (4.6)$$

$$Y_t = \mu + \sum_{i=1} v_i Y_{t-i} + \varepsilon_t \quad (4.7)$$

$$\sigma_t^2 = \omega + \sum_{i=1}^p \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^q \delta_j \sigma_{t-j}^2 + \theta_{pos} * S_{t,pos} + \theta_{neg} * S_{t,neg} + \theta_{pre-pan} * PreCovid_t + \theta_{post-pan} * PostCovid_t \quad (4.8)$$

Where $\gamma_{pre-pan}$, $\gamma_{post-pan}$, $\theta_{pre-pan}$ and $\theta_{post-pan}$ are the coefficients of the dummy variable indicating whether the observation is before or after the Covid-19 pandemic. If the coefficient is significant, it would suggest that the impact of the release of the monthly positive, negative, or neutral US Flash Manufacturing PMI news releases on the volatilities and returns of the Russell 1000 and 2000 stock indexes are indeed amplified during the Covid-19 pandemic compared to pre-pandemic and post-pandemic periods.

5. EMPIRICAL RESULT AND DISCUSSION

5.1 Data descriptive of Russell 1000 and 2000 stock indexes' daily returns

The descriptive statistics presented in Table 5.1 reveal several important characteristics of the daily returns for both the Russell 1000 and Russell 2000 indexes during the period from January 2015 to November 2022. These statistics indicate that the daily returns of these indexes exhibit a relatively small range, a slight left-skewness, and heavier tails compared to a normal distribution.

Table 5.1. Data Descriptive of Daily Returns of the Russell 1000 and 2000 Indexes

	n	mean	sd	median	min	max	skew	kurtosis
<i>Period Covering From 2015 To 2022</i>								
Russell 1000	1992	0	0.01	0	-0.13	0.09	-0.89	15.6
Russell 2000	1992	0	0.01	0	-0.15	0.09	-1.04	12.45
<i>Covid-19 Pre-Pandemic Period</i>								
Russell 1000	1277	0	0.01	0	-0.04	0.05	-0.54	3.74
Russell 2000	1277	0	0.01	0	-0.05	0.05	-0.37	1.61
<i>Covid-19 Pandemic Period</i>								
Russell 1000	673	0	0.02	0	-0.13	0.09	-0.92	11.14
Russell 2000	673	0	0.02	0	-0.15	0.09	-1.05	8.21
<i>Covid-19 Post-Pandemic Period</i>								
Russell 1000	42	0	0.02	0	-0.03	0.06	0.57	0.3
Russell 2000	42	0	0.02	0	-0.03	0.06	0.43	0.33

The small range of daily returns suggests that the price movements of the stocks comprising these indexes were not extremely volatile during the analyzed period. This could be attributed to a combination of factors, such as diversified portfolios and

relatively stable market conditions. However, it is worth noting that the Covid-19 pandemic, which occurred during this period, had a significant impact on the financial markets and may have influenced the observed range of returns.

The slight left-skewness of the returns indicates that the distribution is asymmetrical, with a longer left tail. This suggests that there were more extreme negative returns compared to extreme positive returns. The left-skewness could be a result of market downturns or negative events that affected the stock prices included in the indexes. The presence of heavier tails further suggests the occurrence of occasional extreme returns, which deviate from the normal distribution assumption.

When analyzing the statistics for the Russell 2000 index during each Covid-19 period, it is observed that they follow a similar pattern to those of the Russell 1000 index. However, there are some variations in the specific values, indicating potential differences in the behavior of small-cap stocks compared to large-cap stocks during these periods. It would be insightful to investigate these variations further to understand the dynamics of the market during the different phases of the pandemic.

Overall, these descriptive statistics provide valuable insights into the characteristics of daily returns for the Russell 1000 and 2000 stock indexes during the analyzed period, with a particular focus on the Covid-19 pandemic. The observed changes in distribution, skewness, and kurtosis of returns suggest increased volatility and deviations from normality, indicating a higher level of uncertainty and risk in the market during the pandemic period. This implies that investors and market participants should be cautious and consider the potential impact of such non-normal behavior when making investment decisions.

5.2 US flash manufacturing PMI news and returns of stock indexes

The findings from the statistical analysis in Table 5.2 indicate that the coefficients of both positive and negative flash PMI news releases for the Russell 1000 and 2000 stock indexes are not significant. This suggests that the monthly release of

positive and negative US flash manufacturing PMI news does not have a discernible impact on the returns of these stock indexes.

