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The Impact of Social Media Crisis on Business:

BMW Ice Cream Incident as an Example

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Abstract: On 20 April 2023, BMW was accused of suspected anti-Chinese discrimination at Shanghai international Automobile Industry Exhibition show, mainly because the staff at BMW booth appeared to have deliberately ignored requests from Chinese people to receive free ice-cream. The aim of this paper is to investigate the effect of social media crisis on the business, by taking this BMW ice cream incident as an example. The main research methodology in this article is to use ARIMA model to predict the trend of the BMW share price excluding the effect of this incident based on stock return analysis and then compare it to the real data. The findings from this research provide evidence that predicted stock price are close to the real one, which shows that the possible short-term negative impact of BMW's reputation may appear as a result of this incident, but due to BMW's quality and product status, the negative performance will still not exist for a long-term. The main conclusion drawn from this study is social media scandal may not have lasting impact on business. Different from previous literature, this study contributes on the ARIMA analysis on the certain company's data to derive the relationship between the stock price and the social media crisis. Recommendations include: Improving social media regulation for policy makers; Establishing dedicated teams for dealing with social media information; Changing investment strategy cautiously based on social media messages.

Keywords: social media crisis, stock returns, BMW, ARIMA model

1. Introduction

From 18th to the 27th of April 2023, the 20th Shanghai International Automobile Industry Exhibition Show (hereinafter referred to as "Auto Shanghai 2023") was be held in Shanghai, China. The 2023 edition of this fair is one of the most important and largest exhibitions in the automobile industry, it attracted BWM & Mini and more than 1,000 other exhibitors [1]. The exhibition covers an area of 360,000 square meters, with a total 1,413 vehicles on display in the auto-maker section, while 159 world premieres (including 64 concept cars) are on display [2]. It is a global event that hosted more than 13,000 journalists and in total 906,000 visitors from around the world [2].

However, German auto giant Bayerische Motoren Werke Aktiengesellschaft (BMW) was accused of suspected anti-Chinese discrimination at this exhibition that is supposed to be a great opportunity for auto-makers to promote and showcase their brands and products. The specific reason was the two Chinese staff at the BMW's Mini booth were allegedly suspected of refusing to offer free ice creams

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to a Chinese visitor, but then serving it to a foreigner. After a video documenting the above incident was sent out, it created an uproar on social media in China. At the beginning of the video, it shows two local visitors asking if free ice-cream is still available but get a negative answer [3]. But when a foreigner asked the same just a few seconds later, he was greeted a warm welcome and ice cream [3]. In a subsequent video, it records the video's recorder approaching to booth to ask if the staff could show the ice cream stock but being refused. The potable freezer with the ice cream was then removed. At the end of the video, it is shown that the people getting the free ice cream appear to be foreigners [4].

After the video was released, it gained huge attention as well as discussion on social media in China. It has sparked outrage among many netizens, with many taking to social media to leave messages to boycott BMW. Several hashtags connected to the controversy have received more than 1 billion views in total in Chinese social media Weibo [5]. On 20th April, the official MINI social media account issued a short apology on Weibo for the lack of internal management and stall negligence [6]. However, such a brief apology did not satisfy the netizens. It even provoked a new round of vocal criticism. On the same day, the ice cream supplier Luneurs issued a statement claiming that the brand had only supplied ice cream products to the event, but was not involved in any on-site operations [7]. On 21st April, BWM MINI China apologized again, saying that the 4-5 foreigners in the video were employees of the company and that they received ice cream reserved for employees [8]. But that didn't quell the netizens' anger.

This incident has had an impact on BMW&MINI's reputation and credibility in the Chinese market. A staff at one of the Shanghai MINI 4s shop said that the incident has had a significant impact on daily sales, a lot of customers have called to ask a statement from BMW [9]. BMW's share price also seems to have been negatively affected. On 20th April, the closing price of BMW significantly decreased 3.62% [10]. Furthermore, many competitors have used this as a gimmick to start giving away free ice cream. XiaoPeng motors and Jetour Auto immediately started promoting the unlimited ice cream giveaway at its stand on Weibo [11, 12].

