

# The Different Impact of Covid-19 Pandemic on Catering and Pharmaceutical Industry in China: Evidence from Time Series Model

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**Abstract.** Covid-19 pandemic is a huge setback for the global economy. This essay investigates the distinct impacts of the COVID-19 pandemic on China's catering and pharmaceutical industries using time series models. It highlights how the pandemic differently influenced these sectors, with the catering industry experiencing a significant downturn and the pharmaceutical industry showing a surge in demand for medical products and services. The paper employs indices to represent industry situations, analyzes stock prices' volatility, and predicts closing prices without the pandemic's impact. The study utilizes the ARIMA model for forecasting and empirical analysis, revealing how the pandemic accelerated trends in these industries and its varying effects on them. This research offers insights into industry-specific impacts of global crises and provides valuable perspectives for policymakers, investors, and researchers in understanding economic effects during health emergencies. The results indicated that the covid-19 pandemic had a negative impact on catering industry and the stock price was much lower than expected. While it had a relatively positive effects on pharmaceutical industry since the huge demand of medicine and other related supplies.

## 1 Introduction

The COVID-19 pandemic, emerging in late 2019, rapidly evolved into a global crisis, profoundly affecting economies and industries worldwide. At the same time, China's industries are facing many challenges during this period. Before the pandemic, China's catering industry had developed rapidly, in contrast, the healthcare industry has been in a more stable way. Based on information from the National Statistics Bureau of China, the catering industry experienced a consistent compound annual growth rate of 10.67% over the past decade. In the last five years, its annual output value represented about 4.7% of the national GDP. Specifically, in 2019, the industry's revenue hit 5.89 trillion RMB, marking a 17.7% increase from the prior year. This growth rate surpassed the national GDP growth rate by roughly 11% [1]. In 2019, the size of China's pharmaceutical market was US\$149.8 billion, with expectations to grow at a CAGR of more than 12% between 2019 and 2029. Before the COVID-19 pandemic, China's pharmaceutical industry was undergoing significant growth and development. As the world's second-largest pharmaceutical market, China was a strategic priority for many global players in the industry. The Chinese pharmaceutical industry was characterized by a healthy pace of growth, with market growth remaining in mid-single figures over the years leading up to 2020 [2].

The impact from covid-19 pandemic is global. Utilizing the Global Trade Analysis Project (GTAP) CGE model, Park et al. from the Asian Development Bank conducted an analysis of the worldwide economic impacts of COVID-19 as of May 2020. Their approach factored in variations in trading costs, productivity shocks, and fiscal stimulus measures to estimate the pandemic's economic consequences under scenarios of both short- and long-term containment. According to their findings, global GDP could potentially fluctuate between a decrease of 6.4% and 9.7%. Specifically, Asia (excluding China) might see GDP reductions ranging from 4.6% to 7.2%, while China's GDP could decline by 7.5% to 11.2% [3]. The pandemic has greatly impacted traditionally robust sectors such as petroleum, finance, real estate, and accommodation and catering. These industries have experienced significant challenges due to the pandemic, leading to a diminished role in the overall economic network [4].

The arrival of the pandemic brings both accelerated and pause button to these two industries. Statistics reveal that the catering industry was the second most impacted sector during the COVID-19 pandemic. The industry experienced a severe downturn, particularly evident during traditional peak periods like New Year's Eve dinners, which saw a dramatic decline in subscriptions due to the outbreak. The restrictions on dining out and general movement significantly affected restaurants, leading to substantial financial losses. During the first

