

# Meta-Analysis of the Effect of the COVID-19 Epidemic on China's Food Supply Chain

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## Abstract

With the rapid improvement of China's food industrialization and socioeconomic development level, many specialized food supply chain enterprises have been born in China in recent years, contributing to the development of the food industry and the enrichment of people's material life. A meta-analysis was conducted to investigate the global impact of COVID-19 on China's food supply chain. The objective was to explore whether changes in the food supply chain would affect consumer health, food safety, food prices, and food quality. According to statistics, the COVID-19 outbreak has caused an increase in food prices. This study shows that during the period when the outbreak first occurred imports from other countries were restricted. The COVID-19 epidemic has affected vast numbers of farms directly and indirectly and caused considerable losses in China's market prices. The epidemic has affected the suspension of many industries and businesses, and residents are isolated from their homes. This paper will analyze the impact of COVID-19 on China's food supply chain and propose corresponding solutions.

## Keywords

COVID-19, Food Supply Chain, Food Industrialization, Industries, Market Prices

## 1. Introduction

From 2020 to the present, the COVID-19 pandemic severely impacted the world economically, politically, and health. Soon after it was discovered in Wuhan, China, the virus rapidly spread worldwide. Within four months, the virus infected 4,806,299 people and caused 318,599 deaths (Nordt et al., 2015). COVID-19 threatened the stability of the global economy. The unemployment rate worldwide increased from 4.9% in January 2020 to 5.6% in May 2020 (Nordt et al.,

2015). The COVID-19 epidemic has been spreading rapidly throughout China. It has posed a serious threat to the global food supply and has led to severe health problems. As if it were not enough, it has also led to an important economic crisis in China, leaving a quite number of the population unemployed and starving. The pandemic caused scarcities in certain materials used in production, including food ingredients, cleaning materials, and fuel, thereby disrupting the global supply chain. New processes had to be implemented to ensure that goods would not be contaminated. In China, severe measures were instituted to relieve the pressure caused by the virus and to safeguard the food supply system. As a result, the government established severe restrictions on importing and exporting foods such as soybeans, beef, and pork to China. Those measures mainly served to enhance the collaboration between the government and the citizens to solve pandemic-related issues effectively. This paper will review the current state of knowledge regarding the effect of the pandemic on the Chinese economy and society. A meta-analysis of scholarly and other papers will be reviewed, summarized, and combined.

## **2. General Negative Influence of COVID-19 on China**

The pandemic has hurt global employment. It is estimated that jobs globally declined by 24.7 million while the unemployment rate increased from 4.936% to 5.644%. The Chinese government instituted numerous restrictive regulations to arrest the pandemic's spread. People were required to stay home, resulting in many establishments losing business. For example, a restaurant owner must continue paying for rent and maintenance even though he is not generating any income. As a result, owners would close their restaurants, thus increasing unemployment.

Additionally, suicides often come along with the rise in the unemployment rate. According to the World Health Organization (WHO), for every suicide, there were at least 20 suicide attempts. The increase in suicides exacerbates the unemployment rate due to increased personal stress (Nordt et al., 2015).

China's agricultural exports declined dramatically after the COVID-19 outbreak. According to data from the General Administration of Customs, China's food exports decreased by 11.6% for January and February 2020 (Pan et al., 2020). There are a few reasons behind this drastic decline in food exports.

The first reason is the abrupt disturbance in the export companies caused by the pandemic. Export companies were shut down since employees could not return to work: more than 30% loss in some companies was caused by the lack of workers (Cao et al., 2020).

The second reason is that there were trade restrictions imposed on companies. Trade restrictions have led to a shortage of truck drivers to pick up packages waiting to be shipped internationally. This increases the logistical fees companies have to spend since companies have to increase the payments for looking for drivers who can deliver the goods. The limitation on freight capacity, part of

the trade restrictions, has caused a drastic decline in the total containers being handled.

**Figure 1** (below) indicates the influence of the pandemic on the truck loads recovery rate, showing the impact of governmental regulations on the limitation of truck loads, thus increasing the costs for suppliers (**Table 1**).

