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Impact of COVID-19 on transportation and logistics: a case of China

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ABSTRACT

Recent research has shown that the COVID-19 pandemic has holistically affected the financial and industrial sectors of China, in a considerably adverse manner. This paper aims to examine the impact of the COVID-19 virus on the transportation and logistics sector in China. In this regard, the study opted for a quantitative method of research design, along with primary data collection. The explanatory variable here is the COVID-19 virus, whereas, the dependent variables are air freight, ocean freight, and land freight. The data analysis technique used is the Structural Equation Modelling (SEM) analysis, comprising of the Confirmatory Factor Analysis (CFA) and the path assessment method. A structured survey questionnaire was also used, and the survey questionnaire scale was set from strongly agree to disagree strongly. The findings revealed that the effect of COVID-19 on air freight is statistically negative and significant. Moreover, the impact of COVID-19 on land freight is statistically negative and significant, whereas the effect of COVID-19 is statistically insignificant in the context of ocean freight, particularly during the period of the COVID-19 pandemic. Therefore, keeping these results in consideration, policymakers can enhance their support, so as to increase the performance of the logistics and transportation sector in China.

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1. Introduction

The core aim of the logistics and transportation firms is primarily based on the moving, storage, and flow of goods that can be done effectively with the help of proper channels (Umar, Ji et al., 2021). However, according to Haque et al. (2020), it has been argued that the existing firms have been considerably and adversely affected due to the COVID-19 pandemic. It is noteworthy that the pandemic has exposed the fragility of matters and operations in the corporate sector, and has also brought new

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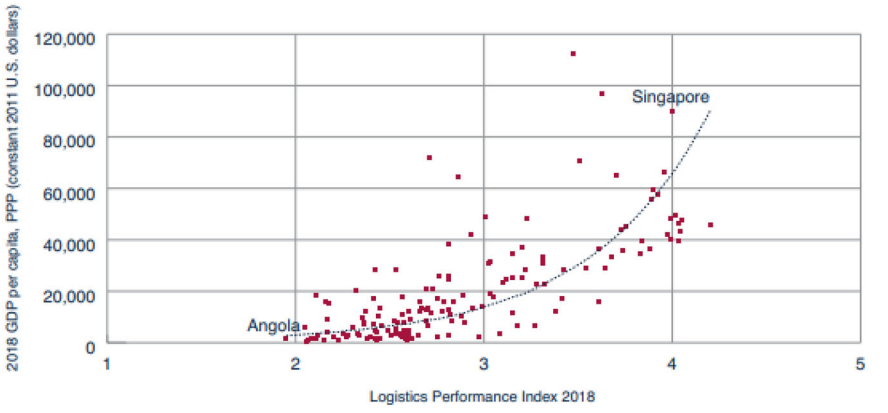
challenges for them. Policymakers have been facing the daunting task of supporting health care and unemployment, all within the economic and financial framework interventions so as to prevent an economic shutdown (Gao et al., 2021; Su, Dai et al., 2021; Yarovaya et al., 2021). Moreover, businesses have also attempted to adjust towards the transformation of the customers and suppliers paradigm, while at the same time, trying to resist any potential operational and financial issues (Mirza, Hasnaoui et al., 2020; Su et al., 2020; Su, Huang et al., 2021; Umar, Su et al., 2021). In addition to this, the firms have also been facing issues in managing the supply chain across the borders and facilitating the means of trade and business in this regard (Dimakou et al., 2020). The pandemic issue has disrupted supply and has also affected the supply and demand in the different countries, as referred to in the study of Apfalter et al. (2020). As a result of this poor performance of logistics and transport, there are limited opportunities for trade that have also affected the economic growth and job creation at the same time, based on the study of the International Development Association. In addition to this, Singh et al. (2021) have highlighted that the transportation companies also carried out different modes of transport and logistics, such as freight forwarding, warehousing, managing inventory, and other multi-model transportation in an effort to mitigate the chances of potential economic risks.

Similarly, global manufacturers have also utilized their modes and methods of transportation that can be considered as a significant component for supplying the goods and services to consumers (Haque et al., 2020). There happens to be a strong relationship between the factors of logistics and the economy, based on the various different functions and operations performed by the companies for trade, which ultimately improves the economic returns (Queiroz et al., 2020; Umar et al., 2020). In this regard, Loske (2020) has also highlighted that the cost of logistics in terms of the GDP percentage is about 25% in the developing countries, where there are higher requirements of keeping track of the products that are needed to be delivered in a timely manner . However, it has become increasingly and severely complicated for the economies to address the problems, and manage their solutions when it comes to the current COVID-19 pandemic situation. this novel virus has created several hurdles for many countries, as referred to in the arguments presented by Grida et al. (2020). In this regard, Figure 1 below presents the contribution of the logistical performance on the GDP in some countries, and indicates that the logistical performance of any country significantly contributes towards its GDP.