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six months of 2020, China experienced a significant 32.8% year-on-year drop in its national catering revenue, a decline that was 42.2 percentage points steeper than the decrease recorded in the same period of the previous year. For larger establishments, revenues fell by 30.2% year-on-year. Overall, 2020 catering revenues were down by 16.6% from the previous year. The industry faced mounting pressures from unsold food stock, high operating costs, and dwindling profits, pushing it into a severe survival crisis [5]. However, the pandemic significantly increased public demand for medical products and services. There was a surge in the need for antiviral and antibacterial medications, traditional Chinese medicines, and protective gear like masks, disinfectants, ventilators, and oxygen generators. Alibaba International Station reported substantial increases in supplying medical protective equipment. The demand for such items in March showed a growth rate three times higher than the previous year, with a 300% increase in Europe. Additionally, the pandemic boosted the demand for online medical consultations, pharmaceutical delivery, and retail services [6]. In order to delve deeper into the impact on these two industries, we use index to represent the industry situation. Indexes serve as measures of risk and reward that change over time, providing a standard for evaluating performance, understanding its drivers, and making improvements. Following the introduction of the Capital Asset Pricing Model (CAPM), indexes have become instrumental in creating passive investment vehicles and in forming the foundation for portfolio management. [7]. This paper highlights the significance of the catering and pharmaceutical sectors in China, noting their differing states of development and market dynamics prior to the pandemic, focus on the trend of two indices and construct an appropriate model to make the comparison.

## 2 Research design

### 2.1 Data acquisition

This paper uses cn.Investing.com to search and obtain indices data for the catering and pharmaceutical industries, in detail, SZHCI can be used to represent the fluctuation for catering and SZHCSI for pharmaceutical industry [8]. This study focuses on the daily opening and closing prices and weekly opening and closing prices and stock returns that calculated by dividing the difference between closing prices during the Covid-19 period (from 2019/1/1 to 2020/1/24). The data are used to analysis the volatility of stock prices in both sectors and make a prediction of the closing prices without the impact of Covid-19 based on the previous data. In order to make a clearer model, we use  $\ln \frac{f(x)}{f_0(x)}(1+x)$  to edit the data and construct the model by STATA. It can show the difference of two industries by comparing their performances through the model.

### 2.2 ADF unit root test

The ADF test, commonly employed to assess stationarity in time series data, operates under the null hypothesis that the time series possesses a unit root, which suggests non-stationarity. In this study, the first step is to input the data includes indices for both the catering and pharmaceutical industries with values for daily and weekly timeframes into STATA to perform ADF test. Then it can get t-value and p-value for  $\ln()$  indices. As indicated in Table 1, the p-value for the 1st and 2nd log-returns is 0, which falls below the threshold of 0.1. This outcome is enable to dismiss the null hypothesis, indicating that the model is both stable and feasible. It suggests that the model may be well-suited for the data being analyzed.

**Table 1** Weak stationarity test

Variables	t	p
Catering, daily		
Ln index	-2.196	0.4923
1st order difference	-11.118	0.0000
2nd order difference	-20.397	0.0000
Catering, weekly		
Ln index	-2.203	0.4880
1st order difference	-3.826	0.0153
2nd order difference	-7.307	0.0000
Pharmaceutical, daily		
Ln index	-2.806	0.1946
1st order difference	-12.675	0.0000
2nd order difference	-20.933	0.0000
Pharmaceutical, weekly		
Ln index	-2.372	0.3945
1st order difference	-3.913	0.0116
2nd order difference	-7.228	0.0000

### 2.3 ARIMA Model

ARIMA, an acronym for Autoregressive Integrated Moving Average, is a model used in statistical analysis to forecast data in time series. It combines three key components: autoregression (AR), differencing (I), and moving average (MA). The AR part involves using past values to predict future values, the I part involves differencing the series to make it stationary, and the MA part uses past forecast errors in the prediction equation. This model is particularly effective for analyzing and forecasting time series data where the data points are sequentially dependent. They are particularly useful for short-term forecasting and have applications in various areas, including stock market analysis, economic forecasting, and sales prediction. ARIMA(p,d,q) can be expressed as follow:

$$\left(1 - \sum_{i=1}^p \phi_i - L^i\right) (1 - L)^d X_t = \left(1 + \sum_{i=1}^q \theta_i L^i\right) \epsilon_t \quad (1)$$

