Heterogeneity of epidemic impact on stock market volatility

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Abstract: In early 2020, a coronavirus virus called COVID-19 suddenly broke out. The rapid spread of the virus has affected people all over the world, including but not limited to people's lives and economic growth. In the wake of COVID-19, many companies have been affected and hit to varying degrees, with their production speed and product quality being affected. This article examines the impact of COVID-19 on businesses. Below are some data on the impact of COVID-19 on corporate earnings, the impact of COVID-19 on corporate decision-making, and recovery strategies after COVID-19. At the same time, this article also demonstrates the impact of the epidemic on stock volatility by enumerating model data and innovative ways to change the method of measuring enterprise value.

1. Introduction

In February 2020, the covid-19 first appeared in China, and with international trade and globalization it soon spread to the world. There are nearly 200 countries and regions invaded by the virus, and a great number of international companies stop normal production and go bankrupt. Although covid-19 has been gradually controlled nowadays, its impact on the world economy would last for a long time. Currently, the main threat faced by international firms is the health risk when conducting manufacturing since people are required to gather in a sealed room, and an unbalanced capital flow among different companies due to the broke of supply chain. In order to reduce the losses and provide as a reference for companies in other countries suffering from covid-19 losses, we believe that it is very important to determine the value changes companies before and after the epidemic. What’s more, , in order to form a more diversified corporate strategy and recovery strategy, we need to take the responses of various companies towards the epidemic as a consideration; distinguish companies based on their main business and form of ownership, try to find more direct data for analysis.

We thus choose the company's stock price change as our research object. The company’s daily operation and its change in value will be quickly reflected in the company’s stocks price. Therefore, analyzing the company’s stocks can help us better understand the impact of their strategies during a particular period. In addition, since the stock market of most companies is unique and highly centralized, stocks there are of similar political environment and can be compared with each other in a larger scale, in order words, this can help to reduce the uncertain impact of national policies on corporate value. We find data mainly from world famous electronical financial platforms such as Eastern Fortune and Yahoo Finance. We also look for some real-life examples from The Economist and the Financial Times. During our research, we first compare the stock exchange rate, amplitude, and trading volume; take the stocks that look similar to each other in these three variables but in different ownership as main objects. We then calculate the price change of each stock. After all data are clearly collected, we established a multiple linear regression model, with 2 variables and take February 14, 2020, as the start point where the epidemic plays a role (there was a clear sudden price decline in the stock market at this day, and at other times such change is not so neat and uniform), finally we conduct a rigorous mathematical analysis.

After repeated screening and comparing of our data, we found that covid-19 will increase the stock volatility of domestic companies by an average of 13.5%, and the huge losses caused are mainly divided into two aspects, loss to state-owned enterprises and loss to private enterprises. State-owned enterprises were less affected by covid-19. It maintained average levels of stock amplitude and turnover rate before and after 2.14. The stock of state-owned enterprises also shows a greater ability of recovery than private enterprises. After about a week of hitting by the epidemic, the corporate value of most state-owned enterprises has risen slightly. We can see how local people are confident to state-owned enterprises and the effectiveness of national regulation from this information. Compared with the financial crises in 2008 and 1997, covid-19 does not have an irreversible influence on the overall value of the enterprise, as predicted before the study. Instead, it reduces people's enthusiasm for working. However, private companies have been greatly affected by covid-19; most private companies experienced a significant share price declines (approximately 4%) a week before the outbreak of virus. Moreover, we find a suppression item in final our calculation formula; it shows -0.124 lower vibration amplitude of state-owned companies. The fluctuation in the stock value of state-owned enterprises is affected by this suppression item, which is relatively lower than that of private enterprises. We speculate that this suppression item is a definite value generated because of a combination of factors, such as the international environment and national macro-control. In other words, the ownership of state-owned enterprises benefits from government's action in this amount.