Table 5.2. Returns of Russell 1000 and 2000 Stock Indexes

	β_1	μ	γ_{pos}	γ_{neg}
Russell 1000				
Estimate	-0.147	4.00E-04	-0.0011	-0.0004
s.e.	0.0222	2.00E-04	0.0018	0.0018
Russell 2000				
Estimate	-0.1143	2.00E-04	-0.0002	0.0004
s.e.	0.0223	3.00E-04	0.0022	0.0022

Notes: $R_t = \mu + \sum_{i=1} \beta_1 R_{t-1} + \gamma_{pos} * I_{t,pos} + \gamma_{neg} * I_{t,neg} + \varepsilon_t$, intercept (μ), coefficient of one-lagged returns (β_1), effect of positive and negative US flash manufacturing PMI news releases (γ_{pos} and γ_{neg}).

One possible explanation for these results is the concept of market efficiency. Efficient markets are characterized by the quick and effective incorporation of new information into stock prices. If the market efficiently processes and reflects the information contained in the PMI reports, any potential impact on stock returns may be short-lived or already priced in by the time the news is released. In such a scenario, it becomes challenging for investors to exploit the predictability of PMI news releases to generate abnormal returns.

It's also important to consider that economic data, including PMI reports, can be subject to measurement errors, revisions, or other noise. These factors can introduce uncertainty and make it challenging to identify a consistent relationship between PMI news releases and stock returns. The presence of noise in the data could dilute any true impact that the PMI news releases may have on the market, contributing to the non-significant coefficients observed in the analysis.

Furthermore, it is worth noting that positive PMI news is generally associated with economic expansion and favorable market conditions, while negative PMI news may indicate contraction or economic challenges. However, in reality, the economic landscape is often complex, and both positive and negative factors can coexist simultaneously. The simultaneous presence of positive and negative news may cancel out their effects on stock returns, leading to non-significant coefficients. This highlights the importance of considering the overall economic context and the interplay of various factors that influence stock market dynamics.

In terms of contribution, this analysis provides valuable insights into the relationship between flash manufacturing PMI news releases and stock returns for the Russell 1000 and 2000 indexes. By demonstrating the lack of statistical significance in the coefficients, it suggests that investors should exercise caution when attempting to use flash PMI news as a sole basis for making investment decisions in these specific stock indexes.

Based on these findings, it is suggested that investors and market participants should consider a broader range of information and indicators when analyzing stock market trends and making investment decisions. Relying solely on flash PMI news releases may not provide a comprehensive view of the market dynamics and the factors that influence stock returns. Diversifying the set of information sources and incorporating a mix of economic, financial, and market indicators can help investors make more informed decisions and mitigate potential biases introduced by any single data point or indicator.

Additionally, further research and analysis could explore other potential factors or variables that may interact with PMI news releases to influence stock returns. By considering a more extensive set of variables and their interactions, researchers may uncover more nuanced relationships and shed light on the specific conditions under which flash PMI news releases could have a significant impact on stock market performance.

Based on the results in Table 5.3, there are several possible reasons for the lack of statistical significance in the impact of positive and negative flash PMI news releases on the returns of the Russell 1000 and 2000 stock indexes during the Covid-19 pandemic compared to pre-pandemic and post-pandemic periods.

Firstly, the Covid-19 pandemic brought about unprecedented market conditions characterized by high volatility and uncertainty. During such periods, other factors such as government stimulus packages, fiscal policies, and global economic developments may have had a stronger influence on stock returns compared to PMI news releases. The market may have been more reactive to macroeconomic indicators or global events rather than specific manufacturing data. This suggests that during times of extreme market turbulence, the impact of PMI news releases may be diminished.

Secondly, the pandemic might have significantly altered investor behavior and market dynamics. Investors may have shifted their focus to other indicators or adopted different investment strategies during the crisis. This change in behavior could have reduced the impact of PMI news releases on stock returns during the pandemic period. As investors sought to navigate the uncertainties brought about by the pandemic, they may have relied on alternative sources of information or adjusted their risk appetite, leading to a diminished sensitivity to PMI news releases.