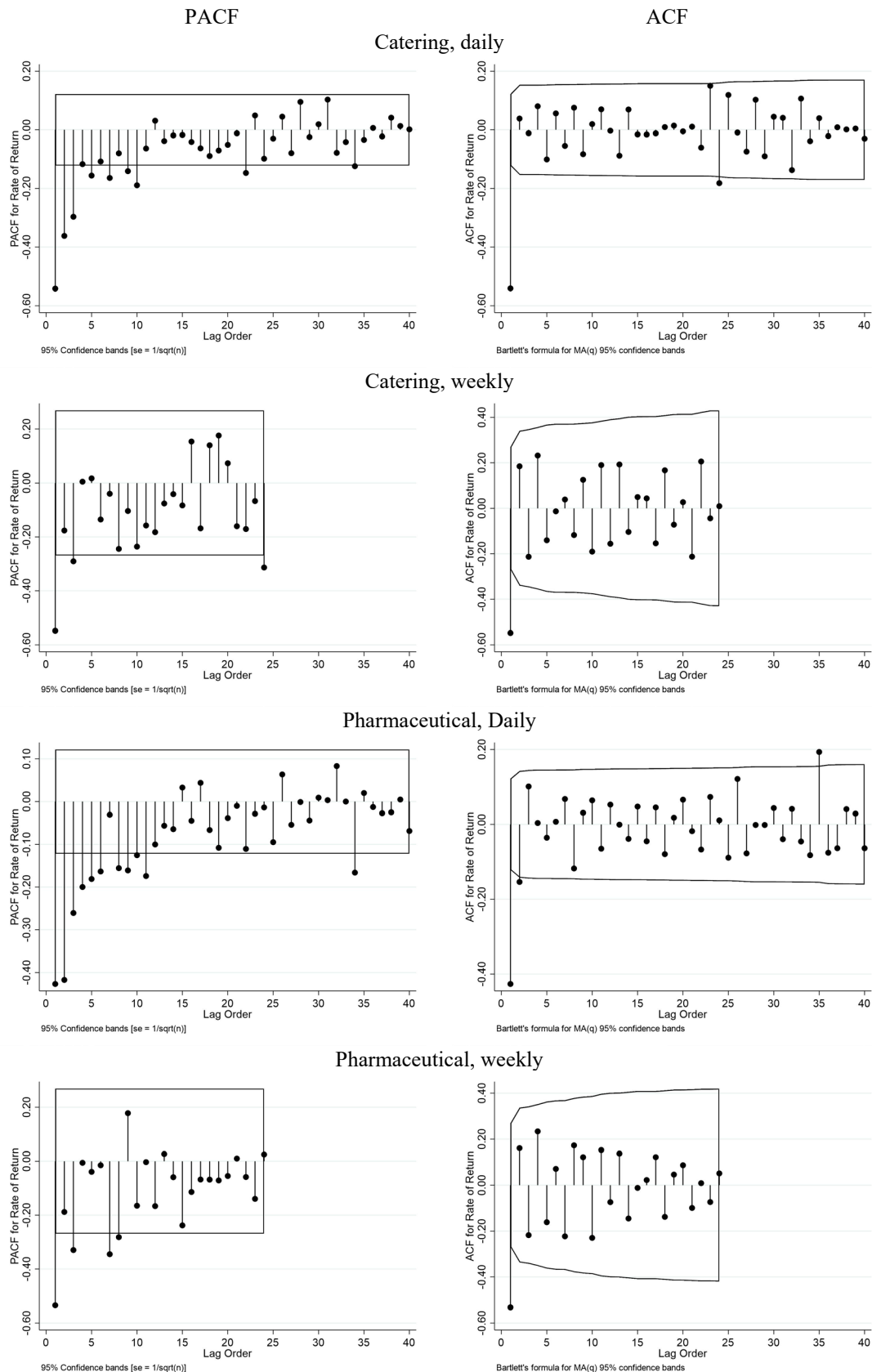
In this formula, 'p' represents the order of the Autoregressive (AR) component as determined by the Partial Autocorrelation Function (PACF) model, 'q' denotes the order of the Moving Average (MA) component as identified by the Autocorrelation Function (ACF) model, and 'd' signifies the degree of differencing.