In the following parts, we will first discuss our literature review, which combines the analysis for the impact of covid-19 by different experts and groups. They focus on some special areas, and we will show you the homogeneity between their research and ours. After that, we will conduct a quantitative analysis, classify and analyze the information that has already been mentioned mathematically, and you will see the statistical tools we use and the whole analysis process. Finally, we will summarize these data information and try to give some relevant suggestions and advice.

2. Literature Review

Currently there are many articles studying the impact of the covid-19 on the economic development of Chinese enterprises. The existing research mainly focuses on three aspects. First, we concentrate on how to maximize the value of enterprises during the epidemic [1]. Second, the impact of covid-19 on government decision-making [2] and how it related to companies' development. Third, we focus on the Recovery Strategy [3]. Those articles are all of good references and help people to have a clear understanding of the relationship between covid-19 and Chinese companies.

First, the literature is on how to maximize firm value during epidemic. It is said that covid-19 has a negative impact on most industries, and in order to survive in this changing market, companies need to take their social responsibility and conduct production that based on unit performance. Chen Shouming and Wang Jie [1] states that during the epidemic, the cumulative excess return rate of Chinese energy companies dropped significantly by 2.7% to 10.6%. Also, Liu Gaoqi [4] pointed out that the great limitations in the offline education industry leads to its great loss during covid-19. Basically covid-19 had interrupted the production plans for most industries. So, in order to earn profits while keeping on normal production, all companies need to establish a rational evaluation system and encourage inner competition, thus create their unique comparative advantages.

Second, the impact caused by covid-19 on government decision-making process. It is believed that the epidemic has changed the decision for many local governments, and these decisions had a huge impact on business operations. As Li Yang and Weng Shihong mentioned in their research [5], in response to the administrative problems caused by covid-19, Chinese local governments eliminated their dependence on unilateral knowledge base and encourage multiple parties to engage in decision making. Same transformations were found in research conducted by Zhou Ying and his other team members [6]. They found that in order to adapt to changing government policies and the international environment, companies are looking for more diversified choices in supply chain and trying to reduce the risks caused by unilateral supplier. From their research, we conclude that the government's decision-making during the epidemic greatly improve the rationality of the companies' decision-making process, and how company well adapt to government polices determines their firm value.

Third, the recovery strategy after covid-19 also receives widely concern. Relative research pays more attention to sustainable development theory and how small and medium-sized enterprises get recovered in recent months. Xiang Feng in his analysis [7] takes Wuhan as an example and shows how covid-19 destroys the local tourism. He states that future development strategies such as establishing a new brand prestige and improving urban safety guarantees can slowly but effectively recover the local economy. On the other hand, Du Libo[8] also states that the recovery of small and medium-sized enterprises can be achieved through a time-costing diversified production. So based on their research, it is impossible to turn back the impact caused by covid-19 in a short time. The most important thing is to ensure a stable recovering pattern for companies. Therefore, people must have a deep understanding of the sustainable development and how other advance companies in the world adapt to covid-19.

Although there are great amounts of current research for the impact of covid-19 on firms' value, our research made something new, we improved the methods of how to measure the value of companies and make a clear classification of different enterprises. First of all, we subdivide companies into private companies and state-owned companies; we also differentiate them based on the industries they registered in Security Market. This is because different companies are different influenced by covid-19 due to their production scales. Second, we are not limited for data analysis of a single company; instead, we integrate data information as a whole. The usage of big data helps to find the impact and correlation between companies. This method reduces the contingency of research. Third, we chose stocks as an indicator to measure the company's value, which can more intuitively reflect the varieties in firm value and how companies' interests for investment change. And since the stock as an asset is closely related to daily life investment, our research can be better applied to real life.