China is one of the largest and most important markets for BMW. According to the BMW Group Annual Report 2022, BMW sold 793,5000 units of vehicles in China, accounting for 33.1% of total sales [13]. China becomes the market with the largest share of sales in 2022. In addition, BMW group revenue in China totals 41,881 million euro in China in 2022, accounting for approximately 29.4% of the total revenue [13]. The Chinese market accounted for around 76.6% of the entire Asian market in terms of revenue, making it the most important consumer market for BMW in Asia [13]. BMW's managers also expressed great interest in the Chinese market. In 18th April, BMW 's chief executive Oliver Zipse highlighted the importance of Chinese customers at Shanghai auto show. "What works in China, works all over the world," he declared. "China is the place to be. BMW is at home in China." [5]

By reviewing the existing literature and analyzing the related data, this paper examines the possible impact of ice-cream incident on BMW's business, which could be short-term or long-term. This research derives a quantitatively method to analyze the social media crisis, which fills the gap that previous literature in this area does not include the ARIMA model forecast about the social media crisis and the stock price. This study can provide some suggestions for policy makers, managers, and investors when the social media crisis of great impact occur.

The rest of this paper is organized as follows: Section 2 is the literature review, which include relevant research on the similar cases and the impact of social media on companies, concluding with a summary of the literature review. Section 3 follows, with providing information about the data source, data stationarity, and model description. After that, the fourth section will conduct an ARIMA model analysis using the relevant data obtained. The results will also discuss in Section 4 which can be used to demonstrate the impact of the ice cream incident on the BMW. Following that, there is a

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discussion in Section 5 on the study's specialty, objective and how to understand and use the findings of this paper in the perspective of government and investors respectively. Finally, Section 6 reiterated the conclusion briefly.

2. Literature Review

2.1. Studies Related to Previous Similar Incidents

BMW is not the first oversea automobile car brand to be accused in this way, as similar incidents have occurred before. In 2017, German automotive brand Audi has placed a suspected sexist advertisement in China. In this ad, a bride is compared to a used car and her future mother-in-law examines its flaws. The mother-in-law tried to check the bride's nose, ears, and other body parts [14]. Then, the ed point out that "an important decision must made carefully", and "Only with and official certification can you rest easy" [14]. All these advertising words are tempting to link the purchase of a used var with the search for a wife. This has generated a great deal of discussion and criticism in China. Audi removed the commercial entirely and apologized for the sexist campaign after it was charged with objectifying women [15]. Audi then apologized for the ed, by one-to-one email rather than public post. Moreover, Audi explained that the ad was produced by a joint venture in China and is completely incompatible with the company's values [14]. Consequently, this incident did not have long-term negative impact on Audi. The Audi annual report 2017 shows that the total sales in 2017 reached 597,886 vehicles in Chinese market, with an increase of 1.1% compared to 2016 [16]. Furthermore, In 2018, Audi's sales in China continued to grow by almost 11% to an unprecedented 663,049 cars [17].

Other companies that have also experienced such incidents is Mercedes-Benz. In 2018, the company had featured a quote from exiled Tibetan spiritual leader Dalai Lama on an Instagram post [18]. This action was quickly slammed by Chinese consumers since Beijing considers Dalai Lama is a dangerous separatist. Mercedes-Benz then promptly issued an apology on Chinese social media platform Weibo and removed the original post [18]. This incident briefly affected Mercedes-Benz's reputation in the Chinese market, but did not have a sustainable negative impact. In 2018, the unit sales of Mercedes-Benz in China increased by almost 10% to 677,700 vehicles compared to 2017 [19]. It continued to grow over the next year, with unit sales increasing by 2% again in 2019 [20].