Moreover, it has also been observed that the wellness of the transport and logistics sectors can also create growth opportunities, which at the moment are being hindered due to this pandemic. It can make the means of gaining a competitive advantage in the emerging markets, as propagated by Wuest et al. (2020). On the other hand, the current issue of the COVID-19 pandemic been observed to have affected the manufacturing firms, and all the other small and large organizations as well (Xu et al., 2020). This is primarily due to the fact that the manufactured material cannot be transported to their respective locations in a timely manner, and the raw material for further production is also unable to reach companies, for them to develop the final output (Amankwah-Amoah, 2020). According to the findings of Dimakou et al. (2020), several travel restrictions are also applicable for the truck drivers and the



Source: World Bank (2018)

Figure 1. Logistic Performance Index 2018.
Source: World Bank (2018).

containers, which have led to a significant factor of perilous hurdles for the carriers, and have also resulted in a shortage and hindrance of operations in the industry. Similarly, due to poor transportation in times of the COVID- 19 pandemic, many firms belonging to the automotive, pharmaceuticals and medical equipment industries, and other relevant sectors have also been highly challenged. They have had to face severe losses due to poor transportation and logistics in the current situation (Gkiotsalitis & Cats, 2020).

As and when the pandemic started to pick up pace in China, which is considered to be one of the biggest suppliers of goods worldwide, the spread of COVID-19 gave birth to several restrictions in managing the long-haul trucking sector that carried more than 80% of the country's interests (Xu et al., 2020). Furthermore, it was been observed that the effects of the lockdown situation adversely affected the transport and logistics in China. In addition to this, it was also observed that the concept of long-haul trucking fell below below 15% for the year 2019 alone. Earlier it had increased by 92% in February (Xu et al., 2020), which was obviously a success factor for the logistics and transportation sector of China, and also benefited multiple other industries. This was primarily because certain government policies had been put into place, and were implementing the requirements of quarantine for trucks and other essential goods based on the study conducted by Liu et al. (2020). Therefore, keeping these intricacies and situations in mind, this study aims to assess the impact of the COVID-19 pandemic on the logistics and transport sector of China. There has been an effort made to address the specific issues that have cropped up pertaining to the lockdowns. Moreover, the researchers have also highlighted the significant impact that has been imposed by the current lockdown situation in the countries that have had their trade and transport severely and adversely affected due to this pandemic.

It is noteworthy that even though transportation and logistics have been critically affected, at the same time a study by Gkiotsalitis and Cats (2020) has shed light on the aspects pertaining to ocean freight, land freight, and air freight, as these are considered to be three of the most relevant and common sources of transportation that

are available. Based on the assessment of the dynamics pertaining to ocean freight, data revealed that the containers had poor performance due to quarantine restrictions, and there was also weak demand for goods from other countries due to the apprehension that it might increase the chances of getting affected by the deadly virus (Paul & Chowdhury, 2020). Data also showed that land freight, however, was partially available for the countries, as it was a safer option and could have been considered by the companies as a method of transportation based on the assessment of the situation at the time (Wuest et al., 2020). Additionally, air freight was also affected in the COVID-19 pandemic, as the companies and manufacturers tended to have a high level of exposure to the traded goods, and also experienced an increase in the demand for goods and services, based on a study conducted by Ivanov and Das (2020).

The following research has contributed towards assessing the current COVID-19 pandemic, and its impact on the different methods of transportation in the countries that have been taken into account. In this regard, the researcher has highlighted other means of transport, and has also addressed the various transportation methods in the countries. At the moment, there is relatively limited literature that has been developed on the COVID-19 influence, particularly on the aspects of logistics and transportation. Therefore, it has been deemed imperative to study this pandemic in thorough detail, since it has significantly influenced economies, countries, and businesses as well (Rizvi, Mirza et al., 2020; Rizvi, Yarovaya et al., 2020). Therefore, this research will contribute significantly to the present literature, especially when it comes to analysing the impact of COVID-19 on transportation and logistics.

2. Literature review

COVID-19 has created problems for each field in the world and has been affecting the performance and profitability of each sector (Mirza, Hasnaoui et al., 2020; Mirza, Naqvi et al., 2020). Loske (2020) has highlighted that logistics and transportation have been considered one of the most profitable fields that are also necessary for businesses to carry out operations and manage the functions based on the supply chain. Admiringly, based on the assessment of Docherty et al. (2021), the logistics has been badly affected by the outbreak of COVID-19 disease as the government has imposed several regulations and has restricted the businesses to carry out the operations in this regard. By the end of January 2020, the pandemic situation was stated and gave rise to the COVID-19 issue that has taken over all the countries in this world, as referred to in the study of Suau-Sanchez et al. (2020). The death ratio has also increased as the stats show 435,000 death in 185 countries (Falchetta & Noussan, 2020).