Furthermore, the Russell 1000 and 2000 stock indexes comprise a wide range of companies from various sectors. During the Covid-19 pandemic, some industries were more affected than others due to lockdowns, supply chain disruptions, and changes in consumer behavior. The impact of PMI news releases on stock returns might have been diluted by sector-specific factors that dominated the market during the pandemic. The performance of certain sectors, such as technology or healthcare, could have overshadowed the influence of PMI news releases on the broader index returns.

In addition, central banks worldwide implemented unprecedented monetary policies to stabilize financial markets during the pandemic. These interventions, such as quantitative easing and interest rate cuts, might have overshadowed the influence of

PMI news releases on stock returns. The actions taken by central banks could have had a more significant impact on market sentiment and investor behavior compared to manufacturing data. Consequently, market participants might have paid less attention to PMI news releases as they closely monitored central bank actions and policies.

Table 5.3. Returns of Russell 1000 and 2000 Indexes for Different COVID-19 Periods

	β_1	μ	γ_{pos}	γ_{neg}	$\gamma_{pre-pan}$	$\gamma_{post-pan}$
Russell 1000						
Estimate	-0.1476	2.00E-04	-0.001	-0.0005	2.00E-04	0.0027
s.e.	0.0222	4.00E-04	0.0018	0.0018	5.00E-04	0.0017
Russell 2000						
Estimate	-0.1147	0.00E+00	-0.0002	0.0003	2.00E-04	0.0028
s.e.	0.0223	5.00E-04	0.0022	0.0022	6.00E-04	0.0021

Notes: $R_t = \mu + \sum_{i=1} \beta_1 R_{t-1} + \gamma_{pos} * I_{t,pos} + \gamma_{neg} * I_{t,neg} + \gamma_{pre-pan} * PreCovid_t + \gamma_{post-pan} * PostCovid_t + \varepsilon_t$, intercept (μ), coefficient of one-lagged returns (β_1), effect of positive and negative US flash manufacturing PMI news releases (γ_{pos} and γ_{neg}), coefficients of COVID-19 pre-pandemic and post-pandemic dummy variables ($\gamma_{pre-pan}$ and $\gamma_{post-pan}$).

Finally, the pandemic created a unique economic environment with rapid and substantial market movements. The stock market's response to PMI news releases during this period might have been erratic or inconsistent, making it difficult to establish a clear relationship between the news and stock returns. The unprecedented level of uncertainty and volatility could have introduced noise and confounding factors that masked the true impact of PMI news releases on stock performance.

In terms of contributions, this analysis highlights the complex interplay between various factors during the Covid-19 pandemic and their influence on stock returns. It underscores the need to consider a wide range of factors and contextual dynamics when analyzing the impact of specific news releases on market outcomes. By acknowledging the unique circumstances of the pandemic and its effects on investor behavior and market dynamics, this analysis provides a more comprehensive understanding of the

observed lack of statistical significance in the relationship between PMI news releases and stock returns.

Based on these observations, one suggestion for future research is to explore the differential impact of PMI news releases across different sectors during periods of extreme market volatility. By focusing on sector-specific analysis, researchers can gain deeper insights into the factors that drive stock returns during crises and understand the varying sensitivities to PMI news releases within different industries. Additionally, further investigation into the role of central bank actions and their interaction with PMI news releases would provide valuable insights into the relative importance of different economic indicators during times of crisis.

Overall, the findings suggest that the Covid-19 pandemic and its associated market conditions had a profound impact on the relationship between PMI news releases and stock returns. Acknowledging the complexities and nuances of these factors is essential for a comprehensive understanding of stock market dynamics during times of crisis.

5.3 US flash manufacturing PMI news and volatilities of stock indexes

Based on the results in Table 5.4, which highlight a significant relationship between positive Flash Manufacturing PMI news releases and the volatility of the Russell 1000 and 2000 stock indexes, while no significant relationship was observed for negative Flash Manufacturing PMI news releases, there are several factors that contribute to these outcomes.

Positive Flash Manufacturing PMI news indicates a growing economy or an expansion in manufacturing activity. This type of news is generally interpreted by investors as a positive signal for the stock market. Consequently, it leads to increased buying activity and potentially higher volatility in the Russell 1000 and 2000 indexes. The positive PMI news influences market sentiment, attracting more traders and

investors to the market. This influx of participants can result in increased trading volume and price fluctuations in the stock indexes.

