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THE VOLUME-RETURN RELATIONSHIP: DO CRISES INFLUENCE THEIR RISE AND FALL?

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ABSTRACT

Understanding the relationship between volume and stock returns is a central question in financial research. Volume is often considered as an essential indicator of market sentiment, liquidity, and the flow of information, and its impact on asset prices has been widely studied. However, the effect of volume on returns might be subject to shifts during different market conditions, especially during periods of financial distress such as the 2008 global financial crisis. We explore whether high trading volume affects returns differently before and after the crisis, with a focus on the S&P 500 index over the past 34 years. The results suggest a negative relationship between high volume and returns, with a pronounced effect only observed after the 2008 financial crisis. More interestingly, the effect has diminished after Covid-19 pandemic, reinforcing the complex nature of market interactions in general and the role of volume on trading returns in particular.

KEYWORDS: Trading Volume, Crisis Period, Volatility, Covid-19, S&P 500.

1. INTRODUCTION

The relationship between volume and stock returns has been studied extensively, with various theoretical frameworks proposed to explain the dynamics between these two variables. The first hypothesis suggests that volume is a proxy for information flow in the market, with increased trading volume signaling new information that can drive stock price movements. This idea is grounded in the Efficient Market Hypothesis (EMH), which posits that markets absorb and incorporate new information through price adjustments. Studies such as those by Karpoff (1987) and Chung and Chuwonganant (2012) indicate that higher trading volume is associated with greater information dissemination, which may either lead to price increases or decreases, depending on the nature of the information.

A related hypothesis, the Liquidity Hypothesis, suggests that higher volume may lead to more liquid markets, which in turn reduces transaction costs and allows for more accurate price discovery. In liquid

markets, assets can be traded without causing significant price changes, which can lower the risk of price manipulation and volatility. Hasbrouck (1991) and Chordia, Roll, and Subrahmanyam (2001) find that trading volume has a positive relationship with market liquidity and can reduce price volatility in normal market conditions. They added that Liquidity plummets significantly in down markets. Conversely, the Contrarian Hypothesis posits that volume can be an indicator of herd behaviour, where increased trading volume may coincide with overreaction or bubbles, leading to negative price movements. Chu et al. (2023) provided broad view/critique of high-volume literature in which sometimes market dynamics reflect investor overconfidence or panic, driving stock prices in a direction opposite to the underlying value of the asset or in other words, produces market inefficiencies.

1.1. Volume and Stock Returns in Pre- and Post-Crisis Periods

While the relationship between volume and returns has been well-documented, much of the literature focuses on specific time frames and market conditions. Financial crises, in particular, are seen as moments of market stress that may fundamentally alter this relationship.

In the context of the 2008 financial crisis, research suggests that the dynamics between volume and returns shift significantly. Schwert (2011) argue that financial crises tend to amplify the effects of trading volume on returns, often because of shifts in investor sentiment and the underlying market structure. During periods of heightened uncertainty, as seen in the 2008 crisis, volume can become a less reliable signal for liquidity and more of a symptom of panic or speculative behaviour. Shiller (2000) observed that in the lead-up to financial crises, increased volume often precedes sharp declines in asset prices, reflecting investor fear and uncertainty. Similarly, Brailsford (1996) suggest that the relationship between trading volume and stock returns changes during market downturns, as volume tends to spike due to panic selling and the forced liquidation of assets. Their work implies that after financial crises, volume often shifts from being a predictor of future price movements to being an indicator of market distress. A recent study by O'Hara (2015) on the 2008 crisis further supports this idea, showing that during periods of market stress, high volume negatively impacts returns, as investors react to worsening market conditions by liquidating their holdings in masse. This finding is particularly relevant to the current study, which hypothesizes that high volume affects S&P 500 returns differently before and after the 2008 crisis.

1.2. The 2008 Financial Crisis and Its Impact on the Volume-Return Relationship

The 2008 global financial crisis serves as a significant turning point in understanding how volume interacts with returns. The crisis exposed systemic risks in financial markets and led to widespread market disruptions, making it an ideal setting to examine the volume-return relationship during times of extreme stress.

