

# A Study On The Impact Of Covid-19 Epidemic On Freight Volume: A Case Study Of Shanghai

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## Abstract

The emergence of Covid-19 has a great impact on transport enterprises. Through the introduction of relevant national policies and subjective efforts of operators, it may reduce or alleviate the adverse effects caused by the epidemic, making the development of the whole year's transportation industry close to or meet the desired target. In this paper, Covid-19 is extracted from the variables that affect the volume of the cargo and the correlation is analyzed. Taking Shanghai as a case study, the development trend of freight transport volume based on different modes of transportation and the means of recovery of the industry will be discussed.

## Keywords

Freight traffic volume; Covid-19; data analysis.

## 1. Introduction

The outbreak of Covid-19 has greatly affected the economy and society in China in the short term, and has also made a great negative impact on the transport industry. Due to the economic attributes of cargo transport services, it also has the nature of social welfare, which is one of the basic systems for the normal operation of society. Therefore, when governments at all levels introduce relevant policies based on the public interest, it is necessary to provide support through appropriate tax reduction and government subsidies. On the one hand, the transportation system plays an important role in the epidemic prevention and control system. On the other hand, due to the epidemic situation, passenger transport and freight transport industry have been impacted. Scientific analysis and prediction of the impact of the epidemic situation on freight transport can provide reference for the transportation industry to do a good job in epidemic prevention and control and the risk of subsequent industry development. Sars is compared with the Covid-19 epidemic situation by Yiming Zhou<sup>[1]</sup>. Based on the analysis of the impact of the new epidemic on the freight flow of various transportation modes, this paper extracts features and analyzes the impact trend of the epidemic development on the development of China's freight transportation, so as to alleviate the negative impact of the epidemic on the transportation industry and avoid the occurrence of industry risks as far as possible.

## 2. Data Processing

Taking analysis based on epidemic situation and cargo data.

### 2.1. Original Data Description

The data sources used in this paper are from Shanghai Statistics, the Ministry of transport and DingXiangYuan, covering the period from January to early May 2020. The format of some datasets is as follows:

	ShangHai	ShangHai	ShangHai	ShangHai
	Current Diagnosis	Cumulative Diagnosis	Cumulative Death	Cumulative Cure
1/19	0	0	0	0
1/20	1	1	0	0
1/21	9	9	0	0
1/22	16	16	0	0
1/23	20	20	0	0
1/24	32	33	1	0
1/25	38	40	1	1
1/26	51	53	1	1

Indicator Name	April
Total cargo transportation volume(10000t)	11873.95
Railway	32.02
Shipping	8086.63
Road	3721
Aviation	34.3
Throughput (10000t)	5843.13
Input	3436.47
Output	2406.66

Figure 1: Partial Original Dataset

The data of freight transportation and epidemic situation all take Shanghai as the statistical range.

## 2.2. Feature Analysis

The freight volume of each period from January to April in 2020 was taken as the independent variable to analyze the freight volume of each period.

### 2.2.1. Freight Volume Analysis

According to the statistics released by the Ministry of transport and Shanghai, the freight volume and port cargo throughput of the four major modes of transportation in Shanghai are counted on a monthly basis.

On the basis of the processed data sets, the trend of freight volume of various transport modes in Shanghai during the epidemic period from January to April 2020 is analyzed as follows:

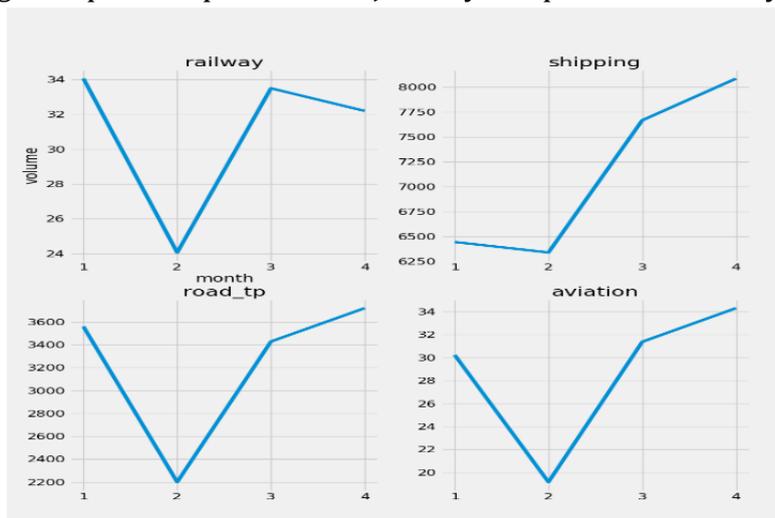


Figure 2: Broken line chart of epidemic futures traffic volume

It can be seen from Figure 2 that the freight volume of all modes of transport dropped to a low point in February and rebounded in March. In addition to railway transportation, water transportation, highway transportation and air transportation resumed the growth trend.

Table 1 and figure 3 show the change degree of freight volume in the same period as shown in Table 1 and figure 3:

Table 1: Comparison of freight volume in the same period

Indicator Name	Jan~Apr	Compared with year (%)
Total Cargo Transportation Volume	41791.56	-18.8
Railway	123.63	-16.2
Shipping	28642.88	-17.5
Road	12910	-21.9
Aviation	115.05	-5.7

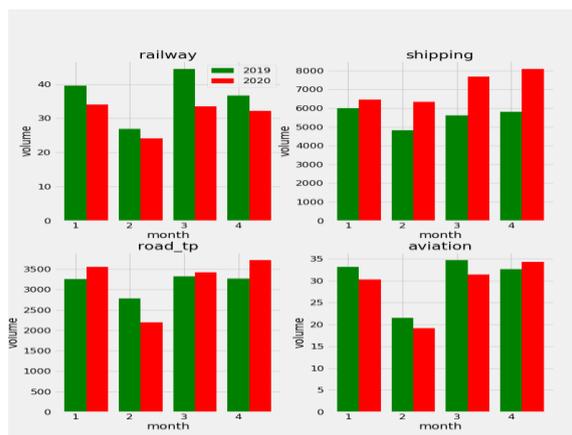


Figure 3: Comparison of freight volume on each area in the same period

It can be seen from table 1 that the total freight volume of each mode of transportation decreased to varying degrees in the same period. Further analysis from Figure 3 shows that:

For railway transportation, the freight volume of each month in the same period of the epidemic situation showed a significant decline; the railway freight transport volume in March showed no obvious growth trend compared with that of last year, and the freight volume in April was basically the same as that in March.

In terms of water transportation, according to the regulations of "a set of table statistical investigation system for highway and waterway transportation enterprises" issued by the Ministry of transport, the statistical caliber of Shanghai's "water transport" indicators has been adjusted since 2020. Compared with the growth in the same period with reference to table 1, it can be seen that the cargo transportation in water transportation is declining. Further analysis of port cargo throughput is shown in Figure 4 below, which shows the ports in the same period As for the transportation of imported goods, the throughput of goods returned to the level of last year in April, while that of outbound goods decreased to a higher level in February. There was still a certain gap in the throughput of outward cargo between April and last year.

For highway transportation, it is obvious that under the condition of growth and development in the same period in January, the highway freight volume decreased significantly in February, rebounded in March, and maintained the growth trend in April, but the total freight volume still decreased compared with the same period.

As for air transportation, the overall change trend is the same as that of last year when the transportation volume in January decreased at the same time, and it increased in April.

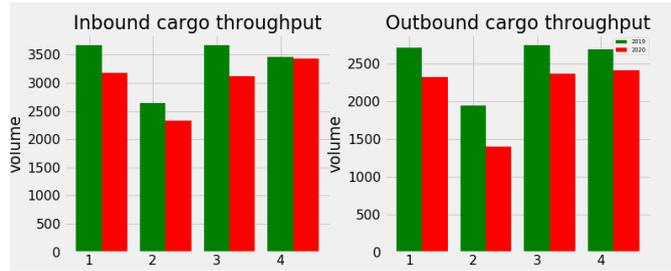


Figure 4: Comparison of freight volume on each area in the same period

### 2.2.2. Analysis of epidemic development

According to the information released by the national and local health committees, January 22 was taken as the initial date of the epidemic impact statistical period, and the number of confirmed cases, cumulative confirmed cases, cumulative deaths and cumulative cured cases of the whole city of Shanghai were counted by day. The data of epidemic development in Shanghai are shown in Figure 5 and Figure 6.

