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The Impact of Land Passenger Turnover on Covid-19

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Abstract

The COVID-19 has caused a large-scale impact on various industries in our country. Due to government policy restrictions and citizens' concerns about their own safety, the transportation industry has been greatly impacted. This essay takes into account the citizens' willingness to travel under the pandemic and the government's travel restriction policies. We select valid sample data of railways and highways in 31 provinces, municipalities, and autonomous regions in mainland China in the 2020 for empirical analysis.

Keywords

COVID-19; Transportation industry; Travel under the pandemic; Travel restriction.

1. Literature Review / Introduction

We found that people's willingness to travel and use public transportation has significantly decreased due to the epidemic. A number of people did not go out during the epidemic, which directly led to a sharp decrease in public transportation passenger turnover. Nevertheless, after the epidemic based on the depressed psychology of prolonged home isolation, the willingness of tourists to travel is obvious that lead the phenomenon of peak travel around the province would occur in the short term. As a result, also leads to an increase in public transportation passenger turnover.

COVID-19 has severely affected many aspects of people's daily lives. While many countries are in the phase of reopening ,the effects of the epidemic on people's behavior of going out are expected to last longer. Beliaev found that financial incentives could be used to reduce the risk of infection and speed up the response of public transport. However, there is a natural tradeoff between these two objectives, which means that financial incentives can be used in ways that put passengers at risk in order to restore public transport more quickly (Beliaev et al., 2021); The pandemic and its response have created significant new challenges for transport systems. Hendrickson found that the impact on freight was already apparent. Supply chains have been severely disrupted, starting with factory closures in parts of China in January 2020 (Hendrickson et al., 2020); Dzisi demonstrated that the policy of physical distancing in vehicles is followed, and that strict enforcement of the policy of using masks in vehicles is effective in preventing the spread of COVID-19. (Dzisi et al.,2020); Shen demonstrated that the transmission of COVID-19 can be effectively prevented through institutional requirements, personal protection, and environmental cleanliness (Shen et al.,2020).

COVID-19 was officially declared a pandemic by the World Health Organization (WHO) on 12 March 2020. The Lee study investigated the association between changes in traffic volume and the spread of COVID-19 in South Korea. He analyzed the national daily traffic and traffic trends

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for the three months from January 1, 2020, and found that: In Incheon, the increase in the number of new confirmed cases was positively linear with the increase in traffic flow (Lee et al.,2020); But in Zhao et al. 's study, they found a significant association between train travel and transmission of COVID-19 infection, but not with automobile and plane travel (Zhao et al.,2020).

The goal of urban transportation development under public health emergencies is to both support socioeconomic development and meet public safety mobility. In this paper, we will establish a multiple regression model for empirical analysis by establishing the number of people infected with the corona-virus with valid sample data of railroads, roads, waterways, and civil aviation in thirty-one provinces, cities, and autonomous regions (except Hong Kong, Macau, and Taiwan) in the first half of 2020 for each province and city. We study people's travel during the Covid-19 epidemic, determine the impact of the epidemic on the urban transportation industry and the recovery of urban transportation after the resumption of work and production. We summarized the characteristics of urban transportation under sudden public health and safety events. Countermeasures are proposed to strengthen the diversity of urban transportation supply, optimize the urban logistics and transportation system, and build an urban intelligent transportation system.

2. Material and Method

2.1. Study Area

China is the most populous developing country in the world, with the third largest land area in the world and the second largest economy in the world. The land area of China is about 9.6 million square kilometers, the eastern and southern mainland coastline is more than 18,000 kilometers, the water area of the inland sea and the border sea is about 4.7 million square kilometers, and there are more than 7,600 large and small islands in the sea. China borders 14 countries and is adjacent to 8 countries by sea. Provincial administrative divisions are divided into 23 provinces, 5 autonomous regions, 4 municipalities, and 2 special administrative regions.

