



Portfolio Management During Epidemics: The Case of SARS in China

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Abstract

This paper assessed the impact of Severe Acute Respiratory Syndrome (SARS) on China's stock market. Our results indicated that the Chinese stock market reacted rapidly to the SARS epidemic. We provide strong empirical evidence that the epidemic had an immediate impact on the pharmaceutical and tourism industries. Pharmaceutical companies particularly benefited from the outbreak of SARS, while the tourism sector was adversely affected. Our results imply the existence of a profitable trading rule during an epidemic.

JEL Classifications: G14

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1. Introduction

Severe Acute Respiratory Syndrome (SARS) is a highly contagious atypical pneumonia caused by a new corona virus. It has claimed many lives and caused panic worldwide.² The outbreak of SARS in April 2003 directly disrupted China's economic growth.³ The GDP growth rate dropped sharply from 9.9% in the first quarter, to 6.7% in the second quarter of 2003. The Chinese stock market was also seriously hit by SARS. From April 15 to April 30, the Shanghai stock market index

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² As of July 31, 2003, there are 8098 reported cases with 774 fatalities, of which 349 cases are from China.

³ Studies on SARS include Siu and Wong (2004), Nippani and Washer (2004) and Hai *et al.* (2004).

dropped by 6.75%. The purpose of this article is to assess the impact of SARS on the Chinese stock market. Instead of looking at the market index, we examine the share prices of firms that were highly sensitive to the epidemic. We focus primarily on the pharmaceutical industry⁴, and the tourism industry. The pharmaceutical industry is of particular interest because it is one of few industries that can benefit directly from an epidemic. In contrast, tourism was one of the most severely debilitated industries of the SARS epidemic. Due to the cancellation of the “Golden Week” holidays, the number of tourist arrivals in Beijing plummeted by nearly 60% in April, when compared to the previous year. In May, the number of civilian passengers plunged by 78%. Domestic tourism was virtually at a standstill. The number of international visitors to China also dropped by more than 70% in June.⁵ Hai *et al* (2004) estimated that China's tourism revenue from foreigners fell by over 50 percent (amounting to about US\$10 billion), compared to 2002. The revenue from domestic tourists was reduced by approximately 10 percent (amounting to about US\$6.0 billion). The total loss to the tourism industry was estimated at around US\$16.8 billion.

Academic contributions on the impact of adverse shocks on stock markets abound. For example, Nippani and Washer (2004) examined the impact of SARS on the stock markets of eight SARS affected economies: Canada, China, Hong Kong, Indonesia, Philippines, Singapore, Thailand and Vietnam. They found that SARS had no adverse impact on any of the affected economies, except for China and Vietnam. Moreover, Chong (2005) and Arin *et al.* (2008) studied the effects of terrorism on stock market returns. In our paper, an event study was conducted to assess the impact of SARS on the Chinese stock market. Our results indicated that the stocks from the pharmaceutical and tourism industries reacted steadily with developments of the SARS epidemic. The event study methodology has become the standard method of measuring security price reaction to certain events, or announcements. A pioneering work in this area is Dolley (1933), who examined the price effects of stock splits. Ball and Brown (1968) and Fama *et al.* (1969) introduced the methodology that is still in use today. For a review of the literature, one is referred to Armitage (1995) and MacKinlay (1997) and Binder (1998). Recent studies using the event study methodology to evaluate the impact of adverse shocks on stock market include Chen *et al.* (2007) on SARS, and Chen *et al.* (2010) on the subprime crisis.

⁴ The pharmaceutical industry of China grows rapidly. In 2007, the sales of the pharmaceutical industry in China reached RMB 599.1 billion, up 24.6% over 2006. The export value reached US\$63.7 billion, 20.5% higher than the previous year.

⁵ By the end of June, about 70% of domestic airline capacity has been restored, but the seat occupancy averages less than 50%.

2. Data and Methodology

2.1 Data

Five representatives of the A-share stocks were selected from both the pharmaceutical industry and tourism industry. The stock price data was obtained from the website of Yahoo Finance. For the pharmaceutical industry, we selected the following five companies:

TIANTAN BIOLOGICAL (600161): Beijing Tiantan Biological Products Co., Ltd.;
SHANGHAI PHARMACEUTICAL (600849): Shanghai Pharmaceutical Co., Ltd.;
TIANYAO STOCK (600488): Tianjin Tianyao Pharmaceutical Co., Ltd.;
TONGRENTANG (600085): Beijing Tongrentang Co., Ltd.;
HAYAO GROUP (600664): Harbin Pharmaceutical Group Co., Ltd..

