Research of future uber stocks trend using ARIMA model

Tianyu Geng

School of Mathematics, The University of Edinburgh, Edinburgh, United Kingdom

S2210107@ed.ac.uk

Abstract. The primary focus of this article is on Uber Technologies Inc (Uber) and aims to provide an in-depth forecast of Uber's future stock price. The article introduces Uber company from various dimensions, including Uber's unique business model, leveraging on the sharing economy, enable individuals to use personal vehicles as a means of generating income. This article will be built around the ARIMA model, which is employs this robust model to generate forecasts that offer insights into Uber's stock performance. Before the forecasting process the article will comprehensively describe the data selection process and offer a clear explanation of how the ARIMA model works including the equations. To enhance the effectiveness and reliability of the prediction results, In this article, data visualization is used to present different data representations. The predicted results are presented in the form of graphs and charts, to make a more visual representation of the data and to present and interpret the prediction results effectively.

Keywords: Uber, stock prices, forecasting, ARIMA model.

1. Introduction

Established in 2009, Uber has emerged as one of the most successful companies globally. In addition, Uber Technologies has emerged as a leader in the broad spectrum of the global transportation industry. As a company valued at nearly $100 billion, Uber provides convenient on-demand transportation in more than 900 metropolitan areas around the world and provides travel services to millions of people every day. It can be said that the emergence of Uber opened the era of shared mobility. By introducing the concept of shared mobility, Uber has revolutionized transportation, giving people more choices and providing more convenient services, and this disruptive shared mobility concept has reshaped urban transportation and changed the way that the people travel in cities around the world [1]. In terms of business model, The Uber business model is actually very simple: the company's smartphone application serves as the conduit linking drivers who provided transportation services with passengers in need of rides. Riders paid by the mile through the credit card they tie up in Uber. The company deducted a portion of each fare as a commission and promptly remitted the remaining amount to the driver. This is the uber business model [2]. This the "sharing economy" business model has brought a profound and significantly disruptive transformation in the well-established taxi industry, causing big changes that spread throughout the worldwide taxi industry [3].

In Taiwan, Uber caused a decrease of about 12 percent in the earnings of traditional taxi drivers during its first year of operation, and this reduction grew to 18 percent by the third year of Uber's presence in the market. [4]. In just a few year it has revolutionised the conventional taxi industry. In addition, Uber

has advantages that the traditional cab industry does not have. The emergence of uber has had a considerable impact on the traditional taxi market. For passengers, compared to the traditional cab industry Uber has low prices, shorter waiting time and convenient ride request and payment methods are the main reasons for Uber's popularity among passengers, and drivers find Uber appealing primarily due to the flexibility in their work schedules and the higher compensation rates it offers [5]. And emergence of Uber brings with it more employment opportunities.

The key to Uber's success has been its ability to revolutionize the market for taxi. Uber's disruptive model removes many of the transactional barriers that have historically disrupted the industry, particularly the significant cost associated with searching for a ride. Uber has fundamentally created a more competitive marketplace for taxi services. In addition, Uber is also acting as a catalyst for vertical and horizontal integration in the taxi industry. In many cities around the world, the taxi industry It's highly decentralized, with numerous small businesses operating independently. The emergence of Uber has strengthened co-operation between different companies and consolidated resources. This transformation towards increased cooperation and it will expand the reach and convenience of taxi services, ultimately benefiting both drivers and passengers. This strong integration capability of Uber promotes synergy within the taxi industry, which remains a key factor of continued success [6].

Meanwhile, Uber Technologies Inc. is a prominent player in the global transportation industry, an on-demand mobile transportation service that fits today's business model and market competition, and this kind of service will influence the future market. As a company with a market capitalization of nearly $100 billion, Uber's stock performance has not only attracted a lot of attention, but it has also sparked a lot of speculation and analysis. In this research report, it will look at Uber's financials from multiple angles. and base on the previous research to gives an appropriate prediction.

On Li's Prediction Using Discounted Cash Flow Model to predict the future of Uber stock, is a good method but it requires a large amount of sample size, and the result has the uncertainty [7]. By scrutinizing the data, market dynamics and trends. This article bases our analysis on the veracity of the real financial statements and utilize the power of various predictive models, So, in the article time series model will be a tool to predict Uber's stock trends, based on the analysis model, the technical analysis primarily focuses on trends and historical stock prices rather than taking into account the operational principles of the company. [8]. Therefore, time series model will provide a more fair and accurate forecasts. Also, Laptev and Smyl research using the LTSM model to do the forecasting shows the accuracy of the time series model [9]. Yadav and Saini. introduce some useful time series models [10]. It also provides some inspiration for the predictions in this article. Nevertheless, it's worth noting that there is a scarcity of articles that introduce the ARIMA model for prediction purposes. Therefore, on the article will meanly base on the ARIMA model to forecast the likely movement of the company's stock in the coming days or years.

2. Methods

2.1. Data sources

Before the forecasting finding an authoritative website to get the dataset is crucial. The Yahoo Finance website proved to be an invaluable resource for this study, providing comprehensive data related to Uber. This data covers all aspects of the company, such as financial summaries, historical stock prices that reflect aspects of Uber's performance, and income statements that detail the company's revenues and expenses. The data for this article was obtained from the Yahoo finance website, The data starts from May 10, 2019, when Uber became a listed company until today.