2.2. The Impact of Social Media on Business

Bhanot pointed out that the social media can greatly influence a firm's reputation, sales, revenue and even survival due to the increasingly usage of social media [21]. The social media phenomenon has experienced some changes over time. Traditionally, Kietzmann et al stated that customers simply use the content on the internet by reading, watching, and purchasing goods and services [22]. Subsequently, the functionality of social software has gradually expanded to allow individuals and communities to share, co-create, discuss, and modify user-generated content through these platforms [22]. As BBC Business Editor Tim Weber said: "These days, one witty tweet, one clever blog post, one devasting video – forwarded to hundreds of friends at the click of a morse – can snowball and kill a product a product or damage a company's share price. [23]" Social media is a strong tool which can help business in many aspects. A article from Dutta Soumitra in Harvard Business Review stated the main three advantages of the usage of social media in business: firstly, it first offer a low-cost, easily accessible platform for you to develop your own brand and communicate who you are both inside and outside of your organization [24]; secondly, it give you the chance to interact quickly and simultaneously with coworkers, clients, and the general public in order to build relationships, show your dedication to a cause, and exhibit your capacity for reflection; thirdly, it can provide you with the chance to gain knowledge through immediate information and unfiltered criticism.

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Admittedly, the increasingly use of social media may also pose unpredictable risks and threats. This is due to the nature of social media. The interactive nature of social media ensures that participants are free to send, receive and process information. In terms of strategic reputation management, this means that content on social media cannot be managed in the same way as traditional media [25]. Aula argued that "social media expands the spectrum of reputation risks and boosts risk dynamics." [26]. An organization's internal communication practices, especially their response to claims made in social media, might have an impact on reputation risk [25]. However, the correct use of social media can help businesses to avoid this risk. The previous studies have proposed some frameworks to help companies use social media properly. For example, Kitzman et al's framework using 7 functional building blocks to define social media [22].

2.3. Review of the Literature

Overall, these previous studies highlight the importance of correctly uses social media. It is not only an influential platform for firms to build brand, communicate inside and outside the organization, reflect own works and gain immediate knowledge, but is also can bring unpredictable risks and lose. Additionally, it is clear that despite the short-lived reputational damage suffered by Audi and Mercedes-Benz, these events have had no long-term impact on the companies' actual sales. Thus, it is still difficult to predict the future impact of reputation risk on businesses. Therefore, this paper aims to go further to address the gaps in the research in this area and use empirical data to demonstrate the impact of the reputation risk created by social media on enterprises quantitively, by taking the BMW ice cream incident as an example.

3. Research Design

3.1. Data Source

This paper use the daily closing stock price of BMW form January 4,2023 to May 12, 2023, from the Choice financial terminal. In fact, the data used in modelling below only includes the period up to 19 April 2023, as this research aims to forecast the original trend of BMW stock price, excluding the effect of the ice cream incident. The remaining data are for comparison purposes only. For specification, BNE stock returns are calculated by dividing the difference between two days' closing stock prices by the one on the prior day. The formula $ln\ (1+x)$ is used to convert the data, and the investigation is continued in the logarithmic scale. In the following analysis, some missing data on specific days are omitted. Stata was the main tool in this research to process and analyze data in the following sections.

3.2. Augmented Dickey-Fuller (ADF) Unit Root Test

In statistic, the unit root test is a common tool to determine whether a given time series is stationary or not. In this analysis, ADF unit root test is used. For a ADF unit test, the null hypothesis is that the data are non-stationary and with unit root. Based on the ADF test processed in Stata, Table 1 shows the p-value for raw data is 0.6340 which is larger than the significance level of 0.05. Thus, there is not efficient evidence to reject the null hypothesis. Computing the differences between consecutive observation is required since differencing can help to eliminate the unit root. After two differencing, the p-value of the processed data is 0 can be found in Table 1. This means there is enough evidence to reject the null hypothesis. Hence, the data after second-order difference is stationary.