For the tourism industry, we examine the following five leading companies:

CHINA YOUNG TOURS (600138): China CYTS Tours Holding Co., Ltd.;
HUANGSHAN TOURISM (600054): Huangshan Tourism Development Co., Ltd.;
JINJIANG STOCK (600754): Shanghai Jinjiang International Hotels Development Co., Ltd.;
EASTERN AIRLINES (600115): China Eastern Airlines Co., Ltd.⁶;
XIAMEN AIRPORT (600897): Xiamen International Airport Co., Ltd..

2.2 The Abnormal Returns

SARS made media headlines in late February 2003. The disease was first detected as a mysterious flu affecting the Guangdong province in November 2002. The first public alert was issued on February 26, 2003, when Hong Kong reported the first case of a flu-type virus. On March 12, 2003, the WHO issued a global alert for SARS. The month following on April 20, 2003, Chinese authorities officially announced the outbreak of SARS.⁷ The World Health Organization faintly divulged that the world population was approaching a SARS-free stage on June 27, 2003. Thus, we define our event window as the period 40 days prior to April 21 until 40 days after April 21 (excluding weekends and public holidays), i.e., the period from February 24 to June 25 of 2003. This 4-month window is long enough to provide sufficient data for analysis, but short enough to exclude market shocks other than SARS. To measure the impact of SARS on stock returns, we calculate the abnormal return during the event window. The abnormal nominal return is the difference between actual stock return and a benchmark return,

$$r_{jt} = R_{jt} - \hat{R}_{jt}, \quad (1)$$

where \hat{R}_{jt} is the benchmark return obtained from three different methods.

⁶ Loh (2006) examines the impact of SARS on the stock prices of airline companies.

⁷ Since it is a Sunday, we define April 21 as the announcement day.

Firstly, we define a pre-SARS period from April 19, 2002 to February 21, 2003, i.e., 200 trading days before the event window, and estimate the average daily return for each firm in this period. The benchmark return for firm j is its mean daily return for the pre-SARS window, i.e.,

$$\hat{R}_{jt} = \bar{R}_j = \sum_{t=-240}^{-41} R_{jt} / 200. \quad (2)$$

The resulting abnormal return is referred to as the mean-adjusted return. The second benchmark return is obtained by the following market model regression:

$$\hat{R}_{jt} = \alpha_j + \beta_j R_{mt} + \varepsilon_{jt}, \quad (3)$$

where R_{mt} is the return on the Shanghai A-share market for day t . β_j measures the sensitivity of firm j , and α_j measures the mean return over the period not explained by the market. The regression produces the estimates $\hat{\alpha}_j$ and $\hat{\beta}_j$. The predicted daily return for a firm in the event period is the daily return given by the market model. The estimation results for the mean adjust return model and the market model regressions are reported in Table 1.

Finally, we also use the market return as a benchmark, i.e.,

$$\hat{R}_{jt} = R_{mt}. \quad (4)$$

This case corresponds to the case where $\hat{\alpha}_j = 0$ and $\hat{\beta}_j = 1$ for all firms. The resulting abnormal return is the market-adjusted return.

Table 1
Estimated parameters for the two industries

	Mean Adjusted Return	Market Model	
Pharmaceutical industry	\bar{R}_j	α	β
Tiantan Biological	-0.00096	-0.00055	1.06197
Shanghai Pharmaceutical	-0.00029	0.00005	0.85422
Tianyao Pharmaceutical	-0.00117	-0.00080	0.94072
Tongrentang	-0.00033	0.00009	0.62776
Harbin Pharmaceutical	-0.00190	0.00223	0.86123
Tourism industry			
China Young Tours	-0.00100	-0.00062	0.97497
Huangshan Tourism	-0.00090	-0.00049	1.03292
Jinjiang Stock	-0.00062	-0.00013	1.25304
Eastern Airlines	0.00041	0.00088	1.19794
Xiamen Airport	-0.00011	0.00035	1.15498

3. The Cumulative Average Abnormal Return

The average abnormal returns across the selected stocks for each event day t is given by

$$AAR_t = \frac{\sum_j r_{jt}}{N}, \quad (5)$$

where N is the number of firms in the sample. The sum of the daily average abnormal returns gives the cumulative average abnormal return (CAAR), which represents the average total effect of the event across all firms. Figures 1 and 2 present the movement of the CAAR for the pharmaceutical industry and tourism industry, respectively, during the event period.

From Figure 1, we note that the CAARs of the market model and the market-adjusted return model are similar. For the mean-adjusted return model, the CAAR is different from that of the other two models. We also note that before the announcement of the outbreak of SARS, the CAAR was rising. The booming sales of medicine are instantaneously reflected in the share prices of these firms. From Figure 1, we can see that SARS had a significant positive effect, which persists for around 35 trading days.