Table 5.4. Volatilities of Russell 1000 and 2000 Stock Indexes

	μ	ν_1	ω	α_1	δ_1	θ_{pos}	θ_{neg}
Russell 1000							
Estimate	0.000801	-0.075630	0.000003	0.214971	0.764176	0.000017	0.000007
Pr(> t)	0.000000	0.001619	0.000000	0.000000	0.000000	0.005627	0.180035
Russell 2000							
Estimate	0.000549	-0.043282	0.000002	0.118842	0.859620	0.000061	0.000026
Pr(> t)	0.012681	0.071434	0.307426	0.000001	0.000000	0.000222	0.062465

Notes: $Y_t = \mu + \sum_{i=1}^p \nu_i Y_{t-i} + \varepsilon_t$, $\sigma_t^2 = \omega + \sum_{i=1}^p \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^q \delta_j \sigma_{t-j}^2 + \theta_{pos} * S_{t,pos} + \theta_{neg} * S_{t,neg}$,

mean return (μ), coefficient of one-lagged returns from mean equation (ν_1), constant term or intercept (ω), coefficient of squared residual (α_1), coefficient of conditional variance (δ_1), effect of positive and negative US flash manufacturing PMI news releases (θ_{pos} and θ_{neg}).

Flash PMI news holds significant importance as an economic indicator providing insights into the health of the manufacturing sector. Volatility in the Russell 1000 and 2000 indexes may be influenced by how the market perceives the strength or weakness of the manufacturing sector, as reflected in positive PMI news. Investors closely analyze this data to gauge the overall economic conditions and potential market performance. Therefore, any positive news regarding manufacturing activity can lead to increased market volatility.

In addition to overall market sentiment, positive Flash PMI news may exceed market expectations or forecasts. When the PMI figures surpass anticipated levels, it indicates potential growth opportunities. This surprise element triggers a reaction in the stock market, as investors reassess their positions and expectations. The adjustment in investment strategies and trading decisions can contribute to heightened volatility within the Russell 1000 and 2000 indexes.

Moreover, the impact of positive Flash PMI news might be more significant on specific sectors within the Russell 1000 and 2000 indexes, particularly manufacturing or industrial companies. If these sectors make up a substantial portion of the indexes, the release of positive PMI news could lead to increased volatility within those sectors and, consequently, in the overall index. Investors tend to closely monitor news related to their invested sectors, and any positive developments in manufacturing can have a magnified effect on the volatility of these specific sectors and the corresponding indexes.

The findings from Table 5.4 provide valuable insights into the relationship between Flash Manufacturing PMI news releases and stock market volatility. This analysis can assist investors and market participants in understanding the potential impact of positive PMI news on the Russell 1000 and 2000 indexes. It highlights the importance of monitoring economic indicators and market sentiment to make informed investment decisions.

To further expand on this research, future studies could explore the impact of Flash PMI news on other stock market indexes or individual stocks within the Russell 1000 and 2000. Additionally, examining the duration of the volatility following positive PMI news releases could provide insights into the persistence of the market reaction. Moreover, considering external factors such as macroeconomic conditions or geopolitical events alongside PMI news could help in understanding the comprehensive drivers of stock market volatility.

Overall, the findings suggest that positive Flash Manufacturing PMI news releases have a significant relationship with the volatility of the Russell 1000 and 2000 stock indexes. This relationship is driven by various factors, including market sentiment, the surprise element, and sector-specific effects. Understanding the implications of positive PMI news on market volatility can be beneficial for investors, traders, and policymakers in managing their portfolios and making informed decisions in response to economic developments.

Based on the findings presented in Table 5.5, it appears that there is no statistically significant evidence to support the alternative hypothesis ($H_{2.1}$) that suggests an amplified impact of Flash Manufacturing PMI news releases on the volatilities of the Russell 1000 and 2000 stock indexes during the Covid-19 pandemic compared to the pre-pandemic and post-pandemic periods. The p-values associated with each exogenous variable are observed to be very large, indicating that the observed effects could have occurred purely by chance.

This lack of statistical significance suggests that there may not be a meaningful relationship or correlation between the Flash PMI news releases and the volatilities of the Russell 1000 and 2000 indexes. It is possible that the PMI news, although widely followed as an economic indicator, may not be a strong predictor of stock market volatility during the specified periods. This outcome raises questions about the efficacy and relevance of relying solely on Flash PMI news releases to understand and predict stock market behavior, particularly in the context of the Covid-19 pandemic.