During the pre-crisis period, research generally indicates that high volume has a neutral or even positive relationship with returns, consistent with the market's informational efficiency and liquidity. However, after the crisis, a shift in market behaviour is often observed. Morck, Shleifer, and Vishny (1990) and Bekaert, Harvey argues that in times of crisis, investors become more risk-averse, and liquidity concerns drive volume up while returns tend to fall, especially in markets like the S&P 500, which is comprised of large-cap stocks sensitive to macroeconomic conditions. Studies examining post-2008 financial crises often find that high volume is associated with negative returns. Schwert (2011) suggests that during the post-crisis period, investors, facing increased uncertainty, may use volume as a measure of market sentiment rather than liquidity, and higher trading volumes are often driven by panic selling rather than informed trading. The negative feedback loop in which high volume leads to lower prices is especially pronounced when systemic risks cause sharp market downturns.

2. DATA AND METHODOLOGY

2.1. Data Collection

To examine the relationship between trading volume and returns on the S&P 500, this study utilizes a comprehensive dataset of daily S&P 500 prices and trading volumes from January 1990 to January 2024, totaling 34 years of data. The data includes daily opening, high, low, and closing prices, as well as the volume of shares traded each day. Data was obtained from Stata Terminal feed which is outsourced from FRED, Yahoo finance and other reliable sources that ensures accuracy and consistency across the sample period.

This period allows us to analyze the volume-return relationship under diverse economic conditions, with a focus on periods of significant market turbulence which are pre-2008, post-2008 crisis, and post-2020 pandemic. The segmentation provides an opportunity to assess how the volume-return relationship may change under different economic conditions, particularly in response to major financial and economic crises.

2.2. Regression Model and Hypothesis

The primary method of analysis is Ordinary Least Squares (OLS) regression. This approach is applied to each sub-period separately to identify any variations in the effect of volume on returns over time. The core hypothesis is that trading volume has a different effect on returns during periods of economic stability compared to periods following financial crises.

The regression model is specified as follows:

$$Return_t = \alpha + \beta high\ volume_t + \epsilon_t \quad (1)$$

Where:

- Return represents the daily return of the S&P 500 index on day t , calculated as the percentage change from the previous day's closing price.
- High Volume is a binary variable equal to 1 if the trading volume on day t is higher than the 90th percentile of trading volumes within each sub-period and 0 otherwise. This threshold is used to capture only the highest-volume trading days. This features a unique aspect of the trading volume, rather than conducting a broad analysis that could be inferior to generalize.
- α is the intercept term, representing the baseline level of returns on non-high-volume days.
- β is the coefficient of interest, indicating the impact of high volume on daily returns.
- ϵ is the error term, capturing unexplained variations in returns.

2.3. Testing Across Different Periods

To capture the varying effects of volume over time, we segmented the data into three distinct periods:

- **Period 1:** Pre-2008 Financial Crisis (1990–2007)
- **Period 2:** Post-2008 Crisis to Pre-2020 (2009–2019)
- **Period 3:** Post-2020 Pandemic (2020–2024)

Each of these periods is analysed separately, with the same regression model applied to each sub-period to capture any temporal differences in the relationship between high volume and returns. Additionally, separate mean difference tests are conducted to examine whether average returns on high-volume days differ significantly between these periods.

2.4. Difference of Means Test

To investigate whether average returns during high-volume days differ significantly across the defined sub-periods, we conduct a two-sample t-test. This test assesses the mean difference in returns on high-volume days between the different periods:

2.5. Robustness Check: Two-Stage Least Squares (2SLS) Regression

To ensure robustness of the OLS regression results and address potential endogeneity concerns (e.g., simultaneity between volume and returns), a two-stage least squares (2SLS) approach is implemented. This approach uses an instrumental variable (IV) that is correlated with trading volume but uncorrelated with the error term in the return equation. Here, we employ **price movement** as an instrument for high volume, assuming that large price movements may lead to high trading activity but do not directly impact daily returns beyond volume's indirect effect.