## 3 Empirical results and analysis

### 3.1 Order of ARIMA model

AR(p) and MA(q). At first use the 1st order difference to print the graphics of PACF and ACF and find the order

To find out the order of the stock return in logarithm, PACF and ACF models can derive the lag orders for is too high. Then it can apply 2nd order difference to the model and the results are as follows.



**Fig. 1.** ARMA (p, q) identification

Photo credit: Original

In the first row in Figure 1, it shows that lag order of AR(p) is 10 and MA(q) is 1 which is the first part beyond the critical value. In the second row, it shows the lag order of AR(p) is 3 and MA(q) is 1. In the third row, it shows the lag order of AR(p) is 9 and MA(q) is 2. In the last row, it shows the lag order of AR(p) is 7 and MA(q) is 1.

Then the residual test can check if the residuals (differences between observed and predicted values) behave like white noise, meaning they are randomly distributed and have no autocorrelation.

**Table 2** Residual test

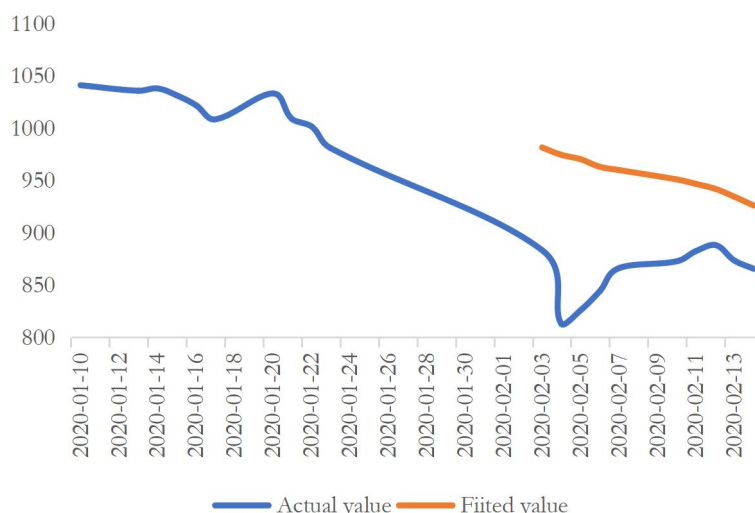
Model	Portmanteau (Q) statistic	Prob > chi2
Catering, daily-ARIMA(10,2,1)	27.0491	0.9413

Catering, weekly-ARIMA(3,2,1)	22.5731	0.5451
Pharmaceutical, daily-ARIMA(9,2,2)	24.8738	0.9707
Pharmaceutical, weekly-ARIMA(7,2,1)	17.4123	0.8306

From Table 2, the residuals show no patterns or correlations, it typically indicates that the model has adequately captured the underlying structure of the time series data, suggesting that the model has successfully accounted for the systematic information in the data.

### 3.2 Prediction and interpretation of results

The ARIMA model then can predict the data based on the indices closing prices from 2019/1/1 to 2020/1/24 as fitted value and compare the fitted value with the actual data.