Figure 1
The CAAR of the pharmaceutical industry

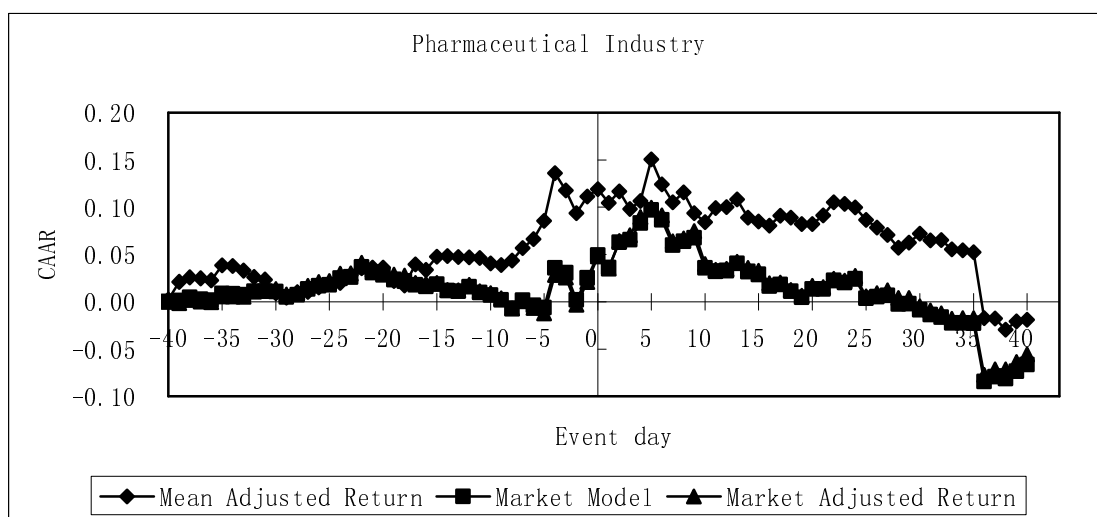
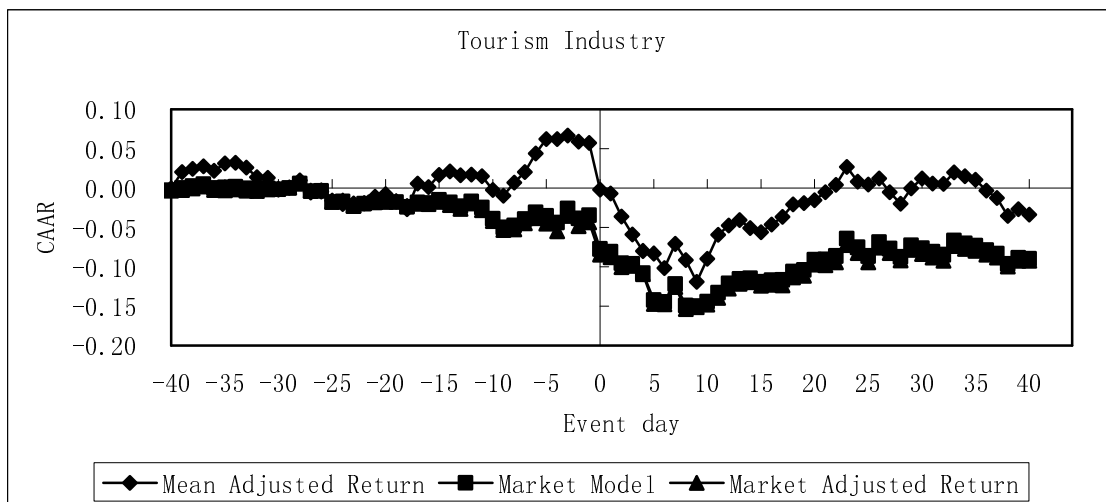


Figure 2 shows that, about ten days before the SARS announcement, the CAAR of the tourism industry increased slightly. People left Beijing and Guangzhou, the two most severely plagued cities, for a safer place. As shown in the figure, in the first two weeks of the announcement, the CAAR of the tourism industry dropped substantially.

Figure 2
The CAAR of the tourism industry



The CAAR for the entire event window is given by:

$$CAAR = \sum_{t=-40}^{40} AAR_t .$$

To test whether the estimated CAARs are significant, we conducted a t-test for

$$H_0 : CAAR = 0 \text{ vs. } H_1 : CAAR \neq 0$$

to see if the estimated cumulative average abnormal return is significantly different from zero. The CAAR over the event window and the corresponding t-ratio (in parentheses) are reported in Table 2.

