

A Review of the Impact of the COVID-19 Epidemic on the Industrial Supply Chain

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ABSTRACT

The outbreak of the novel coronary pneumonia outbreak at the end of 2019 caused a huge impact on the world economy. This paper focuses on the impact of the outbreak on the industrial supply chain, analysing the impact of the outbreak on its supply chain from three aspects: agriculture, manufacturing, and food and beverage, respectively. The results of the study found that agriculture was least affected by the epidemic compared to the manufacturing and catering industries, while the development of the manufacturing supply chain was severely constrained by the unstable logistics. Meanwhile, for the catering industry, the implementation of epidemic prevention and control measures such as city closures, restrictions on going out and restrictions on holding gathering events exposed the catering business to certain bankruptcy risks. By studying the magnitude of the impact of COVID-19 on the industrial supply chain, it has practical implications for the government to develop new policies that can help restore the economy and effectively prevent the epidemic.

Keywords: Supply Chain, COVID-19, Industry, China.

1. INTRODUCTION

1.1. Research Background

As the end of the year 2019 arrived, the world encountered one of the most serious challenges in the century so far, the outbreak of the Covid-19. Covid-19 is recently discovered highly contagious virus, that shares similar symptoms with normal flu but determinates human bodies in weeks. Covid-19 due to its rapid spread and deadly symptoms forced millions of people to be quarantined under the deterrence of the virus. Despite the endeavoring efforts to stop the pandemic from spreading, the virus has swiftly spread to many popular-dense Continent around the globe, including Europe and North America, led to a detrimental crisis of the world economy. Among the aspects impacted by the spreading virus, the global supply chains are one the most wounded industries. On the one hand, the sudden shutten down transportation crossed countries and regions is crucial for the supply chains to operate, on the other hand, many suppliers relied on labor-dense production mode and the

segregation policy applied by most of the countries made such a production method impossible during the pandemic era. According to the statistics, all major transportation channels are blocked at the borders of countries, and the general time cycle of the delivery of supply chain is delayed by up to 75% because the strike of the pandemic.

1.2. Research Motivation and Research Framework

In general, the pandemic has caused interruptions in manufacturing activities, mainly reflected in parts shortages, labor interruptions, traffic interruptions, and inability to deliver to customers. This phenomenon of production shutdowns has exposed the vulnerabilities in the modern supply chain. Most of the current industries requires the cooperation of multiple companies, involving importing necessary production components and diverse categories of capitals. However, some companies rely on single supplier for essential elements of their production lines or have high requirements on

punctuation of deliveries, which made those companies being impacted much harshly than others by the pandemic. It is necessary for such a company to make a transformation or adjustment in order to survive in the harsh conditions. Therefore, companies need a clear understanding in order to make future decisions in the post-pandemic era; it is also important for governments to make corresponding economic policies to spurs the market. Our research will mainly focus on types of industries impacted, the different impacts, and possible future situations.

The framework of this paper is organized as follows: the first part is the introduction, including the background and motivation of the study, the second part is a literature review and classification of the current research results from three aspects: agriculture, manufacturing and catering, respectively, and finally the conclusion.

2. LITERATURE REVIEW

2.1. Agricultural and livestock supply chain under COVID-19

Under the influence of the pandemic, the primary sector of the economy (denoted as primary sector), compared to the second and third sector, was impacted the least according to the value-added to the Gross Domestic Product (denoted as GDP). For example, in China, the GDP from the primary, second, third sectors were decreased 3.2%, 9.6%, 5.2% respectively in the 1st quarter [1]. Similarly, in the U.S., mining, agriculture, forestry, fishing, and hunting industries only contributed a sum of -0.07 out of the -3.5 percent change (year-over-year) in real GDP of the U.S. in 2020 [2]. Dig deeper into the declining GDP in the primary sector, we can summarize the influences from pandemic into two major parts: difficulties or even interruptions in transportation services, and labor shortage due to quarantine, restrictions on movement, and employees' concerns on safety. Since COVID-19 has an asymptomatic incubation period that is difficult to observe [3] and can be transmitted from person to person through close contact with infected persons, coughing, sneezing, respiratory droplets, or aerosols [4], quarantine or restricting movement and control of transportation for epidemic prevention is necessary. This can lead to labor shortages and inefficient transportation. In terms of shipping, containers arriving in Canada are required to be quarantined for 14 days. This resulted in a shortage of empty containers for return trips to Asia due to the forced stoppage of containers from Asia filled with manufactured goods destined for North America and the distress of the ship owners, coupled with the shutdown of Chinese production associated with COVID-19 and the subsequent decline in North American demand. The limited availability of empty non-refrigerated sea containers has led to delays and increased logistical

problems in the export supply chain for some specialty grains and processed products [5]. The agricultural side of Canada could also be negatively affected as a result. Similarly, in the United States, a survey (which preceded the announcement of federal or state programs to support U.S. aquaculture producers and small businesses) showed that affected by transportation and employee furloughs or layoffs due to lack of revenue for their businesses, many people involved in agriculture noted challenges in obtaining necessary production inputs (e.g., feed or seed), and half felt that they would not survive 12 months under the epidemic without external intervention [6]. Another crisis is that farmers were unable to sell their produce in local markets or to local schools, restaurants, bars, hotels, and other leisure establishments, which have been temporarily closed [7].