### 2.1. Problems in China's Food Supply Chain in the Context of COVID-19

The food supply chain (FSC) is a web connecting the demand and the supply of food. The following graph indicates components that might be experiencing an impact of the pandemic. Restriction and impact on transportation, job availability, and factory closures. Certain inputs, such as food ingredients, fuel, and fertilizers, have skyrocketed in price.

**Figure 2** shows how the overall food supply chain works, showing the factors that might be affected due to COVID-19. There is a clear progress in the pictorial diagram to show the fundamental signs of progress of the food step: The start of the supply chain is the raw material—farming, and then the harvested food goes to the processing line. After being processed, food will be distributed to retailers all over the world to be sold to the consumers.

The cycle shows the factors and specific or general parts involved in the Food supply chain. Labor and transport are two keys of this chain, because the main parts—production, processing, and distribution—all rely on these two factors to operate, whereas fuel and inputs are the main factors for driving the chain (Nasereldin et al., 2020).

Each factor in the graph is an indispensable part. With transportation restriction, the cost to attain fuel and hire available drivers would increase, thus making one of the factors unstable. If any one of these factors are affected, the whole chain would be paralyzed.

#### Difficulty in Selling Agricultural Products at the Production End

At the beginning of the COVID-19 outbreak in 2020, the sales of most agricultural products in China were affected to varying degrees. In particular, the backlog of fresh agricultural products was greater than before the pandemic, thus leaving

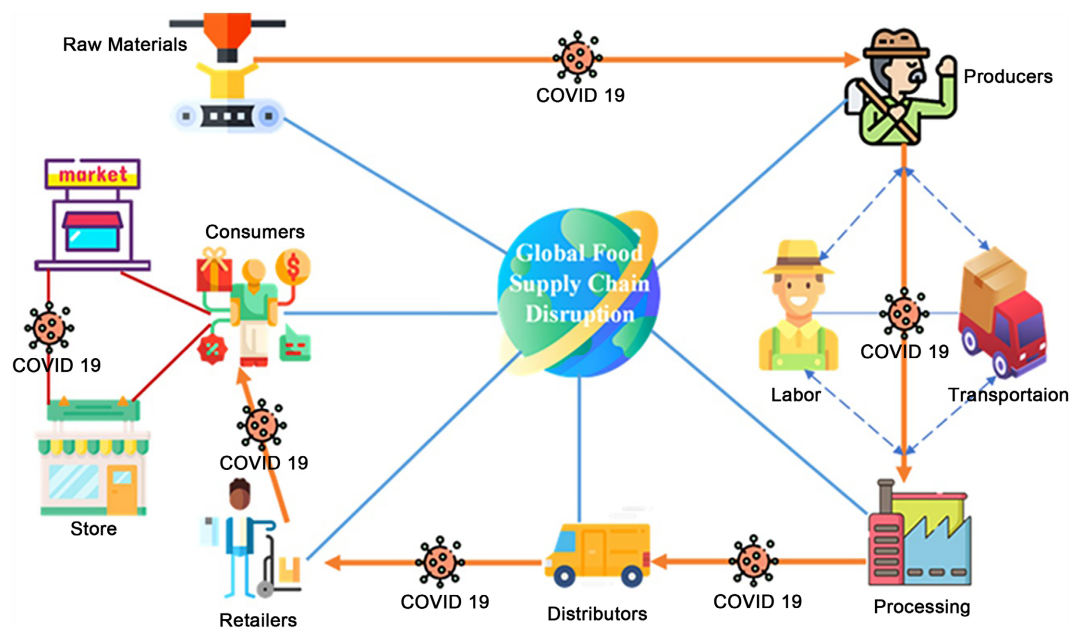


Source: G7 China Road Freight Report.

**Figure 1.** 202 Full Truck Load (FTL) recovery rate.

**Table 1.** Full Truck Load Recovery Rate Data (source: G7 China Road Freight report).

Date	Load(t)
1/9/2020	0.92
1/16/2020	0.65
1/22/2020	0.11
1/30/2020	0.1
2/6/2020	0.13
2/13/2020	0.18
2/20/2020	0.32
2/27/2020	0.51
3/5/2020	0.61
3/12/2020	0.8
3/19/2020	0.82



**Figure 2.** Food supply chain process.

people without sufficient food. Additionally, poultry breeding was banned. The COVID-19 epidemic has affected the food price in China, with the price decreasing as a result. Due to the backlog of agricultural products, farmers could not sell their products at market price. They were forced to sell their crops at lower prices than they would have normally paid. This increased the number of farmers who decided not to grow crops because they did not want to risk losing money on their crops.

