

China's Air Freight Market Observation before and after the COVID-19 Outbreak and Its Enlightenment

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Abstract: The COVID-19 pandemic impacted our lives, as well as our economy and society severely. Air freight has been playing an important role in the epidemic prevention. However, it also impacted by the COVID-19 severely. It is a primary task to promote our air freight capacity to enhance the safety of our industrial chain and supply chain, in the context of the COVID-19 pandemic. To take meaningful comparisons from a holistic perspective of the air freight market, analyses are conducted based on the market shares rather than absolute values of cargo volume. We analyze the impact of the COVID-19 on air freight market shares, conduct operation comparison of main types of air freighters, rank top 20 city-pair in cargo weight flying by overseas airlines, compare the load of air freighters of domestic and overseas airlines, before and after of the COVID-19 outbreak, and propose some suggestions to promote the air cargo sector in China.

1. Introduction

The COVID-19 is hitting human being's lives hard. It requires that we take timely and completely protective measure to defend human beings from its attack and save our lives. To take effective measures, one of essentials is adequate and timely medical protective goods and materials. Air transportation plays an important part in providing goods and materials of this kind. Meanwhile, to retard the epidemic of the COVID-19, flights are reduced dramatically, and thus air transportation is also impacted heavily. To break the vicious circle, we shall first evaluate the impact of the COVID-19 on the air transportation, especially on air freight. The changes to air cargo and air passengers in China during 2012-2020 are illustrated in Fig. 1. It is apparent that the impact on air passengers is much heavier than air cargo.

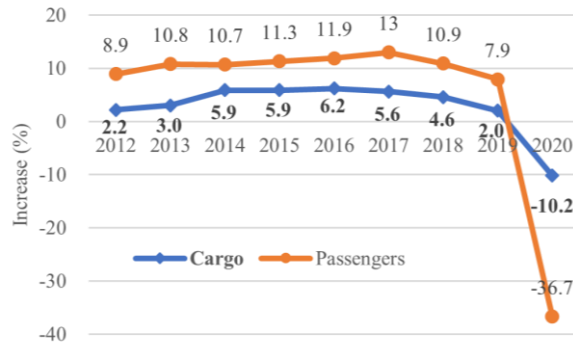


Figure 1: Air cargo and air passenger changes in China during 2012-2020

Many research efforts have been dedicated to China's air cargo. Jiang et al.[1] presented a forecast of China's air cargo demand through 2020 based on the association between economic development and air cargo traffic. Wu et al. [2] concluded that rising demand provided Chinese airlines with opportunities to develop air cargo business. Merkert et al. [3] deemed that air cargo is likely to become some Chinese airlines' primary business rather than by-product. Qia et al. [4] analyzed spatial spillover effects of logistics infrastructure on regional development in China. Tao Li [5] conducted a SWOT analysis of China's air cargo sector in the context of COVID-19 pandemic. However, the specific discussion on the impact of the COVID-19 on air freight market in China has been scarce. To this end, we conduct this research.

2. Overview on air freight market shares before and after the covid-19 outbreak in china

By air cargo total weight, the COVID-19 reduced air cargo volume of overseas airlines by 37.2%, and that of domestic airlines by 10.2%. In 2019, before the outbreak of the COVID-19, the air freight market share of overseas airlines was 30.8%, which was about half of that of domestic airlines, 69.2%, by cargo weight. After the outbreak of the COVID-19, air cargo volume decreased sharply. Accordingly, the share changed significantly. The share of overseas airlines was 23.7%, which is about one third of that of domestic airlines. The shares of air freighters and airliner bellyholds (the belly of regular passenger flights) of domestic and overseas airlines, before and after the COVID-19, are given in Fig. 2.