The 2SLS procedure involves the following stages:

1. **First Stage:** Regress the endogenous variable (high volume) on the instrument (price movement).

$$High\ volume_t = \gamma + \delta\ price\ movement_t + \omega_t \quad (2)$$

Where:

- Price Movement is a measure of absolute price change on day t, capturing large price fluctuations that are expected to trigger higher trading volumes.
 - γ is the intercept term in the first stage.
 - δ is the coefficient of interest, measuring the effect of price movement on high volume.
 - ω_t is the error term in the first stage.
2. **Second Stage:** Use the predicted values of high volume from the first stage as an instrumented variable in the original OLS regression model.

$$Return_t = \alpha + \beta \overline{high\ volume}_t + \epsilon_t \quad (3)$$

Where:

- $\overline{high\ volume}_t$ represents the instrumented variable for high volume, derived from the first stage regression.
- β remains the coefficient of interest, now robust to endogeneity concerns due to the use of the instrument.

3. Empirical Results

By examining the coefficients in the regression models for each period, along with the results of the difference of means tests and robustness checks, we determine whether high trading volume consistently affects returns and whether this effect changes significantly across the different economic conditions.

Table 1: Descriptive Statistics for Returns and High Volume Before and After the 2008 Crisis

Period	Variable	Observations	Mean	Std. Dev.	Min	Max
Before 2008 Crisis	Return	4,705	0.0321	1.0099	-6.8657	5.7327
	High Volume Indicator	4,706	0.0997	0.2996	0	1
After 2008 Crisis	Return	4,075	0.0460	1.2684	-11.9841	11.5800
	High Volume Indicator	4,075	0.2005	0.4004	0	1

Notes: High Volume Indicator is a binary variable where 1 represents trading days with high volume and 0 represents days with lower volume. Returns exhibit higher variability after the 2008 crisis, as indicated by the increase in standard deviation. The average proportion of high-volume days increased significantly after the crisis, rising from 9.97% to 20.05%. This table provides a concise overview of the key metrics for the variables of interest before and after the crisis period.

Mean Returns: The mean return before the crisis (0.0321) is slightly lower than the mean return after the crisis (0.0460). This suggests a modest increase in average daily returns in the post-crisis period, possibly reflecting broader economic recovery and shifts in market behaviour. The change is relatively small, indicating that returns did not undergo drastic directional changes in the long run. **Standard Deviation (Volatility):** The standard deviation of returns increased significantly from 1.0099 before the crisis to 1.2684 after the crisis. This higher volatility is consistent with the aftermath of the financial crisis, which brought greater uncertainty and amplified market reactions to news and events. The wider range of returns post-crisis, with a minimum of -11.98 and a maximum of 11.58, further illustrates the increased variability.

Mean High-Volume Days: The proportion of high-volume days increased substantially from 9.97% (mean: 0.0997) before the crisis to 20.05% (mean: 0.2005) after the crisis. This shift reflects a structural change in market dynamics, likely driven by: Increased participation by institutional investors. Greater market sensitivity to macroeconomic and geopolitical developments. The rise of algorithmic and high-frequency trading post-crisis.

Variability of High-Volume Days: The standard deviation of the high-volume indicator rose from 0.2996 before the crisis to 0.4004 after, indicating greater fluctuations in trading activity. This aligns with increased market uncertainty and potential shifts in investor sentiment. The descriptive statistics reveal a post-crisis market characterized by heightened volatility and increased trading activity. The substantial rise in high-volume days signals greater investor responsiveness to market conditions. This

could also reflect structural changes such as higher liquidity demands. The increase in mean returns, albeit small, suggests a partial recovery in market confidence, though it is accompanied by greater risk.