On the other hand, many people have recovered from the cases and were treated well, as referred to in the study of Chiaramonti and Maniatis (2020). However, the government in different countries has created restrictions and policies to safeguard the people from getting harm and prevent the diseases from spreading (Zhang, 2020). However, these regulations and policies have also created a worse impact on the country's economy as the businesses are unable to carry out the operations as they

were booming in the previous years, according to the arguments of Bhat et al. (2020). In addition, with the trade, manufacture, and other areas of businesses, the field of transportation and logistics has also been badly affected. It has resulted in a poor impact on the overall GDP growth rate in countries worldwide, as referred to in the report provided by Suau-Sanchez et al. (2020).

Transport connectivity plays a major role in trade, tourism, and the movement of goods, integration, and competitiveness in different markets (Wuest et al., 2020). However, the limitations in this field have created issues for the countries to gain the profitability that they were gaining in the previous years, according to the arguments of Docherty et al. (2021). The following section of the literature has highlighted the key aspics present concerning the freights and transport in different countries and the modes of transportation used. Furthermore, the researcher has also assessed the different means of freight and has investigated the impact of the COVID-19 pandemic on these freights in different countries, mainly in China.

2.1. Impact of COVID-19 on transportation and logistics

H_{O1}: COVID-19 has a significant impact on Ocean freight.

The businesses can use different means of transportation in different countries to carry out the operations based on logistics and supply chain management based on (Tardivo et al., 2020) assessment. Rewari et al. (2020) have highlighted that the connectivity between different businesses and the trade routes can only be developed with better transportation arras and creating the activities that can be effective for carrying out the trade in the countries. As referred to in the study of Thuy et al. (2020) the different means of transportation can be used by businesses to create growth opportunities and create measures for better trade and portability in the countries. It has been observed that one of the major routes that are generally used for transportation is the ocean routes that the firms can use in different countries for dealing with the supply chain activities based on the assessment of Gray (2020). It has also been discussed that there have been different changes related to ocean freight worldwide due to the COVID-19 pandemic that has created constraints for the countries for carrying out the means of transportation (Yazir et al., 2020).

The restrictions on the ports and borders have created issues for the businesses to supply the material and other different products to be transported through the sea routes based on the assessment of Klatman et al. (2020). Global shipping has been drastically affected when it comes to the sea routes and other waterways for traveling and moving goods to other counties, according to the arguments of Kwon (2020). The staff working as crew for the waterways is also less as the issue of health and other common accidents currently faced in this situation of COVID-19 pandemic (Ivanov & Das, 2020). Similarly, the regulations in the countries have also reduced the number of goods traveled and have also increased the cost and duty over the products due to the reason od increased safety of the products in this regard, according to Tardivo et al. (2020). Hence, all these issues have created a challenge for the ocean freight to carry out in this pandemic.

H_{O2}: COVID-19 has a significant impact on land freight.

On the other hand, another means of transport that is under consideration island freight includes all the means of transportation on land by the railways or roadways. One of the major challenges faced by land freight is increased manufactured goods that have created challenges for the land travelers for dealing with freight issues based on the arguments of Jain and Sharma (2020). It has been observed that the capacity for ocean transport has decreased, which has also increased the pressure on the land freight and badly affected the timely services for logistics and transportation, as referred to in the study of Siddique et al. (2021). The significance of the COVID-19 pandemic has created a major shift from physical buying to online buying that is also one of the significant challenges in creating the increased pressure on the land freight, as referred to in the study of Benmarhnia (2020).

The research conducted by Gordon et al. (2021) has also highlighted that the traveling of goods has been increased through the land ways in the city and the country that has also reduced the capability of the land routes to carry out the operations in terms of international delivery and transports. Additionally, the study of Lynch and Goring (2020) has emphasized the crisis that requires a re-evaluation of supply chain management. This disruption is due to shuttered production and decreasing sales in the countries in this regard, based on the assessment of Wu et al. (2020). Chins have been creating methods for land freight that can be effective in reducing the risk of reintegration for the fabric business in Asia.

H_{O3}: COVID-19 has a significant impact on air freight.

The third and most commonly used method of transportation is air freight that is under consideration in the following research. Erkhembayar et al. (2020) have highlighted that air freight has faced a huge negative impact due to the COVID-19 pandemic and has created challenges for travelers and moving goods from different locations. Ali and Raja (2020) have also assessed that this air freight has faced challenges due to the COVID-19 pandemic because of increased regulation and restrictions in the markets and airlines. It has been observed that the government has imposed regulations for enhancing safety and creating the safest measures for traveling across the countries with the help of air freight and airlines based on the assessment of Cavaglià et al. (2020). The moving of goods, but the issue of this pandemic has also created several challenges for the people to travel and has badly affected the means of transportation in this regard (Gkiotsalitis & Cats, 2020). There are challenges in addressing the aviation staffing requirements and organizing the means of efficiency and effectiveness in this regard based on the assessment of Ali and Raja (2020). It has been observed that these challenges have created problems for the safety measures and have been affecting the means of transportation in the country in this regard, as referred to in the study of Hagman (2020).

