

Relationship between CEO Facial Expressions and Stock Price Volatility Trends

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Abstract. According to recent research, investors determine their effective investment behavior by recognizing the facial emotions of chief executive officers (CEOs). Accordingly, the introduction of executive facial expressions as an influential factor in research in the field of finance is expected to provide investors with more comprehensive information and help them more accurately assess the future development and investment value of companies. Based on this background, this paper proposes a theoretical framework focusing on the relationship between negative emotions expressed by CEOs' facial emotions in roadshows and stock price volatility trends. By integrating the perspectives of different scholars, adopting diverse research methodologies, and collecting and quantifying data on CEOs' facial emotions in roadshow videos, as well as recording the price data of the company's stock in the week before and after the roadshow, this paper constructs an analytical model. The model can analyze and reveal the relationship between facial expressions and stock price volatility trends. Through an in-depth theoretical study of the relationship between CEO facial expressions and stock price volatility trends, this paper aims to provide investors, managers, and researchers with a deeper understanding of the financial markets so that they can better understand and respond to market volatility.

Keywords: CEO facial expressions; Emotions; Stock price; Investment.

1. Introduction

In recent years, with the rapid development of science and technology, the financial market has become increasingly complex, and the demand for investors to study the trend of stock price volatility has become more and more urgent because effective investment behavior maximizes investors' investment interests. In this context, some studies have gradually focused on the top executives of companies, especially whether there is some kind of correlation between the facial expressions of chief executive officers (CEOs) and stock price volatility trends.

Several studies have focused on the nonverbal signals of CEOs' facial expressions. Wong, Ormiston, and Haselhuhn showed that the facial structure of CEOs may be an important form of messaging that has an impact on investors and market participants [1]. This empirical study found that financial performance tended to be superior in firms led by male CEOs with broader faces and was accompanied by more positive firm stock performance [1]. This association may be related to individual leader characteristics, leadership style, or other relevant factors.

Several scholars have analyzed the association between CEO facial expressions and company performance. Jia, Yao, and Zhang's study found that the higher the level of negative emotions reflected in the chairman's facial expressions during Initial Public Offerings (IPO) roadshow speeches, the greater the degree of post-IPO performance deterioration of the company [2]. This kind of negative emotion expression increases the vigilance of investors' investment behavior to a certain extent. Investors improve their screening ability to avoid investment risks, which also predicts the future performance volatility of the company. This has triggered deeper research on how CEO facial expressions reflect potential business risks.

Several studies have focused on the relationship between investor sentiment and the price volatility of individual stocks within an industry. Li and Liu noted that well-known investment organizations

can rely on the reputational effect of their popularity to trigger fluctuations in investor sentiment, which in turn affects the volatility trend of stock prices [3]. This finding triggered an in-depth study of the relationship between investors and stock price volatility.

Facial expression research has been gradually used in the field of finance, and it is easy to find from past literature that facial expression serves as a window of expression, and emotions can be recognized from facial expressions [4]. However, emotional features are difficult to quantify and often require the help of artificial intelligence [5]. The technique can analyze the types of emotions as well as the dynamics of emotions. The visualization of emotions makes their study of an event more intuitive. In addition, emotions expressed from the face are reflexive and emotions act as signals of communication so that the behavior of the communicating parties is influenced by each other's emotions [6]. In particular, the emotions expressed by leaders' facial expressions may influence investor behavior and thus have a profound effect on stock price volatility. The relationship between CEOs' facial expressions and stock price volatility trends is also a thought-provoking topic. As a result, this paper will propose a methodological approach to explore the relationship between CEO's facial expressions and stock price volatility trends from some perspectives.

First, focusing on the role of the CEO as a leader of the firm, his or her facial expressions may reflect attitudes toward the firm's performance, prospects, and future trends. By analyzing the CEO's facial expressions, it may be possible to get a glimpse of his or her internal emotional state related to the company, including confidence, worry, and excitement. The first part of this paper reviews past psychological and managerial research to support the potential role of CEO facial expressions in foretelling the direction of the firm.

Second, this paper explores the correlation between CEO facial expressions and stock price volatility. Investors play a key role in stock price volatility, and CEOs, as representatives of their firms, have facial expressions that may serve as exogenous manifestations that influence investors. By analyzing this correlation, this paper aims to reveal the impact of CEO emotions on the transmission of investor emotions, which in turn affects stock price volatility.