2.2. Indicators selection and description

The dataset employed in this article is from May 10, 2019, to September 25 and consists of six variables, Open price, Close price, High price, Low price, Adjusted Close price, Volume. Among these variables, the Adjusted Close price takes the spotlight in the predictions because the price is between High price and Low price of a day. Therefore, is more suitable to show the stock price of a company One of the

reasons for prioritizing the Adjusted Close price lies in its ability to eliminate price data discontinuities caused by dividends and stock splits. By using adjusted closing prices, these irregularities can be effectively neutralized, resulting in the data set more stable and continuous. This makes historical price data more consistent and suitable for long-term analysis and forecasting.

2.3. Method description

The Box and Jenkins ARIMA model, also known as the Box-Jenkins methodology, was introduced in 1970.This methodology is a structured framework designed for the identifying estimation, and diagnosis of ARIMA models when working with time series data [11]. The model is used in the financial forecasting. In this article, we mainly use ARIMA model which the full name is the Autoregressive Moving Average Models to do the prediction. This model is a popular and widely used time series forecasting model in statistics and econometrics. Basically, ARIMA model contain three parts of component. Autoregressive (AR) Component, Moving Average (MA) Component and Integrated Models for Nonstationary Data Component:

And the equation below represents the forthcoming value of a variable is represented as a linear combination of prior values and previous errors in ARIMA model:

$$Y_t = \varphi_0 + \varphi_1 Y_{t-1} + \varphi_2 Y_{t-2} + \ldots + \varphi_p Y_{t-p} + \varepsilon_t - \theta_1 \varepsilon_{t-1} - \theta_2 \varepsilon_{t-2} - \ldots - \theta_q \varepsilon_{t-q} \quad (1)$$

Where: Y_t is the actual value at time t. ε_t represents the random error or noise at time t. φ_i are the autoregressive coefficients. θ_j are the moving average coefficients. 'p' is the order of the autoregressive component. 'q' is the order of the moving average component.

Nevertheless, depending on the specific dataset, the parameters can vary. The process of constructing an ARIMA predictive model involves three key stages: diagnostic verification, parameter estimation and model identification [12].

3. Results and discussion

The Figure 1 showed the stock price of Uber form 10 May 2019 to 24 September 2023.And for the price is the adjust close price. Despite not being on the market for very long, the stock price has fluctuated quite significantly from when it first went public, because of the Covid-19 epidemic, it is clear that the price of uber stock price is not moving well, the price of the stock also showed a volatile trend. After the covid -19 The stock's price trends showed a recovery, at the end of 2021 the price rising dramatically to the peak at 56. However, after reach the peaking the price of the stock showed a precipitous fall, dropping as low as a rock-bottom $20. then at the recent there is sign of a rebound to 46. It's showing signs of warming up.
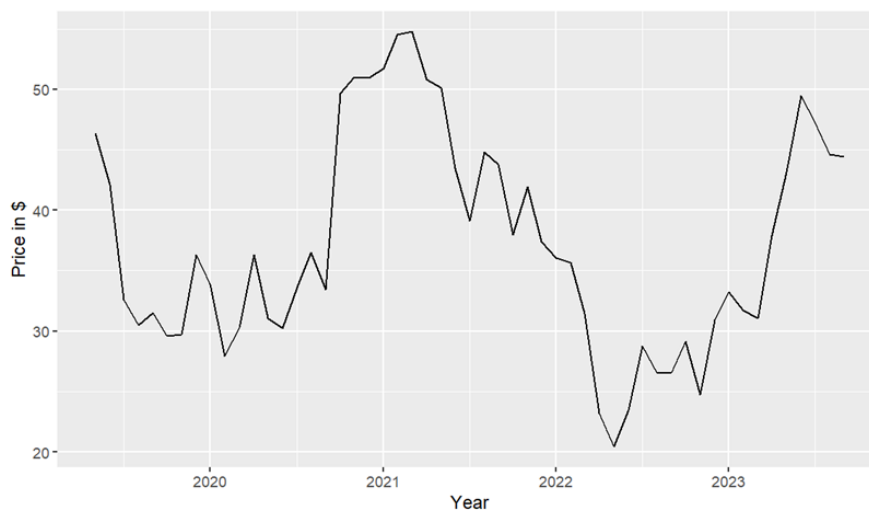

Figure 1. Uber stock prices.

However, before applying forecasting models like ARIMA models to predict Uber's stock price, it's essential to examine the Autocorrelation Function (ACF) graph (Figure 2). The ACF graph allow to assess the presence of autocorrelation within the time series data, which in turn helps to determine the appropriateness of using ARIMA models for forecasting. And it also can judge whether is a white noise, A white noise time series comprises a sequence of random variables that are independent and identically distributed, if it not the white noise that's mean the past data of Uber stock price will influence the future Uber stocks price then it can use ARIMA model to do the prediction. Base on the ACF graph it is clear that the ACF graph shows that the line is out of the blue dashed line, and that's indicates the Uber stock price is not white noise, it implies that past stock prices do influence future prices. This suggests that ARIMA models may be better suited for prediction.