3. Theoretical framework

3.1. Total cost of ownership (TCO) theory

As referred to in the study of Hoek (2020), the total cost of ownership (TCO) theory suggests considering the purchases of the products. It has been discussed that the

firms shall consider purchasing the goods and assess the other costs related to the cost factors as referred to in the study of Hagman (2020). This is one of the most holistic approaches that can be assessed in the current field and can be used for assessing the cost of reliance that needs to be considered for having benefits of the resiliencies (Noorbakhsh et al., 2019). The theory can be applied in the case of risk management in the current COVID-19 pandemic situation that has highly affected transport and logistics in the countries (Bacchetti et al., 2018; Su, Sun et al., 2021). Therefore, it can be stated that there are different costs applied in the manufacture and transportation of the products that require extra cost and increases the overall cost of products after shipment based on the assessment of Hoek (2020). The cost of the products may be reduced with the help of the low-cost factor applied by the TCO theory that has highlighted manufacturing in the low-cost regions. Moreover, Noorbakhsh et al. (2019) have also highlighted that the TCO may also be shifted to address the low factor cost country sourcing. This can be applied in the following case of the COVID-19 pandemic, where it has been observed that there are different kinds of costs applied in the unfavorable conditions of the transport.

3.2. Requirements chain management model

The model of requirements chain management is based on addressing the supply needs and expectations that can be discussed and between the businesses and the 3PL that can be determined for assessing the needs and expectations of the people in the relevant businesses (Tönnissen & Teuteberg, 2020). It has been observed that the quadrants that are present in this model are identification of the constraints, exploitation of constraints, subordinating things and system constraints, elevate system constraints, and the identification of the next constraints in this regard, according to Agrawal and Narain (2018). It has been observed that this model can be applied to the following case to assess the problems and identifying the relevant solutions for supply chain management. The issue of the current pandemic situation of COVID-19 has badly affected the logistics and transport in the country of China. The model would further provide the solutions for dealing with the constraints present in the current industry as it supports the businesses in subordinating the system and its constraints for the supply chain (Yazdani et al., 2017).

4. Conceptual model of the study

The study intends to determine the impact of COVID-19 on transportation and logistics, considering the case of China. In this regard, the study has included key aspects of logistics and transportation in the literature, and therefore, the hypotheses have been constructed. Based on the hypotheses, the researcher has formulated the conceptual model depicted in Figure 2. The figure indicates that dependent constructs are ocean freight, land freight, and air freight whereas, the independent construct is COVID-19.

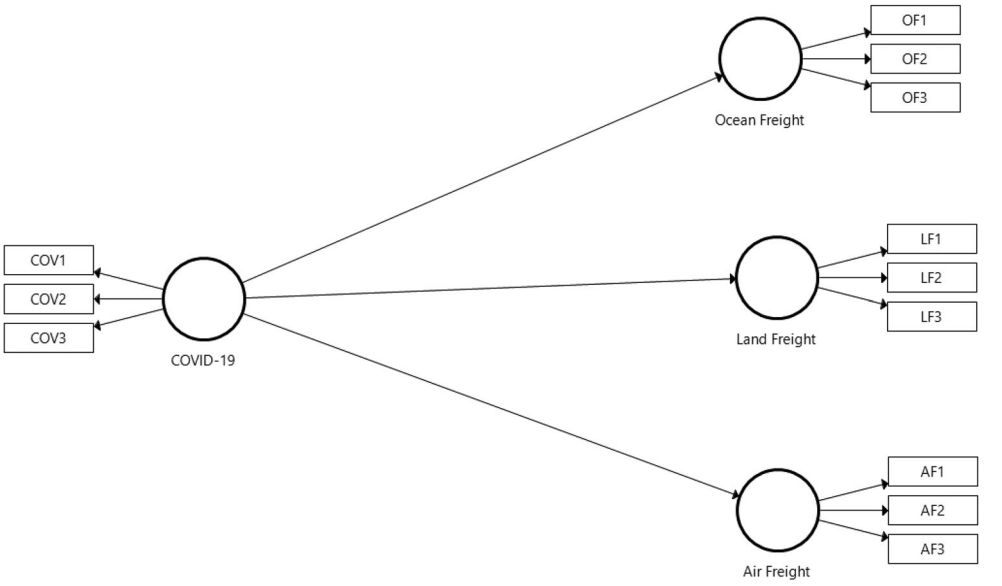


Figure 2. Conceptual model of the study.
Source: Author Estimation.