Table 2: Regression Results on S&P 500 Returns and High Volume across Different Periods

Dependent Variable: Returns	Before 2008 Crisis	Post-2008 Crisis	Post-Crisis (2010– 2020)	Post-COVID- 19
Independent Variables	Coeff. (Std. Err.)	Coeff. (Std. Err.)	Coeff. (Std. Err.)	Coeff. (Std. Err.)
High Volume	-0.029 (0.049)	-0.167*** (0.050)	-0.248*** (0.071)	-0.099 (0.090)
Constant	0.035** (0.016)	0.080*** (0.022)	0.067*** (0.019)	0.090 (0.046)
Model Summary				
Observations	4,705	4,075	2,441	1,186
R-squared	0.0001	0.0028	0.0051	0.0010
Adjusted R-squared	-0.0001	0.0025	0.0047	0.0002
F-statistic (p-value)	0.35 (0.5536)	11.41 (0.0007)	12.40 (0.0004)	1.21 0.2711)

Notes: ***p < 0.01, **p < 0.05, *p < 0.10. Standard errors are reported in parentheses. Data spans 1990–2024, divided into distinct periods to capture structural changes before and after the 2008 financial crisis and the 2020 COVID-19 pandemic.

The results presented in table 2 provide an in-depth view of the relationship between high-volume trading days and S&P 500 returns across four key periods: before the 2008 financial crisis, after the 2008 crisis, post-crisis years leading to the pandemic (2010–2020), and the post-COVID-19 era. These findings capture structural shifts in the market, reflecting changes in investor behaviour and market sentiment during these periods.

Before the 2008 Crisis

The regression results for the period before the 2008 financial crisis reveal that high-volume days have no statistically significant effect on returns. The coefficient for high volume is -0.029 with a p-value of 0.554, indicating no meaningful relationship between trading volume and market returns during

this period. This finding aligns with the efficient market hypothesis (EMH), which suggests that high trading volumes are largely a response to new information and do not systematically impact market returns in an efficient market setting.

Post-2008 Financial Crisis

In stark contrast, the results for the post-2008 crisis period exhibit a significant negative relationship between high trading volume and market returns. The coefficient for high volume is -0.167 ($p < 0.01$), indicating that high-volume days are associated with lower returns in this period. This result is particularly notable as it reflects a shift in the market dynamics after the financial crisis.

The increased significance of high volume as a negative predictor of returns may point to heightened risk aversion and behavioural biases among investors. High-volume trading days in this period could reflect panic selling or overreaction to market news, leading to short-term price declines. Moreover, structural changes in the financial markets, such as the rise of algorithmic trading and shifts in liquidity provisioning, might have amplified the negative impact of high-volume trading on returns.

The analysis of the period between the financial crisis and the COVID-19 pandemic (2010–2020) further supports the significant negative relationship between high-volume days and returns. The coefficient is -0.248 ($p < 0.01$), which is even larger in magnitude compared to the immediate post-crisis period. This suggests that the negative effect of high volume on returns persisted and possibly intensified in the decade following the crisis.

This prolonged effect may be attributed to the lingering effects of the crisis, such as reduced investor confidence and stricter regulations. High-volume trading days during this period likely reflected episodes of heightened uncertainty and volatility, leading to sustained downward pressure on returns.

Post-COVID-19 Era

The results for the post-COVID-19 era, however, show no statistically significant relationship between high volume and market returns. The coefficient is -0.099 , with a p-value of 0.271 , indicating that the relationship observed in earlier periods weakens significantly.

This finding suggests a major shift in market sentiment and trading behaviour after the pandemic. The lack of significance could reflect a normalization of trading activity following the unprecedented volatility during the early days of the pandemic. Additionally, the post-COVID era has been marked by a broader adoption of retail trading and a surge in speculative behaviour, which may dilute the traditional relationship between trading volume and market returns.

The insignificant results in the post-COVID-19 period highlight a key structural shift in market

dynamics. Unlike the periods following the 2008 crisis, where high-volume days were strongly associated with negative returns, the post-pandemic market appears to have adapted to higher trading volumes without significant price repercussions. This could indicate increased market resilience and the influence of new participants, such as retail traders, whose speculative activities may contribute to a decoupling of volume and return dynamics.

Furthermore, the rise of meme stocks, cryptocurrency trading, and social media-driven market movements during this period underscores the evolution of market sentiment. These factors might have introduced noise into traditional volume-return relationships, thereby weakening the statistical significance of high-volume days as a predictor of returns.