Table 2: The estimate of CAAR and the t-ratio

	Pharmaceutical industry	Tourism industry
Mean Adjusted Return	-0.01964 (-1.27)	-0.03374 (-2.21)
Market Model	-0.06634 (-4.26)	-0.08961 (-8.45)
Market Adjusted Return	-0.05547 (-5.29)	-0.00229 (-8.71)

For the pharmaceutical industry, the null hypothesis was rejected at the 1% level for the market model and the market-adjusted return model. However, we could not reject the hypothesis that the cumulative average abnormal return from the mean-adjusted method was equal to zero. Seven weeks after the announcement, SARS was largely contained, and

the cumulative average abnormal returns plunged sharply. Therefore, the boom in the pharmaceutical industry was purely attributed to the SARS event. For the tourism industry, the CAARs were significantly negative at the 1% level for the market model and the market-adjusted return model. The CAAR for the mean-adjusted return model was also significantly negative at the 5% level.

4. Conclusion

This study examined how the outbreak of the SARS epidemic affected stock prices in the pharmaceutical and tourism industries in China. It was found that the CAAR of pharmaceutical firms was trending up before the SARS announcement date. The CAAR of the leading firms, based on the mean adjusted return, remained positive 7 weeks after the announcement. Therefore, we conclude that the pharmaceutical sector was positively affected by SARS. In contrast to Dombey (2003), we show that SARS had a negative impact on the tourism sector. After the announcement of the outbreak, the CAAR for the tourism sector dropped dramatically. The CAAR remains negative for a long period of time after the day of announcement. In light of our findings a profitable trading strategy for investors in epidemic times is to long pharmaceutical stocks, and, short tourism stocks in their portfolios.

References:

- Arin, K. P., D. Ciferri, and N. Spagnolo, 2008. The Price of Terror: The Effects of Terrorism on Stock Market Returns and Volatility. *Economics Letters* 101(3), 164-167.
- Armitag, S., 1995. Event Study Methods and Evidence on their Performance. *Journal of Economic Surveys* 9, 25-52.
- Ball, R. and P. Brown, 1968. An Empirical Evaluation of Accounting Income Numbers. *Journal of Accounting Research* 6, 159-178.
- Ball, C. and W. N. Torous, 1998. Investing Security Price Performance in the Presence of Event Date Uncertainty. *Journal of Financial Economics* 22, 123-153.
- Binder, J. J., 1998. The Event Study Methodology Since 1969. *Review of Quantitative Finance and Accounting* 11, 111-137.
- Chen, Y. C., H. H. Kang and T. C. Yang, 2007. A Study on the Impact of SARS on the Forecast of Visitor Arrivals to China. *Journal of Asia-Pacific Business* 8, 31-50.

- Chen, M. H., S. C. Jang and W. G. Kim, 2007. The Impact of the SARS Outbreak on Taiwanese Hotel Stock Performance: An Event-Study Approach. *International Journal of Hospitality Management* 26, 200-212.
- Chen, J., C. Huang, M. L. Wang and J. C. Cheng, 2010. Information Effects During the U. S. Subprime Crisis: Evidence from the Asia-Pacific Region *Emerging Markets Finance and Trade* 46, 75-86.
- Chong, T. T. L., 2005. Has the 911 Incident Induced any Structural Change in the U.S. Stock Market? *Labuan Bulletin of International Business and Finance* 3 1-10.
- Dolley, J., 1933. Characteristics and Procedure of Common Stock Split-Ups. *Harvard Business Review* 11, 316-326.
- Dombey D., 2003. The Effects of SARS on the Chinese Tourism Industry. *Journal of Vacation Marketing* 10, 4-10.
- Fama, E. F., L. Fisher, M. Jensen and R. Roll, 1969. The Adjustment of Stock Prices to New Information. *International Economic Review* 10, 1-21.
- Hai, W., Z. Zhao, J. Wang and Z. G. Hou, 2004. The Short-Term Impact of SARS on the Chinese Economy. *Asian Economic Papers* 3, 57-61.
- Jia, N. and L. Tsui, 2005. Epidemic Modelling Using SARS as a Case Study. *North American Actuarial Journal* 9, 28-42.
- Loh, E., 2006. The Impact of SARS on the Performance and Risk Profile of Airline Stocks. *International Journal of Transport Economics* 33, 401-422.
- MacKinlay, A. C., 1997. Event Studies in Economics and Finance. *Journal of Economic Literature* 35, 13-39.
- Nippani, S. and K. M. Washer, 2004. SARS: A Non-event for affected Countries' Stock Markets? *Applied Financial Economics* 14, 1105-1110.
- Siu, A. and R. Y. C. Wong, 2004. Economic Impact of SARS: The Case of Hong Kong. *Asian Economic Papers*, 3(1), 62-83.