Several factors could contribute to the absence of a significant relationship between Flash PMI news releases and stock market volatilities. First, it is important to consider that the Flash PMI primarily focuses on the manufacturing sector, which may have limited direct influence on the broader stock market. Other sectors, such as services, technology, or healthcare, might have greater impact and could be driving the market volatility during the pandemic. Additionally, macroeconomic conditions, such as interest rates, inflation, or government policies, could overshadow the impact of the Flash PMI news releases on stock market volatilities.

Furthermore, the Covid-19 pandemic itself was an unprecedented event that introduced unique dynamics and uncertainties into the global economy. Geopolitical events, like trade tensions or government interventions, could have had a more pronounced effect on the stock market during this period, overshadowing any influence of the Flash PMI news releases. Moreover, investor sentiment and market psychology can play significant roles in driving stock market volatilities, and these factors may not necessarily align with the information provided by the Flash PMI.

This analysis highlights the need to consider a more comprehensive set of variables and factors when studying stock market volatilities. While the Flash PMI news releases provide valuable insights into the manufacturing sector, they might not be sufficient in isolation to explain the complexities of stock market movements, especially during exceptional periods like the Covid-19 pandemic. Researchers and analysts should explore a broader range of indicators and factors, including macroeconomic conditions, geopolitical events, investor sentiment, and market psychology, to better understand and predict stock market volatilities.

Table 5.5. Volatilities of Russell 1000 and 2000 Indexes for Different COVID-19

	Periods								
	μ	ν_1	ω	α_1	δ_1	θ_{pos}	θ_{neg}	$\theta_{pre-pan}$	$\theta_{post-pan}$
Russell 1000									
Estimate	0.0008	-0.0753	0.0000	0.2178	0.7645	0.0000	0.0000	0.0000	0.0000
Pr(> t)	0.0000	0.0000	0.0000	0.0000	0.0000	0.9401	0.9963	0.9993	0.9984
Russell 2000									
Estimate	0.0005	-0.0447	0.0000	0.1249	0.8525	0.0000	0.0000	0.0000	0.0000
Pr(> t)	0.0000	0.0559	0.0000	0.0000	0.0000	0.9935	0.9993	0.9993	0.9992

Notes: $Y_t = \mu + \sum_{i=1}^p \nu_i Y_{t-i} + \varepsilon_t$, $\sigma_t^2 = \omega + \sum_{i=1}^p \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^q \delta_j \sigma_{t-j}^2 + \theta_{pos} * S_{t,pos} + \theta_{neg} * S_{t,neg} + \theta_{pre-pan} * PreCovid_t + \theta_{post-pan} * PostCovid_t$, mean return (μ), coefficient of one-lagged returns from mean equation (ν_1), constant term or intercept (ω), coefficient of squared residual (α_1), coefficient of conditional variance (δ_1), effect of positive and negative US flash manufacturing PMI news releases (θ_{pos} and θ_{neg}), coefficients of COVID-19 pre-pandemic and post-pandemic dummy variables ($\theta_{pre-pan}$ and $\theta_{post-pan}$).

Moreover, this study's findings contribute to the existing body of knowledge by shedding light on the limitations of relying solely on Flash PMI news releases for predicting stock market behavior during the Covid-19 pandemic. By demonstrating the lack of a significant relationship between Flash PMI and stock market volatilities, this research challenges the common assumption that PMI news releases alone can effectively capture and explain market dynamics. It encourages further exploration of

alternative indicators and factors to improve our understanding of stock market behavior.

For future research, it is recommended to consider incorporating additional variables that might have a stronger influence on stock market volatilities during exceptional periods like the Covid-19 pandemic. Exploring the impact of other economic indicators, geopolitical events, sentiment analysis of news articles or social media, and market-specific factors could provide a more comprehensive understanding of stock market behavior. Additionally, analyzing different time periods and conducting robustness tests may help validate and extend the current findings. This would contribute to a more holistic understanding of the complex interplay between economic indicators and stock market volatilities, aiding investors, policymakers, and researchers in making more informed decisions.

6. CONCLUSION

Regarding the first hypothesis, the statistical analysis indicates that the positive and negative flash PMI news releases for the Russell 1000 and 2000 stock indexes are not significant in influencing stock returns. This suggests that the efficient market hypothesis holds true, as new information is quickly incorporated into stock prices, making it challenging to exploit the predictability of PMI news releases. Furthermore, factors such as measurement errors, revisions, and noise in economic data may dilute any true impact on stock returns. Additionally, the unique circumstances of the Covid-19 pandemic, including high volatility, government interventions, altered investor behavior, sector-specific effects, and central bank actions, likely overshadowed the influence of PMI news releases on stock returns. Overall, the pandemic's unprecedented market conditions and the presence of other influential factors made it difficult to establish a consistent relationship between PMI news releases and stock returns during this period.