After years of development, China has formed a multi-node, grid-like, and fully-covered comprehensive transportation network, and the "five vertical and five horizontal" comprehensive transportation corridors are basically connected. As of the end of 2019, a multi-level railway network has taken shape, with a total railway operating mileage of 139,000 kilometers, an increase of 6.1% over the previous year, of which high-speed railway operating mileage reached 35,000 kilometers. In addition, China has initially established a water transportation network connecting trunks and branches. The coastal ports as a whole are at a relatively advanced level in the world. The navigable mileage of inland waterways is 127,300 kilometers, ranking first in the world. There are 22,893 productive terminal berths, of which 2520 are berths of 10,000 tons and above. A. The civil airport system has basically taken shape, with 238 civil aviation transportation airports nationwide, and the overall safety level of civil aviation operations is relatively high.

2.2. Data Collection

For research purposes, we need to analyze the influencing factors of land passenger turnover. According to the characteristics of the land passenger transportation system and related literature summary, there are four main aspects that affect the land passenger turnover: the country's economic operation, the number of passengers, the operation of the land transportation department, and emergencies.

2.2.1. National Economic Operation

The operation of the country's economy directly affects residents' travel. Therefore, the GDP (100 million yuan), an indicator that directly reflects the country's economic operation, is

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selected to measure the impact of the country's economic operation on the land passenger turnover.

2.2.2. Number of Passengers

The difference in the number of passengers in each province will directly affect the land passenger turnover, so this paper selects the passenger traffic (100 million passengers) in each province as an indicator to reflect the number of passengers.

2.2.3. Operation of the Land Transportation Department

The operating conditions of railways and highways, such as capacity, coverage, operating mileage, etc., also have a certain impact on residents' choice of travel mode. Therefore, this article selects the highway mileage (km), railway operating mileage (km) and provincial area of each province (Square kilometers) these three indicators to reflect operating conditions.

2.2.4. Emergency

As we all know, the outbreak of covid-19 has had a great impact on China's national economy. As a basic, leading, service-oriented, and strategic industry of the national economy, transportation will also be subject to a greater impact in the context of the epidemic's major impact on economic development. Therefore, we boldly speculate that the spread of the new crown epidemic will have an impact on land passenger turnover, and the cumulative number of people infected with covid-19 (persons) is selected as an indicator to measure the impact of the new crown epidemic.

2.3. Inspection Method Selection

After analyzing and synthesizing multiple influencing factors, a multiple linear regression model is selected. This model can find significant influencing factors based on statistical tests and establish the optimal test model.

Table 1. Summary Statistics

Variable	N	Mean	Medium	SD	Min	Max
gross domestic product	31	32657.99	25115	687935956.06	1902.74	110760.94
Highway traffic mileage	31	161693.55	168700	7029508345.47	13000	337100
Railway operating mileage	31	4512.90	4800	6377252.86	500	13000
Provincial area	31	31.01	17.60	1452.55	0.60	166
Passenger traffic	31	3.16	2.84	5.07	0.38	8.78
Cumulative number of People infected with covid-19	31	2807.32	511	142552069.96	1	68149

3. Multiple Linear Regression of Land Passenger Turnover

3.1. Model Establishment

3.1.1. Symbol Description (Table 2)

3.1.2. Multiple Linear Regression Model

$$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \mu$$

3.1.3. Solving and Testing Multiple Linear Regression Models

This article uses stata 14 to solve the multiple linear regression model based on the above data. First, we try to use parameters other than the cumulative number of new crowns to fit, and the fitting equation with better goodness of fit is:

$$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \mu$$

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Table 2. The inspection result

parameter	description	unit
Y	Land passenger turnover	Kilometers of people
β_0	Constant term	
x_1	gross domestic product	100 million yuan
x_2	Highway traffic mileage	Kilometer
x_3	Railway operating mileage	Kilometer
x_4	Provincial area	Square kilometers
x_5	Passenger traffic	Billion person-times
x_6	Cumulative number of people infected with covid-19	people
μ	Random disturbance	

The inspection result is shown in the figure, which can be obtained from the inspection result,R^2=0.8812 adj-R^2=0.8565.It shows that the explanatory ability of the sample regression equation is 88.12%, and the explanatory ability of each variable on Land passenger turnover is good, that is, the goodness of the model is higher.Except for x1 and x2, the absolute values of the t-test of the other independent variables are all greater than 1, so they are all greater than the critical value of the t-distribution when the significance level is 0.1, and the null hypothesis is rejected. It shows that in this model, except for the gross domestic product and Highway traffic mileage, other variables have a significant impact on Land passenger turnover.