2. Hypothesis

According to research in social psychology, emotions arise from the interaction between individuals, and the speaker's emotions change with the content of their speech [7]. Psychological studies indicate that facial expressions are the primary way that emotions are expressed [8].

Companies will take actions such as beautifying financial statements based on market motivations, etc., so aside from publicly disclosed information, the information conveyed by the emotions of CEOs during interviews plays a significant role in making investment decisions [9].

When an individual's behavior is inconsistent with their self-perception, cognitive dissonance occurs, leading to the manifestation of negative emotions [10]. CEOs have a deep understanding of the company's operational status, and if they provide false information, this deceptive behavior can lead to cognitive dissonance and the generation of negative emotions, which will be reflected in the CEO's facial expressions. Investors tend to link the CEO's emotions in these situations with hidden insider information about the company, interpreting negative emotions as worrisome signals about the company's performance, thereby causing a decrease in investor sentiment [11]. Additionally, there is a significant positive correlation between investor sentiment and individual stock price fluctuations within the industry [3]. Due to the audience's interest in specific topics following an S-curve trend, the impact of interviews on the public is more pronounced in the short term [12]. Based on these observations, the following hypothesis is proposed in this paper:

H1: The higher the level of negative emotions displayed by CEOs during interviews, the greater the likelihood of a downward trend in the company's stock price within one week.

3. Research Design

3.1. Data Sources

Facial Emotion: Collect CEO interview videos of the CEOs of the top 500 companies from 2012 to 2020 on YouTube, Consumer News and Business Channel (CNBC), and other websites with CEO interview as the keyword, and add a video duration of more than five minutes, the facial emotion of the CEO in the interview video is recorded clearly, and the environment of the interview at that time is relatively quiet and no big noise as the screening conditions.

Stock price: Use CNBC, Google Finance, Bloomberg, and other sites to find the top 500 companies and their CEO interview video matching the period of the stock price. The time of the CEO's interview is t_0 , and the time interval is $(t - 120, t + 10)$.

3.2. Research Methodology

Based on the facial expressions of a company's CEO during public speeches or interviews, an automated facial emotion analysis system was used to measure the CEO's intrinsic emotions and produce quantitative data on the CEO's facial emotions during speeches or interviews [13]. This automatic facial emotion recognition system can be trained to recognise the states of three regions of the human face: eyebrows, eyes, and mouth. By recognising different states of facial regions, such as the raising or dropping of eyebrows, the opening and closing of eyes, and the state of mouth corners, the states of different facial regions are combined to correspond to six basic emotion types.

The first five seconds of the CEO video were used as a calibration measure when the CEO was stationary and emotionally stable, ready to be interviewed. The median measure of the six emotions is calculated during these five seconds, and then the CEO is identified as being in one of the six emotions in the remaining frames of the video, and the intensity of this emotion is quantified using the median measure of the emotion obtained previously. The number of times the CEO exhibited each of the six emotions as well as the values were obtained at the end of the video. Afterward, the emotion quantification data was used as an explanatory variable and the abnormal return on the stock of the CEO's company after the speech was used as an explanatory variable to build a regression model to analyse the significance and correlation between the variables.

The quantification of the CEO's facial emotions can effectively transform vague concepts into quantitative values for analysis and identify the six emotions of the CEO in a natural, realistic and objective perspective. It also eliminates the original numerical gap of facial expressions between individuals under the premise of setting a baseline value in the first five seconds.

3.3. Main Variables

Explanatory variable: the value of the CEO's emotions expressed through facial features during the speech.

Explained variable: the difference between the actual return and the normal return of the stock price of the CEO's company at a given time, i.e., the abnormal return.

Control variables:

Price, the initial offering price of the firm's listed shares, which may be related to the size of the firm as well as the impact of the industry environment in which it operates; and

Shares, the number of shares issued by the firm at the date of the interview to reduce the impact of the number of shares issued on the stock price; and

Top10, the percentage of shares held by the top 10 shareholders, reflecting the internal governance structure of the company and the confidence of shareholders in the company's operations; and

Company Years, the logarithm of the number of years the company has been established, which will relate to the company's market position, brand value and other factors affecting the share price;

State-owned, if the company is state-owned, the indicator is equal to 1, the different nature of the company will generate different regulations, market expectations and related policy differences, which in turn affect the stock price.