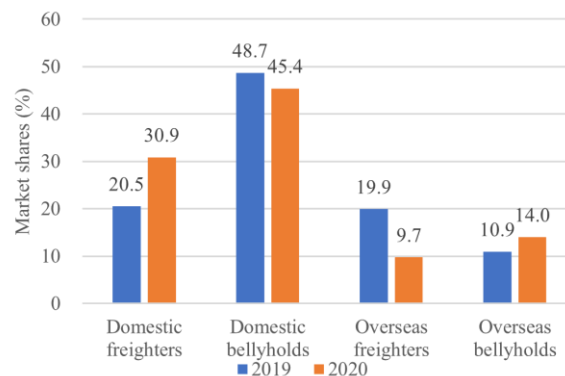


Figure 2: The air freight market shares before and after the COVID-19

For domestic airlines, due to the COVID-19, airliner operations decreased sharply, and air cargo volume carried by bellyholds decreased accordingly. For epidemic prevention need, there is still plenty of medical protective goods and materials need to be serviced by air freight. The massive need that cannot be fully serviced by bellyholds was served air freighters. Thus, there was a notable

increase in the market share of the domestic freighters.

For overseas airlines, due to the severe impact of the COVID-19 on the international trade, the freighter share shrunk sharply. Although there was also a sharp decrease in international airliner operations, due to lower cost, more flexible time tables, and more extensive networks, there was a notable increase in the market share of the bellyholds.

3. Operation comparisons of major types of air freighters

The load capacity of air freighters decided by its type. For B737-300F, the load capacity is about 14 tons. The load capacity of B747-400F, B757-200F, B767-300F, B777F, and MD-11F is about 118 tons, 28 tons, 48 tons, 87 tons, and 82 tons, respectively.

The capacity rate is a percentage that the actual load is divided by the load capacity. The capacity rate and the operation frequency jointly contribute to the total air cargo volume. The operation frequencies before and after the COVID-19 outbreak are illustrated in Fig. 3 and Fig. 4, respectively. The corresponding average capacity rates are illustrated in Fig. 5 and Fig. 6.

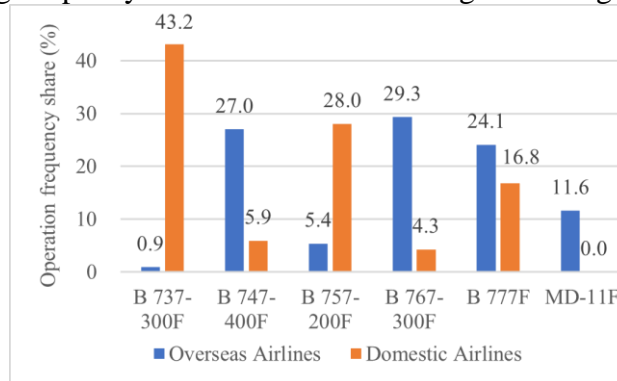


Figure 3: The operation frequency shares of the major types of air freighters of domestic and overseas airlines in 2019

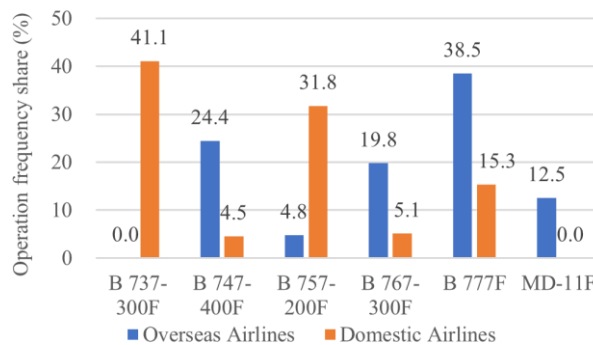


Figure 4: The operation frequency shares of the major types of air freighters of domestic and overseas airlines in 2020

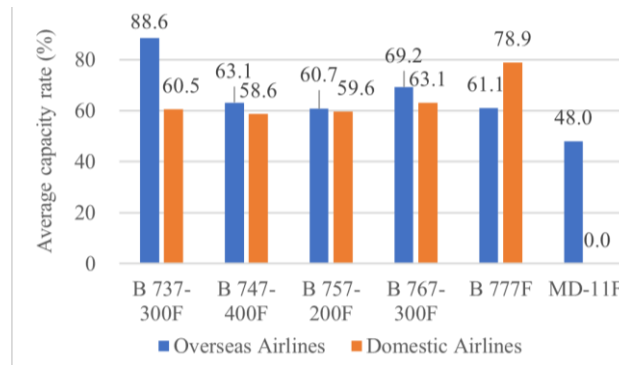


Figure 5: Average capacity rates of major type of air freighters of domestic and overseas airlines in 2019