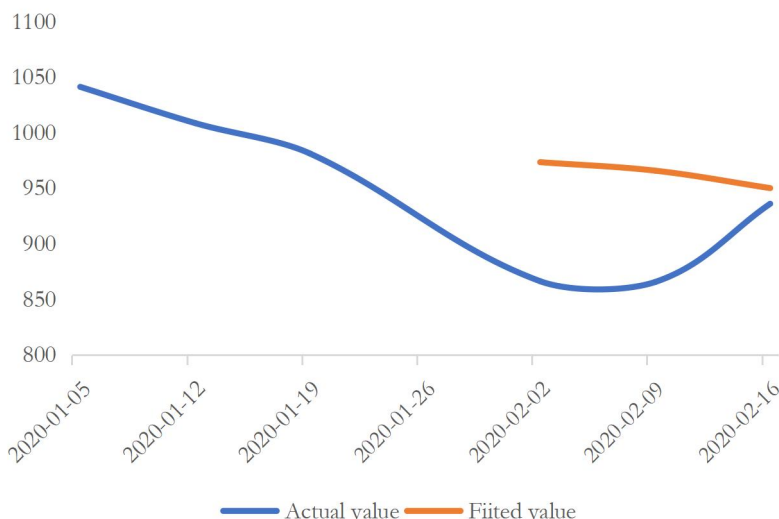


**Fig. 2.** Actual value and fitted value, Catering-daily

Photo credit: Original

From Figure 2 and Figure 3, the catering index in China initially reflected these challenges. Stock prices of companies in the catering industry faced a sharp decline as investors reacted to the sudden and substantial revenue losses experienced by businesses in the sector. There is a sharp decline between 2020-1-22 and 2022-1-23, that the price was from 1001.91 to 981.11 and the price was continue to decrease to the bottom 812.89 on 2020-2-5. The Evergrande research institute has reported that the epidemic led to a significant impact on the catering industry. Specifically, the retail sales in this sector experienced a loss of approximately 500 billion yuan during just seven days of the Spring Festival. The pandemic's effect on the industry was profound, with 93% of catering businesses opting to shut down their stores. Among these, 73% closed all their outlets, 8% shut down over 80% of their locations, and 7% closed

less than half of their stores [9]. The changes on weekly closing stock prices gives a clearer demonstration of this decline. This decline in share prices contributed to a negative trend in the catering index. As the actual stock prices of catering experienced a significant and rapid drop and it displayed heightened volatility during the early stages of the pandemic. While the fitted line shows a relatively steady decline, this may have been influenced by the closing of the stock market during the Spring Festival of China. The pandemic led to widespread lockdowns and social distancing measures, which significantly impacted businesses that rely on customer physical presence, like the catering industry. This resulted in fluctuations in the catering index, reflecting reduced consumer spending and operational challenges for restaurants and related services.

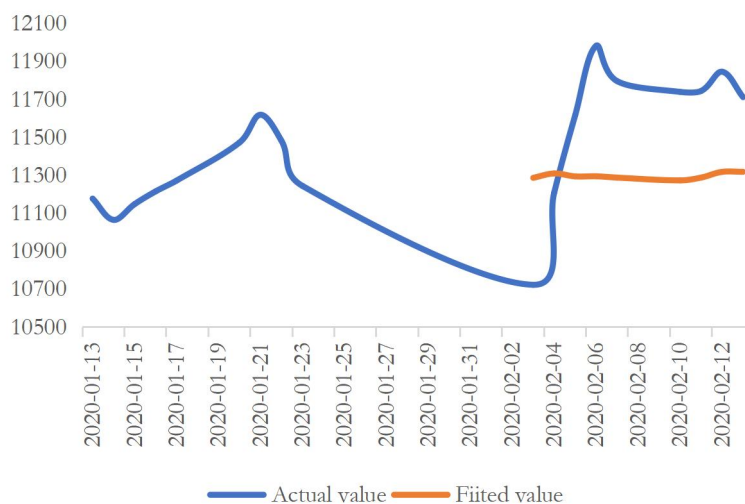


**Fig. 3.** Actual value and fitted value, Catering-weekly

Photo credit: Original

From Figure 4 and Figure 5, it shows that COVID-19 positively impacted the pharmaceutical index in China.