China is a huge global food producer, and it is also a huge consumer of food.

But the current crisis has had an impact on both sides: China has been forced to cut back on its production, while it is also become harder for foreign companies to get their products into the country due to the absence of many ingredients. This led to farmers' suffering due to a shortage of funds and materials, which meant they could not plant as many crops or sell them at the same price. As a result, farmers are being forced to cut back on their planting to make ends meet—which means that more crops will be lost than would have been otherwise. In addition, if farmers are not able to sell their crops at all due to low prices or shortages of ingredients, they cannot afford new seeds or fertilizer—which means they're stuck with lower yields than they would have otherwise had access to; leading to China's food supply chain suffering from a serious shortage of grains.

Retail prices of crops rose, whereas farmers were forced to sell. According to the survey of China's national broiler industry technology system, as of February 14, 2020, the hatching rate of broiler breeding eggs was less than 60% of that in 2019, and the proportion of commercial broilers in the stockade reached 88% (Cui, 2020). The research enterprises took extreme measures such as a landfill to destroy the hatched chickens as high as 60%. According to the estimation of 2020, the loss of the broiler industry nationwide due to the epidemic was up to 12.7 billion yuan (Cui, 2020).

Hubei Province is the area most seriously affected by the epidemic and is also the main production area of crayfish in China. According to the Hubei Provincial Department of Agriculture and Rural Affairs statistics, the average daily sales volume of finished lobsters in Hubei Province was 650 t from January to March 2020. The total sales volume in March 2020 was 18.2 kt, only 35% of the sales volume in 2019. The price of lobsters on the market in March 2020 dropped by more than 50% compared with the same period in 2019, and the price of crayfish of different specifications dropped by 22 - 50 yuan/kg.

The research team of the Rural Development Research Institute of the Chinese Academy of Social Sciences found that 6.3% of the raw milk of dairy farms nationwide was rejected, 27.3% of dairy farms were purchased in limited quantities, 86.7% of dairy farms encountered the situation that raw milk was purchased at a reduced price, 12.5% of the farms dumped milk (Cui, 2020). The early investigation of China's national dairy industry technology system also confirmed that as of February 12, 2020, at least 13 provinces in China had disposed of milk, including Hubei Province, which destroyed more than 700 tons of fresh milk (Cui, 2020).

## 2.2. The Tight Supply of Agricultural Products

During the COVID-19 epidemic, the supply of meat, eggs, milk, and vegetables in some urban areas of China was tight, and the prices rose significantly (Wang & Ma, 2020). In areas where the epidemic was serious, looting even occurred. According to the monitoring of 286 wholesale vegetable markets in China by the

“National Agricultural Product Wholesale Market Price Information System” of the Ministry of Agriculture and Rural Affairs, the prices increased, as shown in **Table 2**.

This is only the price increase in the wholesale market. With the amplification of the bullwhip effect, we can imagine the vegetable price increase in the retail market.

**Table 3** shows food and non-food price rise in the year 2020 and 2019, According to the National Bureau of Statistics.

It can be seen that the rise in food prices is the main reason for the rise in consumer prices of residents across the country. The rise in food prices is far greater than the rise in non-food prices in the same period as shown in **Figure 3** above. The rise in consumer prices in rural areas is greater than in urban areas as evident in **Figure 4**. Moreover, the rise and fall of various prices have a positive relationship with the gradual improvement of the epidemic in China (Wang, 2021). This shows that the consumption market of agricultural products in China was in a tight balance during the epidemic, and some varieties were in short supply. The epidemic seriously affected the social welfare of most residents, especially low-income people.

### 3. Solutions

The COVID-19 pandemic has ravaged China, and many people have lost the ability to work and earn an income. In order to help those affected by this epidemic, organizations need to create campaigns to provide food for those who cannot find food for themselves or their families. Providing food coupons and vouchers to those who need them most during the COVID-19 epidemic will be the most important way to cope with the supply food shortage. The organizations will also have to provide support and assistance to those who may be struggling financially due to the epidemic, as well as education on how best to help themselves through this difficult time in their lives.