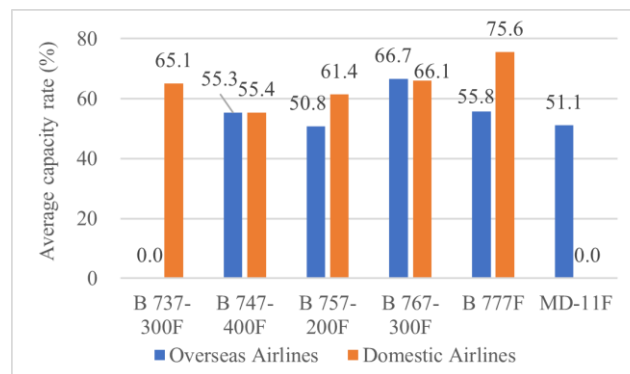


Figure 6: Average capacity rates of major type of air freighters of domestic and overseas airlines in 2020

For domestic airlines, B737-300F air freighters had most operations, more than 40%. It shows that domestic airlines mainly focus on the short-range and small tonnage air freight market. In 2020, B757-200F and 767-300F air freighters had a little rise in the share, and other types had a little shrink. It shows that domestic airlines enlarged per movement capacity to carry more air cargo timely, in the context of COVID-19 pandemic. Due to limited air freighters and lack of large tonnage air freighters, the operation frequency shares did not change significantly. Thus, from a different perspective, the operation frequency shares characterized the air freighter fleet structure and the operation focus of domestic airlines.

In contrast, for overseas airlines, they mainly focus on long-range and relatively large tonnage market, which was demonstrated by larger shares of B747-400F, B767-300F, and B777F air freighters. In 2019, these three types had approximately equal shares. In 2020, B777F's share was the largest, which increased by approximately 14% and was up to 38.5%. B767-300F's share reduced by approximately 10% and was about 19.8%. B737-300F which had the smallest capacity, about 14 tons, lost its tiny market share completely. It shows that, to cope with the impact of the COVID-19, overseas airlines retained long-range and large tonnage freighters operations and reduced smaller tonnage freighters operations. These changes show adjustments of operation strategies of overseas airlines and highlight that the core competitiveness of overseas airlines is the long-range and large tonnage air freight capacity and services.

For domestic airlines, the average capacity rates of B737-300F, B757-200F, and B767-300F, which have smaller capacity, had a notable increase, and the others with larger capacity had a little decrease.

For overseas airlines, the average capacity rates all reduced with different levels, except MD-11F which is not owned by domestic airlines.

4. Analysis on cargo volume of top 20 city-pair flying by overseas airline freighters

The directionality of air freight is quite unbalanced. The air cargo volume from Shanghai Pudong to Memphis, Guangzhou to Cologne, Shenzhen to Osaka, Guangzhou to New Delhi, Shanghai Pudong to Los Angeles in 2019, and that from Sydney to Guangzhou, Guangzhou to Cologne, Shenzhen to Osaka, Paris to Guangzhou, Osaka to Beijing in 2020, were very high. However, the air cargo volume in reverse direction was zero. The cases in 2019 and 2020 are illustrated in Fig. 7 and Fig. 8, respectively.