3. Quantitative Analysis

In order to describe the impact of the epidemic on the rise and fall of stocks, this paper establishes a simple ordinary least square regression. Two dimensions are defined in the model, one is time dimension and the other is individual dimension. From the perspective of time dimension, the time point of the most serious epidemic situation is taken as the policy time point, and the variable is defined as COVID. The value of covid is 0 before the impact of the epidemic, and the value of 1 after the impact of the epidemic. From the individual dimension, enterprises are divided into private enterprises and state-owned enterprises, and the variable is defined as STATE. A state value of 1 indicates that the enterprise is a state-owned enterprise, and a value of 0 indicates that the enterprise is a private enterprise. The variable adjustment is defined as the fluctuation of the stock market, which is measured by the rise and fall of the stock price.

$$fluctuation_{it} = c_{it} + \alpha \times covid_t + \beta \times state_i + \varepsilon_{it} \tag{1}$$

In order to regress the model (1), this paper uses the stock data of 40 enterprises, including 20 private enterprises and 20 state-owned enterprises. The data comes from east-money website. The results obtained by regression are shown in the following table:

Table I: Main regression results.

VARIABLES	fluctuation
STATE	0.0853 (-0.0611)
COVID	0.135** (-0.0559)
COVID_STATE	-0.0754 (-0.0796)
Constant	-0.124*** (-0.0423)
Observations R-squared	280 0.029

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

According to the regression results, it is not difficult to see that the impact of the epidemic will significantly increase the stock volatility, resulting in an increase of about 0.135 percentage points. Compared with private enterprises, state-owned enterprises are more resistant to risks. From the coefficient of interaction term, state-owned enterprises will relatively inhibit the fluctuation of stock market. Although it is not statistically significant, it is significant in economic sense. This is relatively consistent with the fact that the stock price of state-owned enterprises is more stable than that of private enterprises, and the response will be relatively mild in the face of the impact of the epidemic.

Too big to fail can be used to explain that state-owned enterprises are more resistant to risks. State owned enterprises always play an indispensable role in the development of countries. And it relative the perspectives of strategic national interests. They are linked to the country's important strategic resources and are the most basic guarantee of national security. The whole industry chain will be based on those enterprises. If those enterprises fluctuate, the citizens living stander will decline. When those enterprises fail will destroy the economy system. Then state-owned enterprises are perceived protection from government to prevent economy disaster. The power of capital also be the essential factor, which means state owned enterprises will get fund and support from government. State institutions are expected to be shielded from negative impacts. Also, when the virus strikes, the output of private enterprises is affected and difficult to be consumed as usual. Otherwise, most output of state-owned enterprises will be consumer by the government sector. To a large extend, state-owned enterprises do not need to worry about this situation. Next, the private enterprise will face the shortage of money. Funding will be harder to receive at epidemic period.

4. Conclusion

This article includes research and data on the impact of covid-19 on the stock market, some enterprises' decision changes and related research on re, and data and recovery strategies after covid-19. Most companies have been negatively affected by the covid-19 pandemic, and the government's new policies have also affected some companies' operations and revenues. Post-epidemic recovery strategies have also become the focus of discussion. Through data analysis and observation of model data, it is not difficult to conclude that covid-19 has had a huge impact on most enterprises. Private firms will suffer from capital shortages, but state-owned firms will be shielded from the negative effects because of the support of the government. In this case, there are two ways to mitigate the negative impact of covid-19: 1. Companies can reduce taxes and fees to alleviate the pressure. 2: The government can provide appropriate financial support (such as loans). In both ways, the shortage of capital in the private sector can be alleviated to some extent.