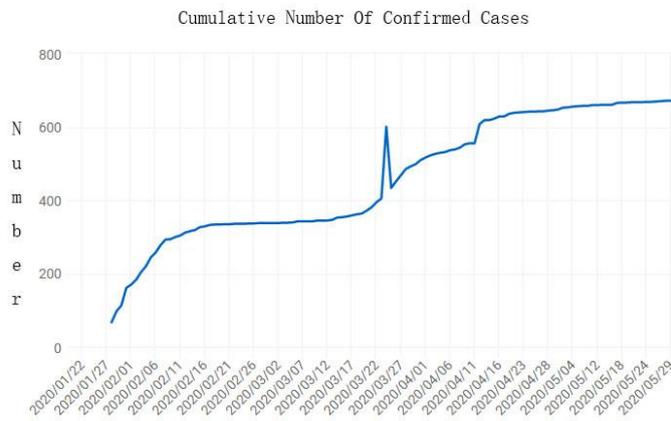


Figure 5: Total number of confirmed cases in Shanghai

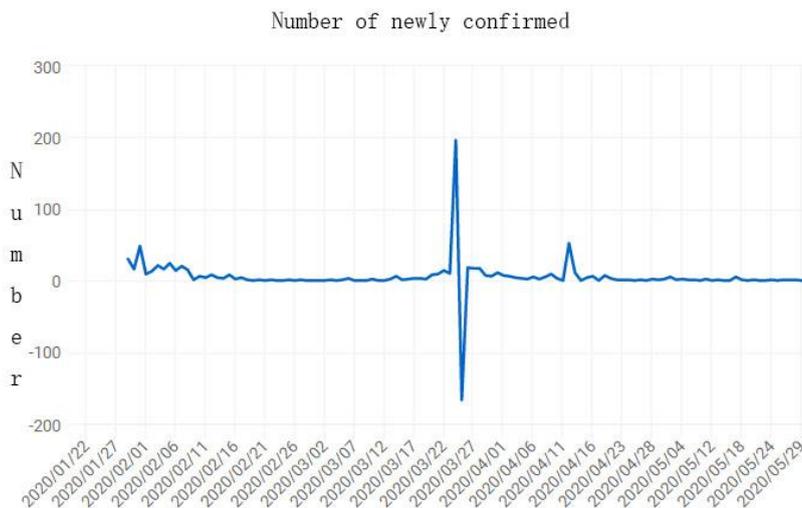


Figure 6: Number of newly confirmed cases in Shanghai

According to figures 5 and 6, it can be seen that the trend of the epidemic situation has been on the rise from the middle to the last ten days of January, and the number of newly added people after March 22 has been negatively decreased after the explosive growth. According to the

query of data sources, the reason for the change is to exclude suspected cases. Combined with figure 5 and Figure 6, the growth rate of the number of newly added and confirmed cases over the same period of the same period is defined as 01 / 27-02 / 16, 03 / 17-04 / 06 and 04 / 11-04 / 16.

### 3. Analysis of Covid-19 impact on freight transport

To analyze the novel coronavirus pneumonia epidemic and the influence mechanism of four freight modes, we extracted monthly average daily number of confirmed patients in Shanghai, confirmed the number of new monthly diagnoses, and the monthly freight volume of each freight transport mode. The average daily number of confirmed diagnoses in Shanghai was used to measure the severity of the city's epidemic situation, as shown in Figure 7.