Firm size is the logarithm of the book value of total assets, which is associated with the firm's market position and level of risk, which in turn affects the stock price.

Liabilities are the logarithm of total liabilities, which is related to the financial stability of the firm and confidence in market operations.

Revenue is the logarithm of total revenue, which takes into account the impact of the company's business position on the stock price [11].

3.4. Data Processing

An automated facial emotion analysis system was used to identify different facial emotions of the CEOs during the interviews, classify the emotions into several categories: happiness, sadness, anger, surprise, disgust, and fear, and use regression modeling to establish the correlation between one or more of these emotions and stock price fluctuations.

$$Price_i = \alpha + \beta_1 Anger + \beta_2 Disgust + \beta_3 Fear + \beta_4 Happiness + \beta_5 Sadness + \beta_6 Surprise + \gamma Controls_i + \varepsilon \quad (1)$$

Where $Price_i$ is the price of stock fluctuations of the firm i , β_j , $j=1\dots,6$ is the explanatory power of the six sentiments, $\gamma Controls_i$ is the set of control variables, and ε is the residual.

Stock prices: take the day of the CEO interview as the event date t , and set the event window to be $(t-2, t+2)$ and the estimation window to be $(t-120, t-10)$. The market model is used to estimate the normal rate of return during the date $(t+3, t+9)$ after the CEO's interview, which is compared to the actual rate of return during the date to obtain the abnormal rate of return, which serves as a measure of the volatility of the stock price in one game.

Market model:

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \varepsilon_{i,t} \quad (2)$$

$R_{i,t}$: The rate of return (Return) of an asset or security i at moment t .

α_i : The Alpha of an asset or security i , which represents its excess return, i.e. the portion that exceeds the expected return of the market portfolio (usually represented by a market index). If $\alpha_i < 0$, the asset or security has performed well relative to the market portfolio; if $\alpha_i > 0$, it has performed poorly.

β_i : Beta of an asset or security i , indicating its systematic risk relative to the market portfolio. If $\beta_i = 1$, the asset or security is volatile in line with the market; if $\beta_i > 1$, it is more volatile than the market; and if $\beta_i < 1$, it is less volatile than the market.

$R_{m,t}$: The return on a market portfolio at moment t is usually represented by a market index (e.g., a stock market index).

$\varepsilon_{i,t}$: The residual term for asset or security i at moment t represents the part that cannot be explained by the model, i.e. unsystematic or idiosyncratic risk.

4. Conclusion

Based on the latest research findings, this study proposes the hypothesis that as leaders of companies, CEOs' emotions reflected by their facial expressions may reflect their attitudes towards the company's performance and prospects. Particularly in public interviews, CEOs' emotional expressions may directly influence investors and subsequently cause short-term fluctuations in stock prices. This highlights the potential impact of executive emotions in the financial market, providing investors with an additional source of information that could significantly affect investment decisions. Using an automatic facial emotion analysis system to analyze CEOs' facial expressions, this study aims to extract their inner emotions. Through regression analysis models, a preliminary relationship between CEO emotions and stock price trends has been established. The main contribution of this study is to provide a complete theoretical framework for future researchers investigating the relationship between CEO facial expressions and stock price fluctuations, as well as offering new

insights for investors in making investment decisions. However, it is important to note that this study did not directly establish the exact relationship between CEO facial emotions and stock price fluctuations but rather presented a feasible method and framework. Future research should further validate this theoretical framework by incorporating more empirical data and delve deeper into exploring the potential impact mechanisms of CEO facial emotions in the financial market.

In future studies, researchers can further subdivide CEO emotions and investigate specific correlations between different emotions such as joy, anger, sorrow, and happiness and stock price fluctuations. Additionally, studying different industries or types of companies can enhance the specificity and practicality of the results. As research progresses, investors can better understand a company's true performance and prospects and anticipate market reactions to the company by analyzing the CEO's facial expressions. This can aid in predicting future stock price trends, reducing information asymmetry, and improving investment returns.

Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

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