5. Research methodology

To determine the impact of COVID-19 on transportation and logistics in China's case, the researcher had opted for a quantitative method of research design along with primary data collection. The purpose of using the quantitative method was to determine the relationship between the independent and dependent variables (Qureshi et al., 2018). The independent variable is COVID-19 whereas, the dependent variables are air freight, ocean freight, and land freight. They all are a part of transportation modes. Due to COVID-19, it is evident that many industries are affected, and one such was the transport and logistics industries where all goods transit were stopped, and most of them were stranded on their ports. This is why the following study has examined this through primary data so that a conclusion can be achieved as to how COVID-19 has affected the transport and logistics systems. Since China has been affected, the case of China was selected for this study as the virus emerged from Wuhan, China and still, the country is taking strong measures to stabilize its economy.

To achieve the desired aim of the study, the researcher had conducted a Structural Equation Modelling (SEM) analysis comprising of Confirmatory Factor Analysis (CFA) and path assessment. SEM is a multivariate statistical technique applied for analyzing structural relationships (Afshan et al., 2018; Afshan & Sharif, 2016). The technique is known as the combination of factor analysis and regression analysis. It usually includes CFA for factor analysis and path assessment for regression analysis (Bowen & Guo, 2011; Frooghi et al., 2015). The data analysis technique also includes the model's quality, blindfolding, and summary of the proposed hypothesis. A structured survey questionnaire was used for data collection, which consisted of questions regarding different variables used in this study. The scale of the survey questionnaire was set from strongly agree to strongly disagree. The respondents were asked to select

Table 1. Reliability and convergent validity of the constructs.

Latent Constructs	Indicators	Factor Loadings	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Air Freight	AF1	0.821***	0.748	0.857	0.670
	AF2	0.935***			
	AF3	0.680***			
COVID-19	COV1	0.837***	0.841	0.904	0.759
	COV2	0.884***			
	COV3	0.891***			
Land Freight	LF1	0.856***	0.921	0.951	0.866
	LF2	0.967***			
	LF3	0.964***			
Ocean Freight	OF1	0.866***	0.870	0.909	0.770
	OF2	0.834***			
	OF3	0.929***			

***: indicating significance at 1%.
Source: Author Estimation.

the most appropriate option and, based on that, submit their questionnaire. The questionnaire has been collected for five months, and the respondents include supply chain managers and employees. The total sample size was 315 because small sample size is not adequate for obtaining significant results or being considered reliable. Large sample size was used to obtain authentic results and show the true picture.

The data was collected from the employees working in the transportation and logistics sector, and they were experienced and had information about how their industry is adversely affected due to COVID-19. Furthermore, the researcher had also ensured to follow all ethical guidelines because it is very important to conduct the study ethically. The survey was shared online after taking consent from the respondents, and they have shared an ethical form consisting of all the regulations. They were also informed about the aim and objectives of this paper and why this study needs their opinion in the form of the survey. The personal data of the respondents was not shared with any external source, and all the data was safely stored in devices.

6. Results and discussions

To attain the aim of the study, the researcher has conducted an SEM analysis comprising of CFA and path assessment. Based on these aspects, this section includes results associated with CFA, path analysis, model quality, blindfolding, and a summary of the proposed hypotheses.

6.1. Confirmatory factor analysis (CFA)

The primary purpose of CFA is to determine the validity and reliability of the constructs that the study has included (Sharif et al., 2019). In this regard, the validity of the factors has been evaluated using factor loadings. The study conducted by Hair et al. (2011) stated that the threshold for the factor loadings is 0.6. Therefore, the values above this threshold are valid. In this concern, the results presented in Table 1 indicate that none of the indicators is required to be dropped since all of them are above 0.6. On the other hand, the study of Latan et al. (2017) opined that the value of Cronbach Alpha and composite reliability should be above 0.7 to declare a variable