Fortunately, due to the necessity of food, governments around the world have taken the necessary steps to ensure the integrity of the food supply chain, and many agricultural and food supply chains are performing relatively well as a result. However, for the livestock industry, the situation looks less promising. Unlike crops, which can be left to grow, animals need to be fed daily. People being quarantined or farming areas being closed off, or disruptions in the supply of feed, can lead directly to the starvation of thousands of chickens, pigs, and sheep. Also, in the case of pigs, swine fever is a terrible cause of death. Without frequent inspections by people, it is likely to cause widespread infection, just as it did for people infected with COVID-19. Combined with the relatively short production cycle of animals, market disruptions and lack of supply are great problems faced by the livestock industry [8]. One evidence could be that among China's primary industries, the livestock sector was the most affected by the epidemic, and as a result, the value-added of China's agriculture, forestry, animal husbandry, and fishery industry fell by 2.8% in the first quarter of 2020 compared to the same period last year[1].

2.2. Manufacturing supply chain under COVID-19

COVID-19, a disease that has spread rapidly around the world in recent years, has caused significant damage to the manufacturing supply chain. In order to assess the epidemic effects, Cai, M., & Luo, J.(2020) investigated the raw material and unsatisfied demand because of unstable logistics aspects[9]. They found that many factories have to shut down due to policies for defending the virus. Thus, some key components' manufactures such as integrated circuits may be stopped, which can affect supply and other countries' imports. For the unstable logistics, it creates severe impacts on demand due to the quarantine policy. In China, some highways are limited to use for transport goods and people need to stay at home to avoid infection with COVID-19, which causes the lack of drivers to keep the stability of logistics

during the virus outbreak. Meanwhile, measures about air flight control exports and imports restrictions between countries also bring challenges to demand. Grida, M., Mohamed, R., & Zaied, A. N. H. (2020) aimed to explore the impacts of prevention policies of dealing with the COVID-19 on the supply chains [10]. They selected the food industry, electronics industry, pharmaceutical industry, and textile industry to assess the influences of restriction policies on supply, demand and logistics. Through modal calculations in these manufacturing supply chains, they found that the demand in one most elements was influenced by various protective policies, such as limiting the air transport between countries, and banning parties. However, this study also has some disadvantages, and the range of samples is small, which is one of their shortages. Meanwhile, most supply chains face heavy pressure, but there are a few industries that bear more than others like medical and health manufacturing. To prevent injection with the covid-19, washing hands immediately when coming home is one of the best ways to prevent it, so some hand sanitizer manufacturing industries are facing greater pressure during this period. The challenges come from two main aspects, one is the unsatisfied supply of raw material, the other is the high-demand market (Paul, S. K., & Chowdhury, P.2020)[11]. During this tough time, it brings huge challenges for managers to make effective decisions to keep the logistics stable, especially in the manufacturing industry. There are many difficult problems that need to be handled such as the lack of human resources, uncertain transportation, shortage of raw material and cash flow. One of the factors that are influenced most is the lack of human resources because of the limitation policies (Biswas, T. K., & Das, M. C.2020)[12]. In India, the government decided to lock down their country in order to decline the virus outbreak. Due to the lockdown, some factories need to be temporarily closed, so that they have to fire a part of employees to prevent the risk of bankruptcy. Meanwhile, people get used to purchasing more daily necessities to defend the unpredictable risk in the future. All of these will pose negative effects on the balance of demand and supply, which will make the supply chains suffer heavy stress.

In addition, governments should consider the economic influence of long-term lockdown cities and the restrictive policies. The longer the lockdown, the higher the demand increase, and the implementation of earlier lockdown will stimulate the demand to rise fast. Consequently, policymakers also need to maintain high-intensity work to make suitable instructions on supply chains in order to avoid unnecessary trouble (Nikolopoulos, K., Punia, S., et al., 2021)[13]. For example, the automobile industry supposes that the effective way to recover production and decrease risk is to develop localized supply and invest more in technical revolution. The airline industry believes that they need to

make different and flexible business management to get ready for dangerous challenges that are brought by COVID-19(Belhadi, A., Kamble, S., et al.,2021)[14].

2.3. Catering industry under COVID-19

The epidemic has had a great impact on the catering industry. Due to the nature of the traditional catering industry, which requires offline service. Tskillthe quarantine measures taken to counteract the outbreak have virtually choked off its customer flow. With the cancellation of group dinners and the closure of major tourist attractions, the passenger flow and industry income have decreased significantly. Compared with other types of service industries such as wholesale and retail, transportation and so on, the catering industry is more deeply affected by the epidemic and recovers more slowly. At the same time, the emergence of the epidemic has brought about the growth of online retail sales, and there has been an era trend of "live broadcasting with goods". The emergence of takeout platform also makes people transfer offline catering consumption to online during the epidemic. All of these are the changes brought about by the appearance of COVID-19 to the catering industry.