The spread of covid-19 is most serious than most of the virus before. In addition, stricter prevention and control measures have been taken across the country. In the short term, production and demand will suffer a great impact. Consumption, investment and import and export will all face negative impacts to varying degrees. The negative impact of the epidemic on enterprises can be clearly seen from the data listed in the article. In terms of consumption, total consumption will fall off a cliff when the epidemic is severe. First, due to home quarantine, traffic control and other factors, tourism, catering and accommodation, transportation, education and training service consumption was greatly impacted; especially films, large-scale entertainment activities, wedding and other gathering consumption activities were basically cancelled. On the investment side, short-term investment will be dampened, while the impact of the pandemic on long-term investment depends largely on expectations. First, the construction of real estate and infrastructure will basically come to a standstill. Meanwhile, as the supply of investment goods is difficult to guarantee, enterprises' investment activities such as equipment purchase, and renewal and inventory investment will also be affected. Second, in the context of declining production and demand, some enterprises, especially micro, small and medium-sized enterprises, will face problems such as cash flow exhaustion and capital withdrawal difficulties. The increase in financing demand will raise financing costs and inhibit investment. Third, if the epidemic causes negative expectations for future growth, the expected return on investment will decrease, and enterprises will adjust their investment plans and actively reduce investment. In terms of import and export, the impact of the epidemic on foreign trade mainly depends on whether production can be started on time and foreign trade orders can be completed on time. But in general, when the epidemic is effectively controlled, the impact of the epidemic on foreign trade is mainly in the short term. As a result, the flow of factors of production has been blocked, normal production activities of enterprises have been restricted to varying degrees, and the overall growth rate of the industry has been hit to some extent. In addition, from the perspective of micro enterprises, small, medium and micro enterprises may be more affected. During the suspension of production due to the epidemic, the proportion of operating costs such as rent, wages and interest will increase, and earnings will be difficult to predict. Some small, medium and micro enterprises with small size and weak risk resistance will face bankruptcy. Risks may also be transmitted along the supply chain and guarantee chain, causing a local crisis. While the outbreak has brought negative impact to some traditional industries, it has also brought new opportunities to relevant industries, especially the Internet industry. With the gradual easing of the epidemic, new development opportunities will unleash new drivers to transform and upgrade the economy and move toward high-quality development. Under the impact of the epidemic, the following suggestions can be used to ease the pressure brought by the epidemic: First, actively promote tax and fee cuts. Enterprises, especially small and micro businesses, will be exempted from taxes to varying degrees. For enterprises that are heavily affected by the epidemic, they will be allowed to apply for an extension of tax declaration during the epidemic period to 3-6 months after the epidemic is over, so as to ease production and business difficulties. After the epidemic is over, we should fully implement the policy of combining inclusive tax cuts with structural tax cuts, with the focus on reducing the burden on manufacturing and small and micro businesses, while providing inclusive tax cuts and exemptions for technology start-ups to support their development. Second, increase financial support. First, increase credit. Banks are encouraged to provide enterprises with minimum standards within the scope of the policy. In particular, small and medium-sized enterprises are encouraged to take measures of "continuous lending" and "no delay in lending" to those enterprises that are in temporary difficulties due to the impact of the epidemic. At the same time, enterprises with difficulties in repaying due loans will be encouraged to postpone their repayments and reduce interest rates. Second, we will optimize financing guarantee and financial leasing services. Financing guarantee institutions are encouraged to appropriately lower the rates of new financing guarantee for enterprises severely affected by the epidemic, and finance leasing institutions are supported to adjust the repayment methods and rates of enterprises severely affected by the epidemic, and to appropriately lower the rates of new financing guarantee for enterprises severely affected by the epidemic, and finance leasing institutions are supported to adjust the repayment methods and rates of enterprises severely affected by the epidemic, and to appropriately reduce or exempt interest. Third, strengthen the consciousness of enterprise subject. Enterprises, especially manufacturing, small and micro enterprises and private enterprises, are encouraged to implement the main responsibility of emergency management by establishing and improving emergency contingency plans, regularly organizing drills, and improving the construction of emergency platform and emergency monitoring platform, so as to improve the ability of enterprises to deal with risks. In addition, the government should focus on increasing employment opportunities and solve the problem of short-term employment. The government should vigorously develop the service industry with large employment capacity and labor-intensive industries with comparative advantages and market demand, encourage small and micro enterprises to develop and broaden employment channels through financial and tax preferential policies. At the same time, we will accelerate the improvement of the capital market, optimize the household financial structure, and increase people's property income. Through these ways above, the negative impact of covid-19 will be mitigated.

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