Through the above solution, we have established a mathematical model of Land passenger turnover that does not include Cumulative number of people infected with covid-19. At this time, we add Cumulative number of people infected with covid-19 into the model to get the fitting equation:

The test results are shown in the figure. We can see that in addition to the problems in the previous model, adding Cumulative number of people infected with covid-19 does not improve the goodness of fit of the model, and the absolute value of t is 0.03, in At a significance level of 0.1, the Cumulative number of people infected with covid-19 has no significant impact on Land passenger turnover.

Table 3. The regression results of revised model

	(1)	(2)
Variables	unitp	unitp
gross domestic product	0.002	0.002
	(0.138)	(0.205)
Highway traffic mileage	0.0002	0.0002
	(0.642)	(0.650)
Railway operating mileage	0.045***	0.045***
	(0.000)	(0.000)
Provincial area	1.826***	1.83***
	(0.004)	(0.005)
Passenger traffic	86.1***	86.1***
	(0.008)	(0.000)
Cumulative number of People		0.002
infected with covid-19		(0.973)
Constant	−178.754***	−179.2***
	(0.008)	(0.01)
N	31	31
R-squared	0.8812	0.8812

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Robust P > |t| in parentheses are clustered at community level for all the equations, *** p<0.01, ** p<0.05, * p<0.1

4. Empirical Analysis

The changes of the independent variables Railway operating mileage, Provincial area, Passenger traffic and Land passenger turnover are positively correlated, that is, the directions of changes are the same. Railway operating mileage represents the level of highway construction in our country. The increase in highway mileage indicates that our people are more convenient to travel, and we can have good traffic conditions, which provides favorable conditions for promoting a more balanced development of our country.

With the continuous improvement of people's living standards, more and more people choose to travel. Among the main modes of transportation, railways and roads are still people's limited choices of travel, especially due to the impact of the epidemic on the country's strict aviation control and due to aircraft Airtightness In the special period, people have reduced the choice of air travel, resulting in land transportation becoming the main mode of transportation in the special period.

From the test results in the previous part, we can see that the impact of gross domestic product and Highway traffic mileage on Land passenger turnover is not significant, indicating that the economic development of the region during the epidemic has a small impact on people's land transportation travel and that the mileage of road traffic is more important than that of people. The traffic trip has nothing to do.

In addition, according to the test results, the Cumulative number of people infected with covid-19 has no significant impact on Land passenger turnover, because the degree of epidemic situation varies from place to place, but the final test result shows Cumulative number of people infected with covid-19 has nothing to do with Land passenger turnover. This shows that my country's epidemic control is better and the epidemic prevention policy is relatively strict. Under the strict prevention and control of the government, even in areas with a small Cumulative number of people infected with covid-19, the number of travelers will decrease accordingly. This reflects the superiority of our national defense epidemic policy.

5 conclusion

This paper finds that due to the pandemic, people's willingness to travel and use public transport has decreased significantly. Thus, we make the following conclusions. Firstly, different sites will be affected by the surrounding environment, geographical location, per capital income of surrounding areas, age of surrounding residents, educational level, and other factors. Secondly, according to the characteristics of the overland passenger transport system and the relevant literature review, the turnover rate of overland passenger transport is mainly affected by four aspects: national economic operation, the number of passengers, the operation of the overland transport sector, and emergencies. Third, due to the influence of national air traffic control, land transportation has become the primary mode of transportation in particular periods. The impact of GDP and road traffic length on the road passenger turnover rate is not particularly obvious, indicating that the regional economic development has little impact on people's road travel during the epidemic period. Because the cumulative number of infected people has no significant impact on the land passenger flow, the pandemic's severity varies in different regions. The final empirical results show that the cumulative number of infected people with COVID-19 has nothing to do with the Land passenger flow, suggesting that China has better pandemic control and a strict pandemic prevention policy. In this paper, we also put forward strengthening the diversity of urban transportation supply, optimizing the urban logistics transportation system, and constructing an urban intelligent transportation system strategy.

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