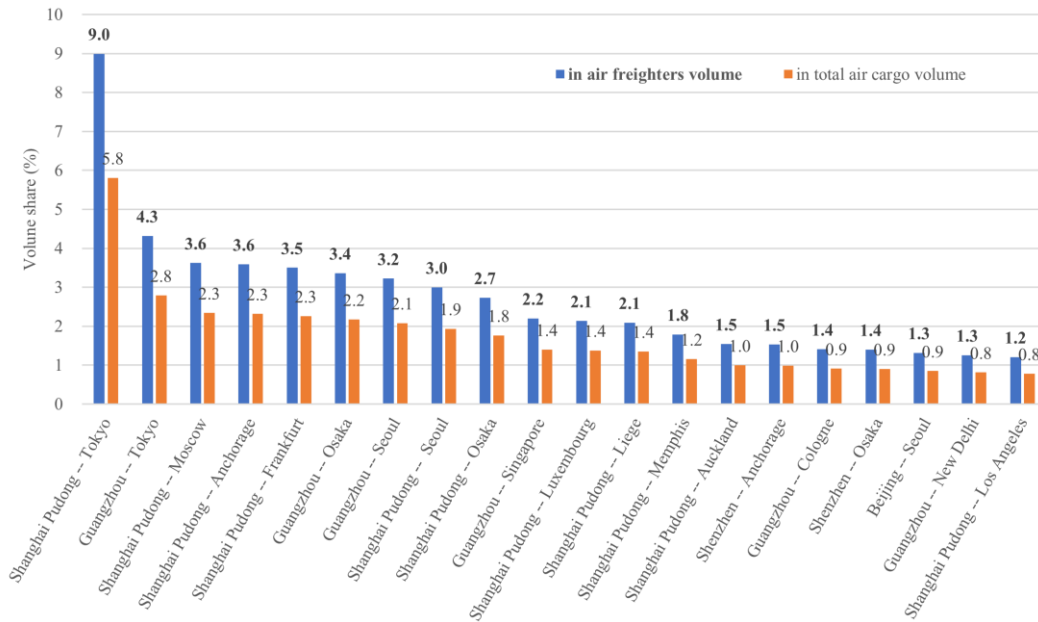


Figure 7: The top 20 city-pair by cargo weight carried by overseas airline air freighters in 2019

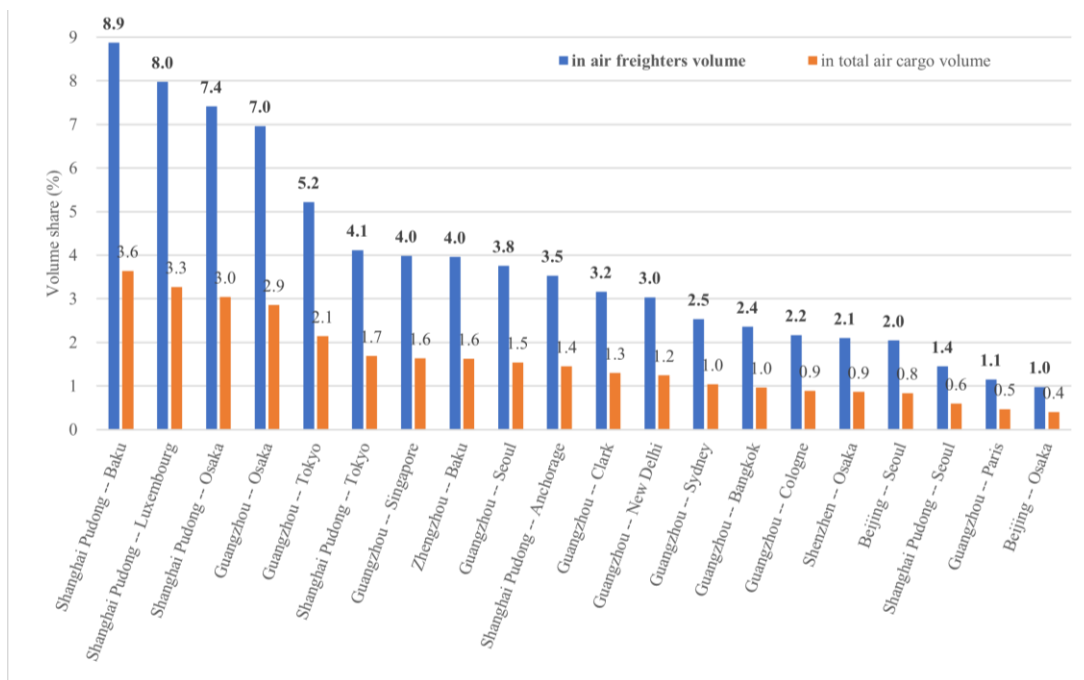


Figure 8: The top 20 city-pair by cargo weight carried by overseas airline air freighters in 2020

In 2019, by air cargo weight, the air cargo volume of top 5 city-pair took a share of 15.5% in total volume carried by overseas airlines, and a share of 24% in total volume carried by air freighters of overseas airlines. In 2020, the shares were 15.0% and 36.4%, respectively. For top 20 city-pair, the shares in 2019 were 35.0% and 54.2%, and they were 31.5% and 76.8% in 2020.