Under the circumstance of rampant COVID-19, the crowd cannot gather in a large scale, causing catering enterprises to get into trouble for four main reasons: first, income is almost cut off. The flow of stores fell like a cliff, and the source of cash flow was cut off (Wu, 2020) [14]. According to the data in 2019, online catering service revenue accounts for less than 20% of the overall catering, and it is difficult to maintain the survival of the enterprise; on the one hand, the cost is rigid. The 2019 China Catering Annual Report shows that raw materials, rent and labor costs accounted for 41%, 10% and 22% of the revenue of catering companies, respectively. The emergence of the epidemic has caused a large number of stores to close down, but rental expenses and labor costs cannot be compensated (Shi & Li, 2021) [15]; on the other hand, almost all of the inventory during the Spring Festival has been lost. As the Spring Festival approaches, many businesses have purchased a large amount of food materials in advance, because the epidemic has also caused serious losses; finally, the continuation of the epidemic has also had a negative impact on the development of the catering industry (Liang & Xing, 2020) [16]. From the dynamic point of view, even if the epidemic situation is alleviated later, it still takes some time for consumers' panic to dissipate, so there are still some risks in running catering stores during this period.

As the saying goes, there are difficulties, there will be methods. The state has also introduced a series of measures to save the catering industry under the epidemic situation. For example, actively use the Internet platform to increase operating revenue. The second is to advocate "sharing employees" to reduce operating costs; make full

use of national preferential policies to strengthen cross industry cooperation and alleviate the shortage of cash flow. Skilfully use "stall economy" to solve the current difficulties, realize enterprise self-help and promote the recovery and development of the catering industry as soon as possible, so as to let relevant enterprises get through the crisis.

3. CONCLUSION

3.1. Conclusion of Key Findings

By reading and researching the studies published by scholars on supply chain and epidemic in recent years, it is clear that the epidemic has had different degrees of negative impact on supply chains of primary, secondary, and tertiary sectors of the economy. The tertiary sector, such as the restaurant industry, is most affected by the epidemic prevention policies. The brick-and-mortar service sector generally suffer from a significant drop in foot traffic, which led to a drop in revenue. As a result, many brick-and-mortar stores were forced to close. The secondary sector was also affected by the quarantine, labor shortage due to movement restrictions, and intermittent production shutdowns, which led to the breakage of corporate capital chains, making many industries, such as manufacturing, unable to continue production and forced to lay off employees. Consequently, downstream industries were also affected. The primary sector was the least affected. Due to the necessity of food, the government supported primary industries, such as agriculture, which was not greatly affected in all countries, but livestock, mining industries, etc. generally suffered considerable losses.

3.2. Researcher Significance

Obviously, it is great significance to study the impact of the epidemic on the supply chain, which has a far-reaching impact on the future development. This study analyzes the supply chain of various industries, explains the impact of many policies to deal with COVID-19 on the economy and the supply chain, and provides reference value and significance for policy formulation and evaluation. The COVID-19 may not disappear in the next few years. Thus, the value provided by this paper is that the existing policies, such as lockdown of the city, will have a huge economic impact and will not be applicable in the future. The impact of existing policies, such as barriers to labor flow between low-risk areas and high-risk areas, rising prices caused by insufficient raw materials, and increased bankruptcy risk caused by reduced passenger flow in the service industry, has caused huge losses to the economy. In the future, more reasonable policies can be formulated according to more comprehensive evaluation, and economic losses can be avoided under the condition of ensuring safety by regulating the market and multi-directional allocation of

the supply chain. For companies, a lot of companies may have a single supply chain before the outbreak of the virus, and they do not have good response ability in the face of large-scale virus outbreak. This study can also provide some references for these companies in their future development and help them survive in this difficult environment.

3.3. Limitation and Future Studies

However, this study still has some limitations. The study in this paper only assessed the relatively active industries used to represent the primary, secondary, and tertiary industries. The industries involved are not comprehensive enough and more industries can be taken into consideration in the future. At the same time, there is still the problem of heterogeneity within the same industry across regions and scales, and future research could pay more attention to the differences in the impact of the epidemic on enterprises of different scales and industries within different cities, especially the development of SMEs, which would help complete the assessment of the epidemic on the global economy. Also this paper focuses on COVID-19 and the impact of the recession on the global supply chain. In fact, there are several international companies, such as Nike. They are gradually recovering from COVID-19 and their profits and revenues have increased a lot. In addition, their inventory reductions were similar to those prior to the outbreak, and future research could attempt to identify the reasons why this type of company survived and thrived during the outbreak.

AUTHORS' CONTRIBUTIONS

The authors contributed equally.

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