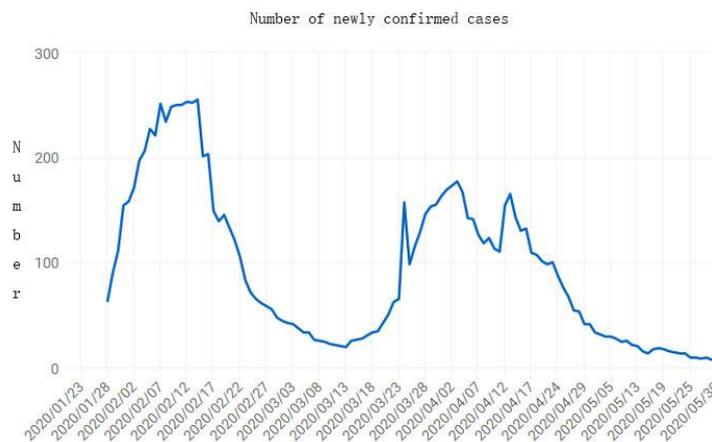


Figure 7: number of confirmed cases per day in Shanghai

Pearson correlation was used to explore the correlation between epidemic development and freight volume in time dimension, and the characteristic correlation matrix (as shown in equation 2.1) was calculated, and the characteristic correlation thermodynamic diagram was drawn, as shown in Figure 8

$$\frac{\sum_{i=1}^n \frac{(X_i - E(X)) (Y_i - E(Y))}{\sigma_X \sigma_Y}}{n} \tag{1}$$

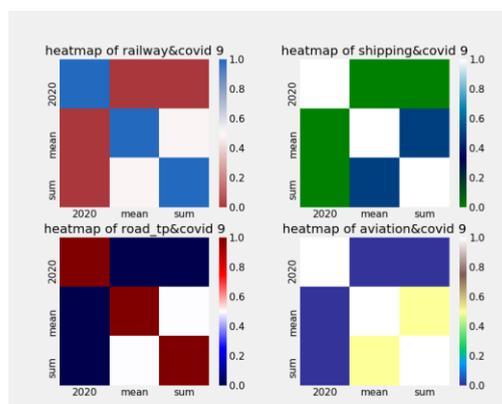


Figure 8: Variables correlation heatmap

In the figure, 2020 represents the freight volume of each mode of transportation during the epidemic period, “mean” represents the average daily number of confirmed cases in Shanghai, and “sum” represents the number of new confirmed cases per month.

### 3.1. Railway Transportation

Railway freight transport is less affected. For China's transportation system, railway transportation is one of the backbone modes of mass transportation in China, which has great advantages in medium and long distance, but does not play the most important role in freight transport. The goods transported by railway are mainly coal, steel, ore and other bulk commodities, and the transportation demand fluctuation of such commodities mainly depends on the cycle of upstream raw materials. Therefore, the current railway freight volume is less affected.

### 3.2. Road transportation

Highway transportation is greatly affected by the epidemic and is expected to be negatively affected in the short term. The scope of the epidemic is nationwide, the scale is huge, and some rural areas also have outbreaks, resulting in the impact of county-level urban and rural transportation industry. In terms of freight transport, only a small proportion of freight and logistics enterprises participated in the task of epidemic prevention and transportation, while the rest of freight transport enterprises basically stopped operation. After the resumption of labor production in March, considering the government's cancellation of highway tolls during the epidemic period as a means of stimulation, and according to the development trend of highway freight traffic volume, it is expected that there may be a short-term replenishment of inventory in highway transportation before and after the end of the epidemic, and then return to normal.

### 3.3. Air transportation

Air transportation is under great pressure in the process of fighting the epidemic. During the outbreak of the epidemic in China, it is the main transportation channel to receive overseas epidemic prevention materials. Due to the lag of global epidemic development time, China's epidemic situation has entered a stable period from March to April, and China's air transport has turned to take the role of transporting anti epidemic materials. For other air transport goods, due to the characteristics of high value and limited storage time, air transport often has the characteristics of high cargo value and limited storage time. In the context of the global outbreak, the demand for transportation of such goods has declined.