Both for top 5 and top 20 city-pair, the volume share had a decrease in total volume carried by overseas airlines, and an increase in total volume carried by air freighters of overseas airlines, after the COVID-19 outbreak.

The decrease of the shares in total volume of the top 5 and the top 20 city-pair carried by overseas airlines indicated that operations of air freighters had made a little less contributions to the air cargo volume than 2019, after the COVID-19 outbreak.

The increase of the shares in total volume of the top 5 and the top 20 city-pair carried by air freighters of overseas airlines indicated that more capacity of air freighters were concentrated in less city-pair, which also meant that plenty of air cargo need between some city-pair had shrunk sharply or even vanished.

For domestic cities, in 2019, 11 city-pair was associated with Shanghai, whose air cargo volume carried by freighters took a share of 34.2% in total. Meanwhile, 6 city-pair was associated with Guangzhou, and the share was 15.8% in total. In 2020, only 6 city-pair was associated with Shanghai, whose share was 33.4% in total, and 10 city-pair was associated with Guangzhou, whose share was 34.3% in total and increased by 18.5%. The increment was 117%. Guangzhou promoted its key role in the international air cargo market, sharply, in the context of the COVID-19 pandemic.

For overseas cities, in 2019, 8 city-pair was associated with Japan and Korea, whose share was 28.3% in total, and 9 city-pair was associated with Europe and America whose share was 18.8% in total. In 2020, 9 city-pair was associated with Japan and Korea, whose share was 34% in total, 4 city-pair was associated with Europe and America whose share was 14.8% in total. It shows that Japan and Korea have been our primary international air cargo origin and destination, and the air cargo connections became more close after the COVID-19 outbreak. The second is Europe and America.

5. Share comparison of overseas and domestic cargo airlines

More than 15 overseas cargo airlines operate in China, and we only have 8 domestic cargo airlines. Air freight market shares of overseas and domestic cargo airlines were given in Fig. 9 - Fig. 12, and they were calculated separately. Specifically, the share of domestic cargo airlines is based upon the total air cargo volume carried only by domestic cargo airlines, and the volume by overseas cargo airlines is not accounted. The same to the share of overseas cargo airlines.

In this section, Market Concentration Rate (CR_n index) is used to explore the concentration of the market shares of top cargo airlines, where n is set to be 3 and 5, that is the market share sums of the top 3 and the top 5 cargo airlines are calculated, respectively.