The results from the regression analysis reveal significant insights into the changing relationship between high-volume trading days and S&P 500 returns across different market regimes. While the negative impact of high-volume days on returns is prominent in the post-2008 crisis period, this relationship fades in the post-COVID-19 era, indicating a significant shift in market sentiment and trading dynamics. These findings emphasize the importance of considering structural changes and evolving investor behaviour when analysing market patterns over extended time horizons. By segmenting the analysis into pre-crisis, post-crisis, and post-pandemic periods and conducting robustness checks using two-stage regression, we reinforce the credibility of the results. The low R-squared does not negate the broader trends and structural changes identified.

Table 3: Two-Stage Least Squares (2SLS) Regression Analysis

Variable	First Stage: High Volume (DV)	Second Stage: Return (DV)
High Volume		-0.8755*** (0.1034)
Price Movement	0.1277*** (0.0031)	
Constant	-0.0603*** (0.0049)	0.1263*** (0.0161)
Observations	8,782	8,781
R-squared	0.1585	-
F-statistic	1653.49	
Wald chi-squared		71.76
Root MSE	0.2755	1.1579

Notes: *Standard errors are in parentheses. *** indicates statistical significance at the 1% level. First-stage regression validates the use of **price movement** as an instrument for **high volume** (F -statistic > 10). The second stage confirms that **high volume** has a statistically significant and negative effect on returns.*

The results of the two-stage regression analysis strengthen the validity of the findings reported in the primary regression analysis, demonstrating the robustness of the effect of high volume on returns. The use of instrumental variables (IV) regression is critical for addressing potential endogeneity issues, where high volume could be influenced by unobserved factors that simultaneously affect returns, leading to biased estimates.

The first stage of the IV regression models high volume as a dependent variable using price movement as an instrument. The coefficient for price movement (0.1277, significant at the 1% level) indicates a strong, positive association with high volume, confirming the relevance of the instrument. Furthermore, the F -statistic of 1653.49 is well above the rule-of-thumb threshold of 10, ensuring the instrument's strength and appropriateness for the analysis. This validation is crucial, as a weak instrument could render the second-stage results unreliable.

In the second stage, high volume is modelled as an explanatory variable for returns, leveraging the exogenous variation provided by the instrument. The coefficient for high volume (-0.8755, significant at the 1% level) demonstrates a negative and statistically significant effect on returns. This finding aligns with the results from the primary OLS regression in Table 1, particularly for the post-crisis period, reinforcing the conclusion that high trading volumes exert downward pressure on returns in the S&P 500 after 2008.

The two-stage regression results provide robust evidence that the relationship between high volume and returns is not spurious. By addressing endogeneity, the IV approach authenticates the causal interpretation of the observed volume-return relationship. Importantly, the negative effect identified in the second stage validates the OLS findings and highlights the significance of market dynamics post-crisis, where high volume may reflect risk-averse behaviours or market inefficiencies. The absence of such a robust relationship pre-crisis and post-COVID further underscores a shift in market sentiment and trading behaviours during distinct economic regimes.

Table 4: T-Test Results for Mean Returns Based on Trading Volume

Period	Volume Group	Observations	Mean Return	Std. Err.	Std. Dev.	95% Confidence Interval	Difference in Means	t-Statistic	p-Value
Before 2008 Crisis	Low Volume	4,236	0.0350	0.0152	0.9913	[0.0052, 0.0649]	0.0291	0.5924	0.5536
	High Volume	469	0.0059	0.0538	1.1651	[-0.0998, 0.1116]			
After 2008 Crisis	Low Volume	3,258	0.0796	0.0150	0.8570	[0.0501, 0.1090]	0.1674	3.3776	0.0007
	High Volume	817	-0.0878	0.0788	2.2537	[-0.2426, 0.0669]			

Notes: Low Volume represents trading days with lower trading volume. High Volume represents trading days with higher trading volume. The Difference in Means is calculated as the mean return for low-volume days minus the mean return for high-volume days. Statistical significance is evident after the 2008 crisis, where the p-value is less than 0.01, indicating a significant negative impact of high volume on returns.

The results of the t-tests of means provide an important preliminary examination of the relationship between returns and high trading volume, stratified by two distinct periods: before the 2008 crisis and after the 2008 crisis. This analysis helps contextualize the regression findings that follow, establishing whether the mean returns differ significantly based on trading volume in each time period.