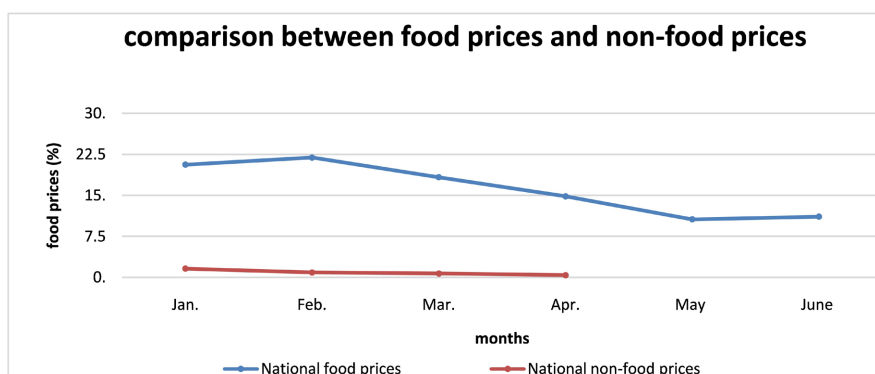
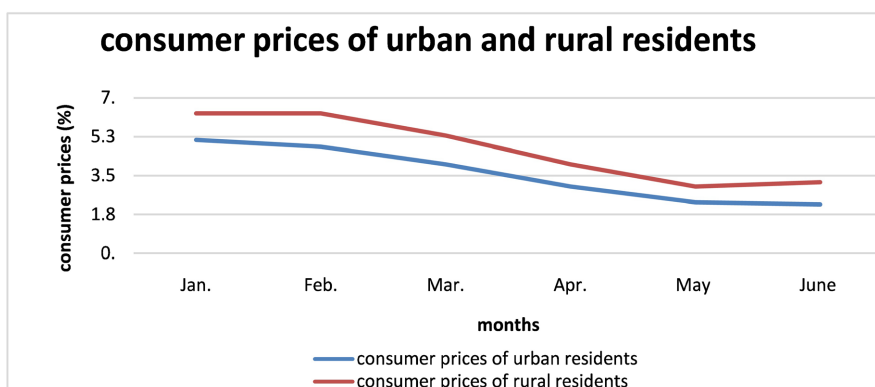
Utilizing the existing labor force effectively can eliminate the shortage of employees in the food supply field. The increasing unemployment rate in every job field has created a crisis, while there is still a labor force to support a local food supply chain. The food supply companies can hire currently jobless workers to work for them. Matching demands and supplies for jobs immediately. In China,

**Table 2.** Wholesale market price increase of selected agricultural products.

Product	Wholesale Market Price Increase: March 14-20
Tomatoes	38.2%
Potatoes	33.0%
cauliflower	28.6%
Green peppers	26.2%
Eggplant	16.4%

**Table 3.** Food and non-food percentage price increase.

Month	2020			2019		
	Consumer Prices	National food prices	National non-food prices	consumer prices of urban residents	consumer prices of rural residents	National non-food price rise
Jan.	5.4	20.6	1.6	5.1	6.3	0.4
Feb.	5.2	21.9	0.9	4.8	6.3	0.3
Mar.	4.3	18.3	0.7	4.0	5.3	
Apr.	3.3	14.8	0.4	3.0	4.0	
May	2.4	10.6		2.3	3.0	
June	2.5	11.1		2.2	3.2	

**Figure 3.** Line graph showing national food prices and non-food prices (source: generated using excel).**Figure 4.** Line graph showing consumer prices of urban residents and rural residents (source: generated using excel).

there is little few available jobs-China.

In order to ensure adequate food production and supply, the Ministry of Agriculture and Rural Affairs (MARA) will guide and coordinate different solutions to maintain the agricultural food value chain. MARA will announce policies to



solve instant food supply-related problems.

These policies will include; Farmers will receive subsidies to make the transition from traditional agriculture methods to more efficient methods that are less harmful to the environment, a new market to be created for farmers who grow their food without using chemicals or fertilizers, which is expected to lead to a reduction in chemical use and soil erosion as well as an increase in crop yields, installing new technology throughout the country so that it can be used by small-scale farmers who do not have access to advanced irrigation systems such as drip irrigation or micro-irrigation systems, creating a fund for small businesses that are affected by the new policy changes, which will allow them time to adjust without losing money due to falling sales due to a lack of inventory.