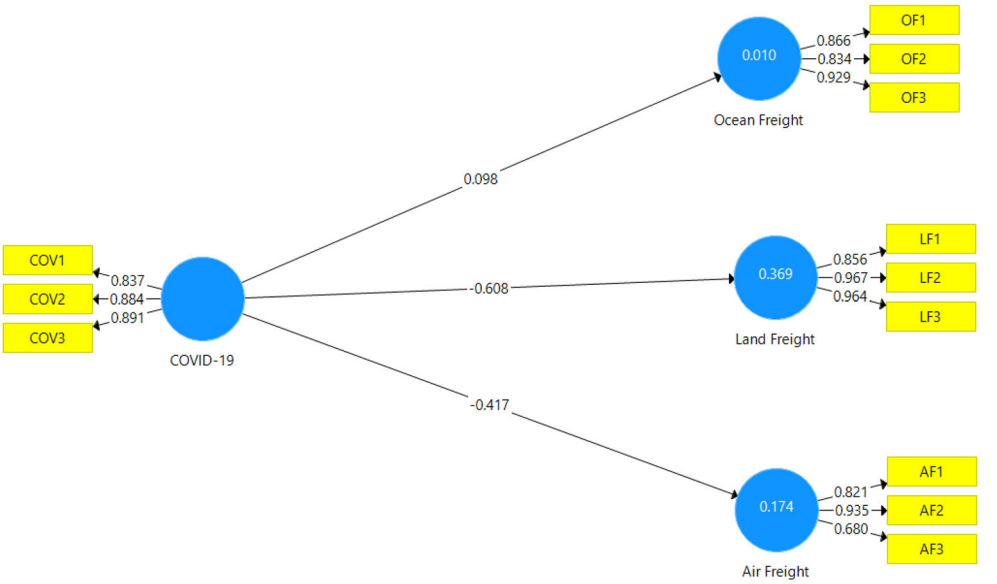


Figure 3. Measurement model.
Source: Author Estimation.

statistically reliable. Therefore, the latent constructs used in this study can be regarded as reliable since all the values of Cronbach Alpha and composite reliability is above 0.7. Moreover, convergent validity is considered the degree of relatedness between the latent constructs, and it is generally measured using Average Variance Extracted (AVE), having a threshold value of 0.5 according to the study of Avkiran and Ringle (2018). The results obtained in this study assert that all the latent constructs are statistically and convergently valid. In addition, the measurement model can also be seen Figure 3: Measurement Model.

In addition to the determination of the convergent validity, it is also necessary to determine whether the latent constructs are too much associated with each other or not. In this regard, it is required to evaluate the degree of distinctiveness which in this study is determined using the HTMT ratio. The study carried out by Brown (2015) opined that the value of the HTMT ratio should be below 0.9 as a liberal criterion of discriminant validity. In this concern, the results have been presented in Table 2. The results show that none of the constructs has a high association with the other construct, which validates the discriminant validity between the constructs.

6.2. Path analysis

Following the determination of the factor structure, reliability, and validity of the constructs and indicators, the study's researcher tested the path based on the hypotheses formulated earlier. To fulfill this, the researcher conducted bootstrapping. The study conducted by Civelek (2018) professed that bootstrapping can be deemed a resampling technique and useful to obtain significant values. The results in this regard have been presented in Table 3. According to the results, the effect of COVID-19 on the air freight is statistically negative and significant [B= −0.417; p-value= $0.000 < 0.01$].

Table 2. Determination of discriminant validity using HTMT ratio.

	Air Freight	COVID-19	Land Freight
COVID-19	0.513		
Land Freight	0.337	0.686	
Ocean Freight	0.111	0.096	0.112

Source: Author Estimation.

Table 3. Path analysis.

Path	Path Coefficient (B)	T Statistics	*p* values
COVID-19 -> Air Freight	−0.417	7.338	0.000
COVID-19 -> Land Freight	−0.608	15.348	0.000
COVID-19 -> Ocean Freight	0.098	1.522	0.128

***: indicating significance at 1%.
Source: Author Estimation.

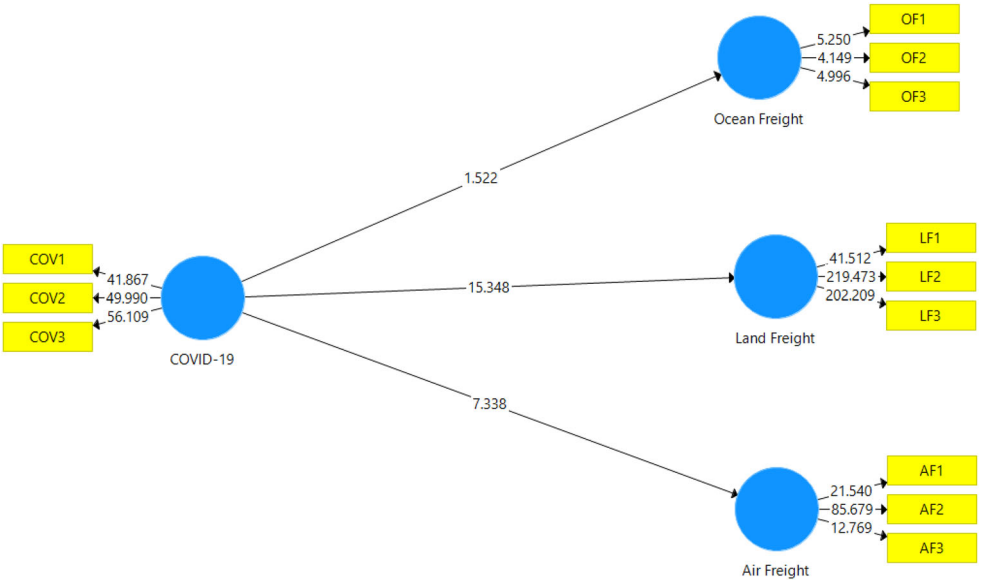


Figure 4. Bootstrapping with T-statistics.
Source: Author Estimation.