Figure 2. ACF graph of Uber stock price.

Figure 3 shows the prediction of Uber stock price by using the ARIMA model. ARIMA model gives the forecasts of the Uber stock price in the future until 2024, It can be seen from the Figure 3, the blue region represents the forecasted Uber stock prices, shedding light on the expected movements in the market. According to the graph before the forecasting, in short time the Uber Stock prices have reached a high in the short term. And base on result of the ARIMA model stock prices will not show a continued increase trend, Instead, the forecast shows that in future there is a slightly decreasing trend can be seen until 2024.

Figure 3. ARIMA model forecasts of Uber stock price.

To enhance the credibility and robustness of the findings, it presents the forecast for the first and second differences data in Figures 4 and 5. The reason using differenced data is imperative for data analysis since it can make the data stationary, and making it better suited for time series analysis. The results indicate a minor decline in Uber's stock prices. The charts' blue area shows a consistent decrease in Uber's stock prices until 2024.

After carefully analyzing the outcomes demonstrated in the three ARIMA models, The results of three ARIMA models' outcomes suggest future downward trends for Uber's stock prices. it can be seen that the Uber's stock value will probably decline in the foreseeable future. While this forecast may contradict the assumption of economic recovery that after the Covid and continual growth in tech orientated companies, but it emphasizes the significance of Importance of usage of forecasting models and decision making based on the data. And Company needs modify accordingly to ever-changing market trends.
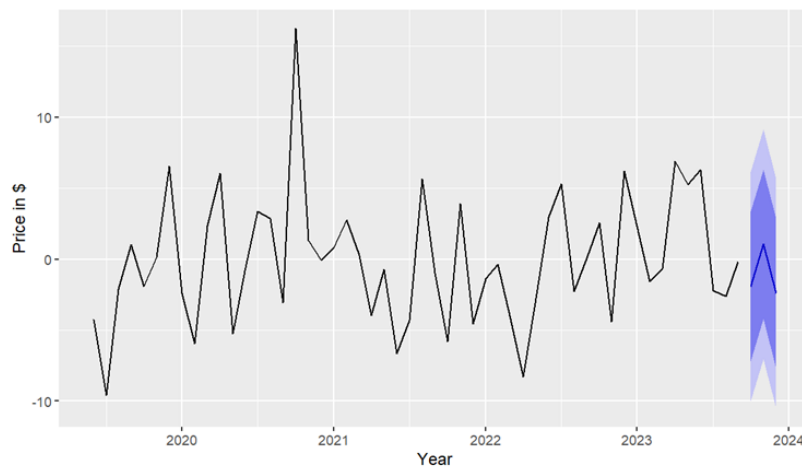

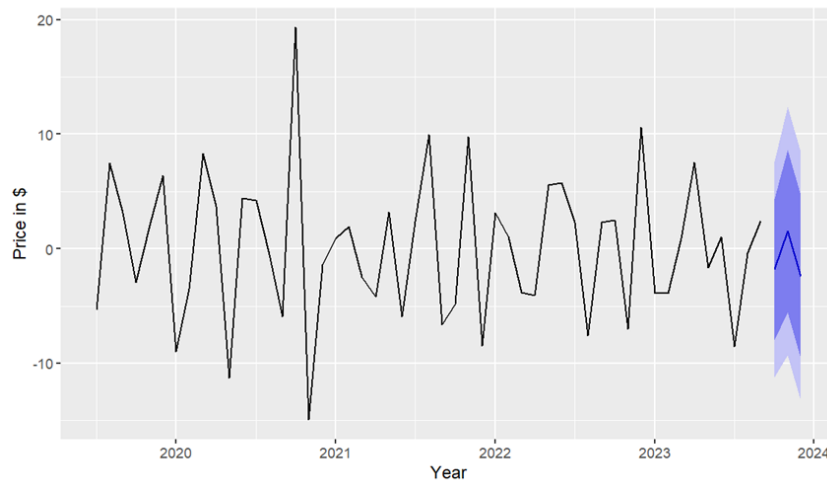**Figure 4 .**ARIMA model forecasts of Uber stock price (first difference).

Figure 5. ARIMA model forecasts of Uber stock price (second difference).

4. Conclusion

This article is primarily exploring the future movement of Uber's stock price. And by using the Adjusted Close price and historical stock prices to employ a robust forecasting model, the ARIMA model,

predicting potential market trends. All the output of the ARIMA models indicate a downward trend in the stock prices until 2024.

This article provides a prediction of the potential future movements of Uber's stock price based on available data and advanced forecasting models. However, stock market is a complex endeavor, a complex ecosystem influenced by a multitude of variables. And market trends, financial performance, economic conditions are all the vital factors that need to be consider. While this article provides the potential direction of Uber's stock price, but the stock market is inherently unpredictable, and past performance of the stock's price is not always indicative of future results because there are many factors are not predictable. Therefore, this article only provides a possible prediction of future Uber stock price movements based on available data.

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