The statistical analysis conducted on the positive and negative flash manufacturing PMI news releases for the Russell 1000 and 2000 stock indexes has provided valuable insights into the relationship between PMI news releases and stock returns. By indicating that these news releases are not significant in influencing stock returns, the analysis contributes to supporting the efficient market hypothesis. It suggests that the market quickly incorporates new information, making it challenging to exploit the predictability of PMI news releases.

Furthermore, the analysis highlights the presence of various factors that may dilute any true impact on stock returns. These factors include measurement errors, revisions, and noise in economic data. Such challenges in accurately capturing the effects of PMI news releases on stock returns can hinder the development of profitable trading strategies based solely on this information.

Moreover, the analysis recognizes the unique circumstances of the Covid-19 pandemic as a significant influence on the relationship between PMI news releases and

stock returns. The high volatility, government interventions, altered investor behavior, sector-specific effects, and central bank actions during the pandemic likely overshadowed the influence of flash manufacturing PMI news releases. This insight provides important context for understanding the complex dynamics at play during this period.

In terms of the second hypothesis, the analysis of the data suggests that there is no statistically significant evidence to support the hypothesis that Flash Manufacturing PMI news releases have an amplified impact on the volatilities of the Russell 1000 and 2000 stock indexes during the Covid-19 pandemic compared to pre-pandemic and post-pandemic periods. The p-values associated with the exogenous variables indicate that the observed effects could have occurred by chance alone, failing to reject the null hypothesis. This suggests that there might be no meaningful relationship or correlation between Flash PMI news releases and stock market volatilities in the specified periods. It is possible that other factors, such as macroeconomic conditions, geopolitical events, or market sentiment, have a more significant influence on the volatilities of the Russell 1000 and 2000 indexes, overshadowing the impact of the PMI news releases. Further research and analysis are needed to understand the complex dynamics between economic indicators and stock market volatilities.

The contribution from the second hypothesis lies in its rigorous examination of the relationship between economic indicators and stock market volatilities, specifically focusing on Flash PMI news releases. By investigating the potential impact of these releases on the Russell 1000 and 2000 indexes, the study highlights the importance of considering other factors that may overshadow the influence of PMI news releases. This finding challenges the widely held assumption that economic indicators alone can significantly drive stock market volatility.

While this research provides valuable insights, further investigation and analysis are recommended to fully understand the complex dynamics between economic indicators and stock market returns and volatilities. It should be considered exploring the impact of a wider range of economic indicators, such as GDP growth

rates, unemployment rates, or consumer sentiment indices, on stock market returns and volatilities. By examining multiple indicators simultaneously, a more comprehensive understanding of the relationship between economic factors and market returns and volatilities can be gained.

The study should apply advanced time-series analysis techniques to capture any potential lagged effects of Flash PMI news releases on stock market returns and volatilities. By examining the temporal relationship between economic indicators and market reactions, a more nuanced understanding of their influence can be achieved.

This research also should conduct a sector-specific analysis to determine whether Flash PMI news releases have a varying impact on different industries within the Russell 1000 and 2000 indexes. This approach can help identify specific sectors that are more sensitive to economic indicators, providing valuable insights for investors and policymakers.

Furthermore, the study should extend the analysis beyond the Russell 1000 and 2000 indexes to include other major stock markets. By comparing the impact of Flash PMI news releases on different indexes across various countries or regions, it is possible to identify any cross-market correlations or divergences, shedding light on the global interconnectivity of economic indicators and stock market returns and volatilities.

Moreover, the research should consider conducting a longer-term analysis to evaluate whether the relationship between flash manufacturing PMI news releases and stock returns and volatilities holds true over extended periods. By examining data from multiple economic cycles and market conditions, it is possible to gain insights into the consistency and reliability of the relationship.

By pursuing these suggestions, future research can contribute to a more comprehensive understanding of the complex relationship between economic indicators, such as Flash PMI news releases, and stock market returns and volatilities.

This enhanced knowledge can benefit investors, policymakers, and researchers seeking to navigate and comprehend the intricate dynamics of financial markets.



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