Moreover, the effect of COVID-19 on the land freight is also statistically negative and significant [B= −0.608; *p*-value= 0.000 < 0.01]. The negative effect indicates that on land and air, COVID-19 has affected logistics and transportation adversely. On the other hand, the effect of COVID-19 is found to be statistically insignificant on ocean freight. The results that have been discussed are presented in Figure 4 as well.

6.3. Quality of the model and predictive relevance

Following the study of Leguina (2015), the quality of the model can be determined with the help of R-squared. In this regard, the results have been presented in Table 4: R-squared and Blindfolding (Q-square). It has been found from the analysis that the variance in COVID-19 is explaining 17.42% variance in the air freight whereas

Table 4. R-squared and blindfolding (Q-square).

	R Square	R Square Adjusted	Q-square
Air Freight	17.42%	17.15%	0.110
Land Freight	36.94%	36.74%	0.315
Ocean Freight	0.97%	0.65%	0.003

Source: Author Estimation.

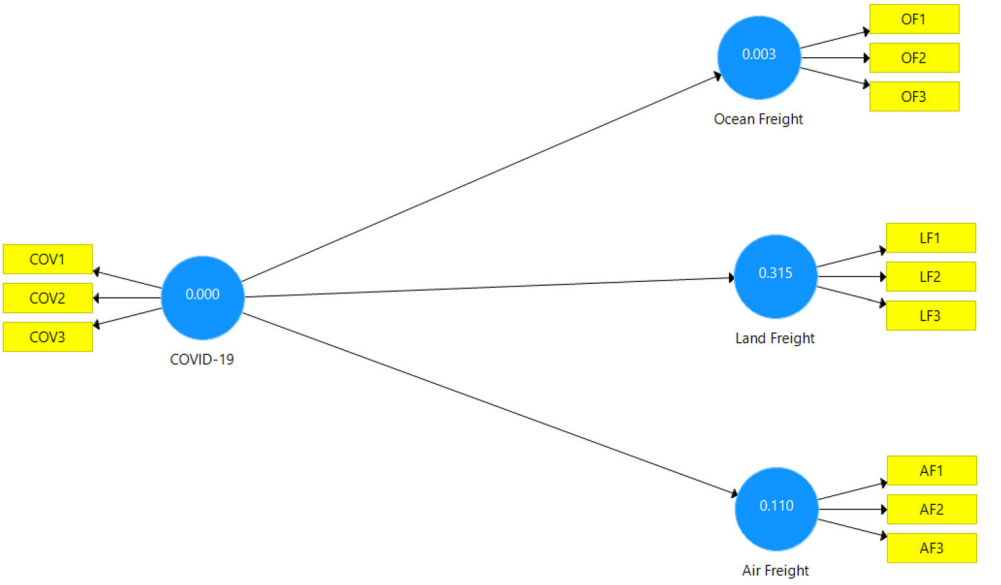


Figure 5. Blindfolding.
Source: Author Estimation.

36.94% variance in the land freight. However, in terms of ocean freight, the variance explained is only 0.97%. This indicates that the highest effect is found on land freight. Besides, to determine the predictive relevance of the model constructed in this study, the researcher has used Q-square obtained after blindfolding. The research of Hancock and Mueller (2013) asserted that the value of Q-square should be above 0 to declare a model possessing any predictive relevance. Therefore, the results presented in Table 4 and Figure 5 show that only air freight and land freight possess considerable predictive relevance whereas, for ocean freight, the value of Q-square is extremely low in the context of China.

6.4. Hypotheses assessment summary

The hypothesis assessment summary provides evidence of whether the initial hypothesis is accepted or rejected. The purpose of analyzing the hypothesis is to know whether the testing has been proved to be significant or not and whether the aim of the study is achieved. The researcher aimed to determine the impact of COVID-19 on transportation and logistics in China's case; hence, the variables selected were air freight, ocean freight, and land freight of transportation and logistics. The following hypothesis was prepared, and the results are shown below:

Hypothesis	*p* values	Accept/Reject
There is a significant impact of COVID-19 on Airfreight	0.000	Accept
There is a significant impact of COVID-19 on Land freight	0.000	Accept
There is a significant impact of COVID-19 on Ocean freight	0.128	Reject

After carrying out statistical analysis through SEM analysis comprising of CFA and path assessment, it was found that the first hypothesis was related to whether there is a significant impact of COVID-19 on Airfreight. The p-value was 0.000, which is way too less than 0.05; hence, it can be stated that the hypothesis was accepted and that there is a significant impact of COVID-19 on Airfreight. The following hypothesis was whether there is a significant impact of COVID-19 on land freight or not. The p-value was 0.000, which is way too less than 0.05; hence, it can be stated that the hypothesis was accepted and that there is a significant impact of COVID-19 on land freight. The last hypothesis was whether there is a significant impact of COVID-19 on Ocean freight. The P-value was 0.128, and since this value is above 0.05, there is no significant impact of COVID-19 on Ocean freight. The hypotheses are rejected on this basis.