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Table 1: ADF test.

Variables	t-statistic	p-value
Raw	-1.939	0.6340
Difference (2nd order)	-28.510	0.0000

3.3. The Autoregressive Integrated Moving Average (ARIMA) Model Specification

The ARIMA model is a efficient and powerful tool in financial time series, especially the short-term prediction [27]. It has been widely used in the economic and financial areas [28]. It always have the better performance than other complex models in short-term prediction [29]. The future value if a variable in the ARIMA model is a linear combination of the past values and the past noise [28], and can be written as:

$$y_t = c + \phi_1 y_{t-1} + \cdots + \phi_p y_{t-p} + \theta_1 \varepsilon_{t-1} + \cdots + \theta_q \varepsilon_{t-q} + \varepsilon_t \quad (1)$$

where y_t is the actual differenced series, ε_t is the random error at t , ϕ_t and θ_q are coefficients, integers p and q are frequently referred to autoregressive, and moving average, respectively.

The ARIMA model combines autoregressive (AR) model, moving average (MA) model [30]. It can be written as ARIMA (p, d, q). p stands for the order of autoregressive model, d represents the time of differencing, q is the order of the moving average model.

4. Empirical Results and Analysis

4.1. Model Order Identification

To determine the order of ARIMA (p, d, p), the study related autocorrelation and partial autocorrelation would be helpful. By examining the Auto-Correlation Factor (ACF) and Partial ACF (PACF), value for p and q are estimated [31]. After second-order differencing, the time series is stationary. Thus, the value of d is 2. By observing and analyzing Figure 1, the first significant spike is at lag 9 in the PACF plot which demonstrating that AR(p) has order 9 and the value of p is 9. Simultaneously, the first significant spike occurred at lag 1in the ACF plot. It stands for the MA(q) has order 1 and the value of q is 1. Hence, the entire ARIMA model can be determined by ARIMA (9,2,1).

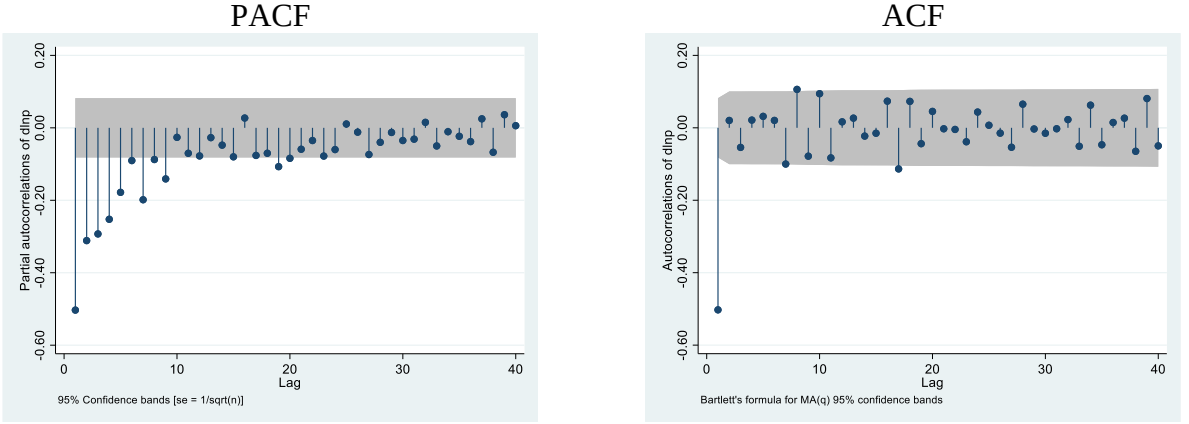

Figure. 1: PACF and ACF.
Photo credit: Original

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4.2. Estimation Results

To test the performance of the obtained ARIMA model, it is necessary to derive a portmanteau test. In this paper, Ljung-Box test was selected. Ljung and Box introduce this test in 1978, it is more accurate than the original test proposed by Box and Pierce in 1970 since the modified statistic can standardizing the residual autocorrelation [32]. The portmanteau test statistic is based on [33]:

$$Q = T(T+2)\sum_{k=1}^{\ell}(T-K)^{-1}\gamma_k^2 \quad (2)$$

where γ_k is the autocorrelation for lag k, T is the number of observations.