The actual value is much higher than the fitted value as they should act without the impact of pandemic.

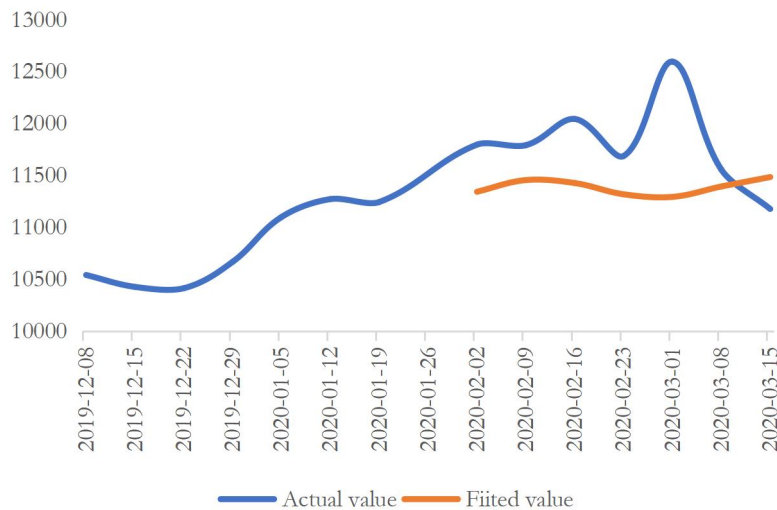


**Fig. 4.** Actual value and fitted value, Pharmaceutical -daily

Photo credit: Original

The prices of pharmaceutical index decreased first from 11,481. It may be because of the reduced Trading volume and the Chinese New Year period often comes with a pause in corporate and governmental economic activities, which might affect market expectations about economic growth and corporate earnings, thereby impacting stock prices. While from 2020-2-4, the beginning of the pandemic, there has been a significant increase, well above the pre-New Year's prices. The pandemic led to increased demand for medical products and services, including pharmaceuticals, personal protective equipment, and healthcare supplies. This surge in demand was reflected in a rise in the

pharmaceutical index, indicating growth and resilience in this sector during the pandemic, in contrast to many other industries that faced downturns. The pharmaceutical industry's performance highlights its critical role and increased consumer reliance during health crises. It indicates that the investment attitude toward the pharmaceutical industry in China during the COVID-19 pandemic has been generally positive and has seen significant growth since when an outbreak of an infectious disease is declared, investing in medical companies can be an effective strategy to mitigate risks [10].



**Fig. 5.** Actual value and fitted value, Pharmaceutical -weekly  
 Photo credit: Original

## 4 Conclusion

This paper's findings show unique insights into the impact of COVID-19 on the catering and pharmaceutical industries. Unlike existing literatures, which broadly focuses on the overall economic impact of the pandemic, this study provides a nuanced comparison between two distinct sectors. The implications for research are significant, offering a detailed case study for understanding industry-specific impacts of global crises. Policymakers can leverage these findings to tailor responses and support mechanisms for different sectors. Investors, on the other hand, can use this analysis to make informed decisions, recognizing the varying resilience and vulnerabilities within different market segments. This paper thus contributes valuable perspectives to the existing body of knowledge on the economic effects of the pandemic.

The aim of this study is to investigate the different impacts of the coronavirus pandemic period on the restaurant and pharmaceutical industries in terms of utilization, stock returns and stock volatility through ARIMA models. This study draws its conclusions after conducting an empirical investigation. The paper demonstrates that the catering and pharmaceutical industries have very different impacts during the epidemic period. Compared to the pre-epidemic period, the catering industry was extremely impacted and volatile, while the pharmaceutical industry showed a growing trend. This is due to the fact that policies during the epidemic limited the growth of the restaurant industry, while the demand for healthcare services boosted the healthcare industry. With the end of the epidemic, the industry will eventually weaken and return to normal with the general trend of the stock market.

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