6.5. Discussion

The following discussion is based on the results obtained after carrying out statistical analysis. The sample was 315, and the tests carried out were SEM analysis comprising of CFA and path assessment. Based on the primary findings obtained, it was determined that the effect of COVID-19 on air freight is statistically negative and significant. The effect of COVID-19 on land freight is also statistically negative, and significant COVID-19 is found to be statistically insignificant on ocean freight. The negative impact shows that COVID-19 has affected land and air freight adversely. Based on these findings from the path analysis above, it is evident that ocean freight is less used for freight as it takes too long whereas, common modes of transportation are air and land.

Most of the deliveries are timely delivered through air and land mode of transport which are comparatively more expensive transportation channels. However, due to COVID-19, most countries had closed their air, land, and ocean routes, so cargo deliveries were delayed. In the case of China, from where the COVID-19 had spread, other nations rejected anything from the country and closed all their deals temporarily. China was adversely affected, and the economy almost slowed down in the second quarter but, they managed to control the situation and conducted widespread fumigation.

It was also found from the existing studies that logistics firms facilitate trade and help businesses deliver their products to customers. The major adverse impact on the supply chain results in a lack of competitiveness, economic growth, and losing jobs. Many of the employees working in the logistics and supply chain sectors lost their jobs because no cargo or any orders were delivered or dispatched from one country to another. The current global value chain system requires great resilience and efficiency in the flow of goods.

Even outsourcing products or giving them to third parties will not benefit the logistic companies as due to COVID-19, all the processes have come to a halt. China is a major supplier and manufacturer of large companies that fall under the Global 500 fortune companies. Major containers were backlogged at a Chinese port, and travel restrictions of all kinds were placed. Even other industries like electronics, pharmaceuticals, and automobile, and medical equipment deliveries were adversely affected. The lockdown placed across the world and the restrictions of product deliveries had affected the logistics chain, and it became difficult for consumers to receive their goods timely. For the supply chain companies, one of the major issues was also the safety of the drivers and employees as they could become the victim of the deadly virus.

7. Conclusion, policy recommendation, and limitations

To conclude the paper, it can be stated that the researcher developed the aim to determine the impact of COVID-19 on transportation and logistics in the case of China, for which primary data was collected. The total sample size was 315, and the data was collected from the employees working in the transportation and logistics sector. The findings found that the effect of COVID-19 on air freight is statistically negative and significant. The effect of COVID-19 on land freight is also statistically negative and significant, whereas COVID-19 is found to be statistically insignificant on ocean freight. For this reason, it is suggested that new safety protocols should be developed for staff health, and new protocols for warehouses should also be developed so that the areas are disinfected at all times. Charter flights should be used instead of the normal modes of transportation. Airlines can use passenger airplanes for cargo as a very less number of passengers are now traveling due to restrictions. Logistic companies are also delivering medical supplies. Hence, no-contact delivery options should be used to deliver the essential supplies to the customers.

7.1. Policy recommendations

There are certain policy implications from the findings of the study. It is implied that the policymakers can enhance their support for increasing the performance of the logistics and transportation sector. The COVID-19 influence has been adversely influencing logistics and transportation, and it is quite challenging to recover from the pandemic. Therefore, the policymakers can help and support to increase performance and recover from the pandemic situation. The transportation and logistics sector has contributed significantly to economic growth; hence, regulators and government must work on improvement and recovery.

7.2. Limitations and future work

Even though the following study was conducted to determine the impact of COVID-19 on transportation and logistics in the case of China still, the region of the study is restricted, and this study cannot be applied to other regions. However, the COVID-

19 has affected every industry globally. Hence, the study scope could be broadened by taking the sample from other countries and then carrying out a detailed analysis. In this manner, the comparison between the countries could also be done easily. Secondly, the scope of this study could also be improved by carrying out primary analysis and secondary analysis. Several journals and articles are published related to the impact of COVID-19 on the transportation and logistics industry; hence, large economies like the US and Italy could be used to collect data.

Furthermore, in this paper, the researcher has taken the sample in primary form only, but the study could also gather statistics from different industries of logistics and transportation sales and growth and then analyze whether COVID-19 has hit these industries or not. Apart from the sample and the region, the following study was prepared in a limited period with a limited budget, due to which it was difficult to complete the analysis on time as it required statistical testing and in-depth analysis. Moreover, this study is significant for the logistics and transportation industry as it will provide an overview of how and to what extent COVID-19 has affected them and how they can combat it. COVID-19 has affected industrial production and growth that is why the overall profitability has declined.

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