The null hypothesis of the Ljung-Box is that the model does not show lack of fit, which means there is no significant autocorrelation in the residuals [33]. From the Table 2, the p-value is 0.9993 which is relatively large.

Table 2: Residual test.

Model	Portmanteau (Q) statistic	Prob > chi2
ARIMA(9,2,1)	17.4775	0.9993

Thus, it is clear that it has no efficient evidence to reject null hypothesis. It represents that the residuals cannot be distinguished from a series of white noise. Hence, the ARIMA (9,2,1) can fit the required data well, so it can be used for the prediction.

4.3. Prediction and Analysis

In this paper, it aims to analyze the impact of the ice-cream incident on BMW. To achieve the goal, it is possible to compare trends of the stock daily closing price that exclude the effect of ice-cream incident with the actual raw trends. The trend exclude the effect of ice-cream incident can be found by using the obtained model above ARIMA (9,2,1). By using the above model, this research forecast the BMW's stock closing price for next 10 days from 20, April, 2023, until 3, May, 2023 and then compare to the real data. Table 3 below show the result of forecast value through Stata:

Table 3: Actual value vs. fitted value.

Date	Actual value	Fitted value	Difference
20/04/2023	100.22	103.77305	-3.55
21/04/2023	100.53	100.43693	0.09
24/04/2023	101.24	100.85926	0.38
25/04/2023	101.38	101.4246	-0.04
26/04/2023	100.80	101.54506	-0.75
27/04/2023	100.78	100.52442	0.26
28/04/2023	101.00	100.98586	0.01
02/05/2023	100.72	101.2779	-0.56
23/05/2023	101.05	100.55887	0.49

Then, combine the two trends together, the results have shown in Figure 2.

From the Figure 2, the red line represents the predicted value through the ARIMA (9,2,1) model, while the blue line stands for the actual BMW stock closing price. Generally, the two trends are similar. They both have a dramatically decrease in 21, April. This means that even without the ice cream incident, the BMW closing price on this day would still have been a significant drop. The

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possible reason is that the German stock market entirely fell on that day. Considering the Germany DAX30 index, it decreased 0.62% at the closing of the business on 20 April [34]. However, the fitted values are still larger than the actual values on 20 April, which means the ice-cream incident still have some negative impact on BMW's stock price. Then, the two line keep the similar trends. They both increase first and then have a slight decrease. Finally, it followed by a minor rise. By observing the difference between the fitted and actual values, it shows that the distinguish between these two value is very minor since almost all differences are lower than 1. Through calculation of the above data, the fitted average closing stock price is about 101.27 for the next 10 days, while the actual one is 100.86. It means the ice-cream incident do have some short-term impact on the closing price of BMW within days of incident, but the impact does not sustainable. Another possible reason is that BMW's prompt apology and handling of the matter did not significantly affect BMW's stock price.