The monitoring group would assist MARA by keeping an eye on the local virus cases closely and offer a possibly effective measure to MARA to bring China's agriculture back in full operation: In addition to the working groups, China has devised three customized solutions in accordance with different levels of risk levels. Such preparation improves China's efficiency in saving the cost of decreasing the Covid cases.

Furthermore, creating distribution points to distribute food products such as canned goods, fresh produce, and fruits/veggies via trucks or vans to individuals in need throughout their respective communities is another way to curb shortage. There are various methods to deal with the supply shortage and related problems.

First, the government can utilize its sources to unite the public and private sectors to cope with the pandemic. It can set up various working groups to handle different aspects of Covid-19, such as a monitoring group and a medicine development group. The monitoring group would closely monitor the pandemic and do dynamic analysis to help make a precise decision. The medicine development group would develop vaccines and effective medicines to relieve the symptoms. The outbreak of the epidemic has brought serious uncertainty to the health and safety of agricultural product circulation practitioners. Health insurance can fully utilize additional costs arising from this uncertainty. The government can entrust commercial insurance institutions to design policy-based health insurance, with 70% of the government's investment for each insurance policy and 30% of the employees' investment (Cao et al., 2020). Once the health risk occurs, the compensation range will exceed the health loss likely caused by most employees to stimulate agricultural product practitioners to continue providing agricultural product circulation services on the premise of good safety protection and to maintain the safe and stable operation of the agricultural industry chain.

Second, innovation is another key to dealing with new situations and challenges. Food enterprises in China have utilized technology to lower the chances of virus contamination: technology companies like SiFeng developed food delivery robots to deliver food ingredients in the community; such robots provide



contactless food delivery, eliminating the occasion that people have to with each other and thus spread the virus through platysma. Also, certain food companies set up food shelves and service spots in the communities; Food would be loaded into a car truck after the driver ordered food online, minimizing the chance of contaminating and ensuring a stable way to get rid of the unsalable fruits and vegetables.

Third, the digitalization of food supply chains and agricultural services is another key to solving the pandemic-related food supply problem once and for all. In the past, farmers and wholesalers have never used or relied on online markets to make profits, but now they are familiar with online platforms like Alibaba. Alibaba helped rural crops and food suppliers to get rid of the stacked food and taught suppliers to use streaming platforms to advertise their crops and answer potential customers' questions. By using the existing logistics web, Alibaba facilitated e-commerce in China. Suppliers won't be worrying about shipping their crops out because Alibaba got everything covered, only needing them to stream and show customers that there are supplies for their demands. And consumers are also getting used to using online platforms to order fresh food instead of taking the risk of going shopping at the physical market. E-commerce platforms can encourage a long-run strategy to collaborate closely with food suppliers and ensure a stable food supply chain. Moreover, e-commerce can build a strong rural-urban linkage. Such linkage would maintain the flow of goods, especially when traditional exchange channels are disrupted.

#### **4. Conclusion**

The COVID-19 epidemic has had a great impact on the circulation of agricultural products in China. In some provinces, the imbalance between supply and demand of agricultural products has appeared. The increase in the circulation cost of agricultural products has caused great losses to agricultural producers' income and urban consumers' welfare. The epidemic prevention and control led to the forced interruption of agricultural products trading and logistics and the inability to meet the terminal consumption demand, ultimately leading to the imbalance between the supply and demand of agricultural products. The analysis of the supply policy of agricultural products during the control period recognizes the internal mechanism of the imbalance between the supply and demand of agricultural products in China. It effectively reduces the additional costs caused by the outbreak of the epidemic. This will promote public health event insurance, which helps farmers transport their products more quickly and efficiently. It will increase temporary subsidies for agricultural products, issuing targeted information on the level of epidemic risk, and conducting training on the epidemic prevention ability of employees. This ensures that the effective operation of the agricultural product supply chain and the stability of the agricultural industry chain during the post-COVID-19 period, so that similar supply and demand imbalances can be avoided.

## Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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