T-Test Results before the 2008 Crisis

- Mean Returns for Low-Volume Days: 0.0350, with a standard error of 0.0152.
- Mean Returns for High-Volume Days: 0.0059, with a standard error of 0.0538.
- Difference in Means: 0.0291, which is not statistically significant ($t = 0.5924$, $p = 0.5536$).

Before the 2008 crisis, there is no statistically significant difference in returns between high- and low-volume days. This finding suggests that trading volume did not exert a noticeable influence on returns during this period. This lack of significance aligns with the broader economic context

of relatively stable market conditions pre-crisis, where trading behaviours and market sentiment were less prone to extreme fluctuations.

T-Test Results after the 2008 Crisis

- Mean Returns for Low-Volume Days: 0.0796, with a standard error of 0.0150.
- Mean Returns for High-Volume Days: -0.0878, with a standard error of 0.0788.
- Difference in Means: 0.1674, which is statistically significant ($t = 3.3776$, $p = 0.0007$).

Post-2008, there is a marked and statistically significant difference in returns between high- and low-volume days. Specifically, returns are significantly lower on high-volume days compared to low-volume days. This result underscores the role of heightened trading activity in periods of increased market uncertainty and volatility, consistent with the behavioural hypothesis that high-volume days are associated with risk-averse market participants or overreaction to information.

The negative mean returns on high-volume days suggest that these days are characterized by sell-offs or panic-driven trading rather than informed or balanced trading activity. This observation aligns with the significant results in the OLS and two-stage regression analyses, which indicate that high volume negatively affects returns during the post-crisis era.

Before 2008 Crisis: The insignificant t-test results indicate that trading volume did not have a measurable impact on returns during a period of relative market stability. This aligns with a less reactive or speculative trading environment. After 2008 Crisis: The significant results reflect a shift in market dynamics post-crisis. Increased trading volume, particularly on high-volume days, is correlated with adverse returns, reflecting heightened market sensitivity and possibly the influence of systemic risk factors introduced during and after the financial crisis.

These analyses suggest a profound structural shift in the role of volume in market behaviour before and after the 2008 crisis. The t-test results reinforce the validity of focusing on the post-crisis period in subsequent regression analyses and highlight the importance of market sentiment shifts in understanding the volume-return relationship.

In line with existing literature, we find that high volume negatively affects returns, but this relationship only becomes statistically significant after the 2008 financial crisis. This result suggests that the dynamics of volume and returns are not static, but rather change depending on the broader economic environment and investor sentiment.

We add to the growing body of research that explores the impact of financial crises on market

behaviour. In particular, it highlights that while high volume may indicate information flow and liquidity in stable markets, it becomes a signal of investor fear and overreaction in times of crisis. The post-crisis period is characterized by heightened uncertainty, where investors' increased sensitivity to risk is reflected in negative returns during periods of high volume.

Our results are consistent with the findings of O'Hara (2015) and Schwert (2011), who argue that after crises, high volume is associated with market distress. This suggests that investors' behaviour changes significantly in the aftermath of a crisis, and the information content of volume is altered by changes in sentiment and liquidity conditions.

4. CONCLUSION

The volume-return relationship is a cornerstone of financial market analysis, with trading volume serving as a proxy for information flow, liquidity, and investor sentiment. While the relationship between volume and returns has been well-explored, the dynamics of this relationship shift significantly during periods of market stress, such as the 2008 global financial crisis. We contribute to this literature by demonstrating that high volume is negatively correlated with returns after certain crisis, suggesting a shift from volume as a signal of liquidity and information to volume as a reflection of panic and investor fear. More importantly, we highlight a meaningful shift in the volume-return relationship where the negative effect diminishes after the Covid Pandemic. Despite the persistence of elevated trading volumes, the absence of significant return-volume relationship suggests a transformation in market behaviour. These findings emphasize the evolving nature of market dynamics. They underscore the importance of understanding the context in which volume occurs and how investor behaviour changes during different market phases.

Future research could explore whether similar patterns hold in other crises or in different asset classes, expanding our understanding of how volume interacts with market returns in times of uncertainty.

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