As one of the transportation modes in China, air transportation is in the period of rapid growth, and its traffic volume grows fastest. However, due to the high sensitivity of air transport to abnormal events or crises, the impact is greater this time. For air transport, passenger and cargo traffic volume decreased significantly in the first quarter. On the other hand, considering the rigid characteristics of air transport demand in normal period, it is expected that after the elimination of the epidemic crisis, it will gradually recover and continue to maintain a rapid growth trend.

### 3.4. Shipping

The impact of the shipping market on the outbreak of the epidemic is relatively mild. Considering the overlapping of the outbreak time and the Spring Festival holiday, the shipping market has little change compared with the same period last year. On January 30, 2020, the freight index of oil transportation (BD - Ti) and dry bulk (BDI) decreased by 9.5% and 6.4% respectively compared with January 23 (the beginning of the Spring Festival holiday), in line with expectations. At the same time, in addition to the impact of the epidemic, the shipping market itself fluctuates with the development of global economy and trade. Under the conditions of domestic enterprises returning to work and ports resuming operation, the international trade environment is globalized rather than normalized with the outbreak of the epidemic. According to the epidemic development curve and the data of inbound and outbound cargo transport volume, it can be seen that, as an important shipping city in China, Shanghai

has a domestic epidemic situation After the outbreak of the foreign epidemic, the demand for imported goods has basically recovered to the same level, while the demand for export goods has been affected to some extent. In addition, the impact of the epidemic on port operations is limited. Shanghai port is mainly engaged in import and export cargo loading and unloading business. Due to the globalization of customer groups and the diversification of loading and unloading types, and the development of global epidemic situation is not easy, port operation activities are carried out as usual. The follow-up recovery and development of shipping market should also pay attention to the trend of international market policy. Whether China will be restricted in international trade due to the epidemic situation will also reflect the trend of shipping market to a large extent.

#### **4. Countermeasures and suggestions for dealing with epidemic situation**

From the perspective of the demand for goods transportation, in the current stable period of the epidemic situation and the period after, the population mobility will gradually recover, the residents' pent up consumption demand during the epidemic prevention period will be gradually released, and the demand for goods transportation of food and entertainment products will gradually increase. However, due to the time lag of global epidemic spread and control in China, there is a time lag After that, some commodities with large export volume in the past will grow slowly with the control of the epidemic situation for a long time. From the perspective of supply side, due to the use of anti epidemic measures such as disinfection and anti epidemic equipment, the pace of commodity production and the service efficiency of transportation enterprises will be reduced to a certain extent. In addition, the isolation and protection of international freight transportation for floating population will also have an impact on transportation efficiency and increase transportation costs, and the income of China's freight logistics enterprises will be significantly reduced.

From the perspective of transportation services, in order to control the risk of infection, there will be an increase in additional human costs; after the spread of the epidemic, the prevention and control inspection set up at various transportation hubs and nodes will extend the transit time of goods, reduce the efficiency of logistics circulation and increase the transportation cost. However, it is worth noting that due to the decline in global oil prices and the government's policy of toll free roads, freight companies have made up for the losses caused by the epidemic to a certain extent.

According to the statistics of the Ministry of transport, during the period from February 17 to May 5 when toll roads are free, the vehicle freight rate dropped by 10% to 30%. After the highway toll resumed on May 6, the price of road freight generally showed a recovery rise, and the freight price of road goods returned reasonably. However, due to the overall oversupply of transport capacity, the sharp drop in diesel prices and the overall reduction of truck tolls, the overall freight rate is about 5% lower than that in the same period last year.

Therefore, it is suggested that during the epidemic prevention period, enterprises and vehicles related to daily necessities should be included in the scope of application of "green channel", so as to improve transportation efficiency and provide transportation convenience for freight vehicles undertaking important materials and major national engineering projects. At the same time, it is suggested to pay more attention to the income reduction faced by freight logistics enterprises by reducing taxes and optimizing credit policies, To reduce the operational pressure of freight logistics enterprises and vehicle owners in a period after the epidemic, and maintain the stable development of the cargo logistics service system.

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