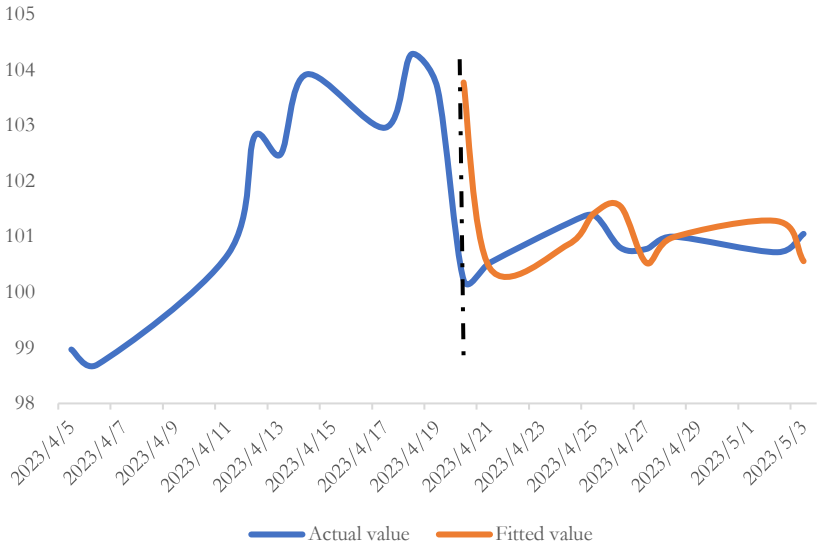

Figure. 2: Actual and fitted value (Photo credit: Original).

5. Discussion

In comparison to previous literatures, this paper focused on how social media impact affect the stock return of BMW quantitively, especially this article discusses the influence through ARIMA model forecasting. The previous articles investigate stock market performance by using entirely qualitative method or using some other quantitively methods such as 5E instructional model, ordinary least squares regression modelling, and VOSviewer [35-37]. Additionally, although some previous papers investigate stock market performance impacted by social media, their conclusions and topics are more related on a whole industry or a country rather than a specific company. For example, for Italian market, fashion industry, chain store industry [36-39]. In this paper, it derives ARIMA model to analyze the impact of social scandals on the specific company. It fills the gaps that few studies have used ARIMA model to predict the likely trend if the event did not occur to estimate the impact of social scandals.

Through this paper, company's managers could pay more attention to information on social media. It may helpful to set up a complete program to deal with social media information, with a dedicated team of professionals. This will help the company to be timelier and more aware what is being said about the company on social media. Although this paper proved that the ice-cream incident has no long-term effect on BMW, it is still exist the negative effect and to a certain extent damage the company's reputation. After such an incident, a prompt apology and a statement to the public is the

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best way to remove the repercussions. Thus, It is very important that the company has a professional social and PR team. Moreover, it is also very important for managers to have an awareness of risk management and a professional risk management team. Using the BMW ice cream incident as an example, a more detailed risk assessment of the event and appropriate adjustments prior to opening the event may have prevented subsequent incidents.

The findings of this paper may lead policy makers think more about the regulation of online social platforms. While it is important to have public discussion and opinion when some social hotspots arise, it is equally important to keep public sentiment on social media contained and generated. In order to avoid uncontrollable situations, it is vital that policy makers develop norms to ensure that the discussion goes in the right direction.

It is important for investors to be sensitive to social media information, but investing based on social media information requires careful consideration and caution. The social scandal has negative impact on company's reputation, while this paper state that there does not exist the long-term influence. Thus, the financial approaches in companies involved in social scandals must be seriously considered, both in terms of investment and disinvestments.

6. Conclusion

The goal of this study is to examine the relationship between social scandals and business. By deriving a quantitively method, this paper chooses to implement ARIMA model process in Stata and predict the possible future data. After transform the data to be stationary, the required model is selected by observing the corresponding ACF and PACF plot. Then, employing a Ljung-Box test to check the model performance is necessary. Finally, this paper obtained the predict values for the next 10 days and deduce the conclusion by comparing the actual and fitted data.

In summary, this paper demonstrates that the impact of the social scandal on the company is only a short-term shock, and there is not exist lasting effect. In the case of the BMW ice-cream focused on this paper, The company's timely approach resulted in the scandal not having a significant impact on the actual financial operation of the company. This article predicts a trend in the company's stock price that is very close to the actual trend, excluding the effect of events. Moreover, the differences between the actual and fitted value are also very small. Hence, it is a good opportunity to or managers, policy makers and investors to reflect on and improve their practices since the social media becomes more and more important in the real life.

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