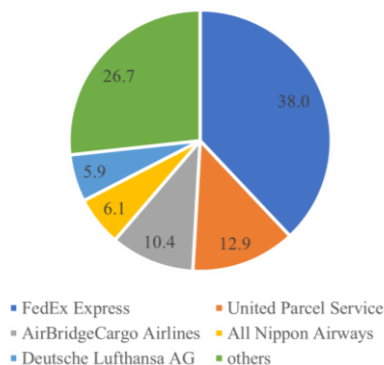


Figure 9: Market shares (%) of overseas cargo airlines in 2019

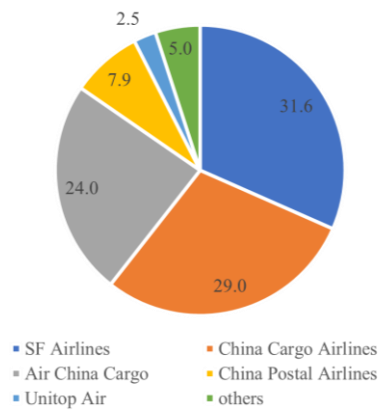


Figure 10: Market shares (%) of domestic cargo airlines in 2019

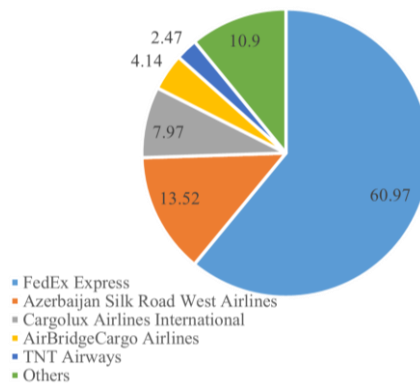


Figure 11: Market shares (%) of overseas cargo airlines in 2020

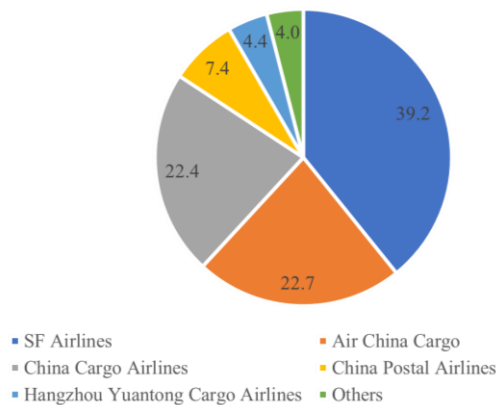


Figure 12: Market shares (%) of domestic cargo airlines in 2020

For domestic cargo airlines, in 2019, CR3 was 84.6%, and CR5 was 95.0%. In 2020, the indices were 84.3% and 96.0%. For SF Airlines, the top one, its share increased by 7.6%, and the other airlines did not have notable changes.

For overseas cargo airlines, in 2019, CR3 was 63.1%, and CR5 was 73.3%. In 2020, CR3 increased by 19.5% up to 82.5%, and CR5 increased by 15.8% up to 89.1%. Both CR3 and CR5 have a notable increase, in the background of sharp decrease of air cargo volume. For FedEx Express, the top one, its share increased by 23%, which was a remarkable achievement.

The difference between the share changes of overseas and domestic cargo airlines indicated that overseas cargo airlines were more competitive, flexible, and well-adapted to the air freight market

changes.

6. Enlightenment to domestic cargo airlines development

Based upon the above analyses, enlightenment to domestic cargo airlines development could be obtained:

1) The freight capacity of freighter fleets need to be enhanced, so that the dependence of bellyholds could be weakened to strengthen the adaptation to emergencies. As of the end of 2020, only 179 domestic air freighters in operations. In contrast to FedEx's 681 freighters, DHL's 270 freighters, and UPS's 261 freighters, we have a huge gap. Without adequate freighters, air cargo has to be dependent closely on bellyholds or overseas cargo airlines, which is quite dangerous when some emergencies attack us. The COVID-19 pandemic had revealed the fact to us. Adequate air freighters are the essential prerequisite of the high-quality development of the air cargo sector of China.

2) The structure of air freighter fleets can be optimized to take in more air freighters of long-range and large tonnage. As of the end of 2020, only 46 domestic air freighters of long-range and large tonnage, including B 747-400F, B 777F, A330F, were in operation. It severely limited long-range and large-scale delivery of air cargo, and limited the development of domestic cargo airlines in turn.

3) To strengthen the stability of the national industrial chain and supply chain, domestic air cargo airlines need to develop overseas air freight markets more vigorously and build up global-covered airline networks, which may be achieved by improving integrated service on the chains and providing customized service.

4) Powerful operation management capability, cargo and mail collecting capability, and resource support capability are the requirements of the high-quality development of cargo airlines. The direction imbalance of air cargo is very prominent. When there is a serious shortage of one-way air cargo demand, it has always been an unavoidable practical problem for air cargo airlines to reduce operating costs and maintain competitiveness. It requires domestic cargo airlines to closely track market fluctuations, be of perfect, strong, and flexible capacity planning, management, and deployment capabilities. Moreover, they should flexibly adapt to various operation modes such as hub and spoke route network and series flight return to improve their cargo and mail collecting capability so that they can promote competitiveness in the rapidly changing air freight markets.

7. Conclusion

The impact of the COVID-19 pandemic on air freight market has been analyzed in this research. Some suggestions to promote the air cargo sector in China have been proposed, based upon the analyses of changes to air freight market shares of domestic and overseas airlines. Based upon the analyses, we intuitively recognize that there is a huge gap between domestic cargo airlines and overseas. To save our lives and enhance our industrial and supply chains, the air freight should be enhanced specifically, especially in the background of emergency outbreaks.

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