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**Post Pandemic Aviation Market Recovery:  
Focus on Changes in China**

**By**

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**ABSTRACT:** China was the first aviation market in the world hit hard by the COVID-19 and has been recovering gradually as the pandemic became largely under control within mainland China. This study reviews the recovery pattern influenced by the Chinese government's aviation policy choices, in the hope that our discussions and findings will help improve aviation policy responses elsewhere. While the domestic market in mainland China has enjoyed a quick recovery to about 80% of the pre-crisis level by July, 2020, the recovery of international services has been much slower, due to the bilateral route and flight frequency/capacity control and strict requirements for health check and quarantine. China's domestic aviation market was recovered by about 80% in two months after the pandemic became under good control. Most other countries with a "curve flattening" strategy, instead of full pandemic control, may not expect the fast recovery path China has achieved. A British "travel corridor" approach may be more practical for Western countries to follow, albeit more likely to be subject to serious setbacks and disruptions. The aviation fee reductions and cost support China and many other countries have been using are helpful but not sufficient. Capital injection and/or credit guarantee may be needed for many airlines to survive. Airlines based in open economies that have small domestic markets will face particularly serious challenges during the recovery process.

**KEY WORDS:** *COVID-19; air transportation; aviation market recovery; Chinese airlines*

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## 1. Market performance amid the COVID-19 pandemic

The COVID-19 pandemic has brought unprecedented negative impact to the aviation industry. The global total flight number decreased by almost 80% as of early April 2020 (Pearce, 2020a). For airlines relying exclusively on the international market such as Cathay Pacific Airways, Singapore Airlines, and Emirates Airlines<sup>1</sup>, their operations were almost entirely grounded during this time. In addition to an off-the-cliff demand decline, severe travel restrictions were imposed in 98% of the markets in terms of passenger revenue (Pearce, 2020a). The cross-fire from both the demand and supply sides hit hard an already fragile industry with a long tail of weaker airlines leading to a sharp increase in bankruptcy numbers. Table 1 provides an incomplete list of airlines filed for bankruptcy during March – early July, 2020. It includes small and young airlines such as, for example, Miami Air International and Level Europe GmbH each with a fleet size of 6 aircraft as well as long established and big airlines such as, for example, LATAM with a fleet size of 315.

**Table 1. Airlines filed for bankruptcy amid pandemic\***

<b>Airline</b>	<b>Service starting date</b>	<b>Bankruptcy application date</b>	<b>Fleet Size</b>
Flybe	1979	2020.03.05	63
Miami Air International	1990	2020.03.24	6
Trans States Airlines	1982	2020.04.01	45
Compass Airlines	2007	2020.04.05	56
Ravn Air	1948	2020.04.05	73
Braathens Regional Airlines	1976	2020.04.06	14
Germanwings	1997	2020.04.07	33
South African Airways	1934	2020.04.16	39
Virgin Australia	2000	2020.04.21	98
LGW	1980	2020.04.22	15
German Airways	1980	2020.04.22	20
Air Mauritius	1972	2020.04.23	14
Avianca	1919	2020.05.10	102
LATAM	1919	2020.05.10	315
Thai Airways	1988	2020.05.27	80
Level Europe GmbH	2017	2020.06.18	6
NokScoot	2015	2020.06.26	7
Aeromexico	1934	2020.06.30	68
Avianca Brasil	1998	2020.07.06	10

\*Sorted based on the time of bankruptcy application date.

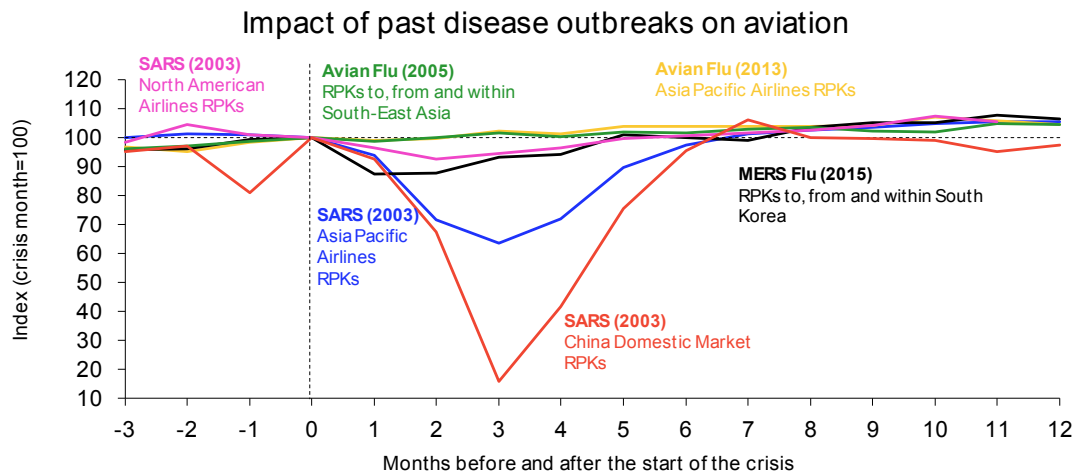
Source: Compiled by the Institute for Aviation Research (IAR)

Although many argued that the COVID-19 pandemic will fundamentally change virtually all modes of transportation (Beck and Hensher, 2020), it is far from clear what would be the “new normal”, and in which way the aviation industry could recover and return to growth. Pearce (2020) analyzed traffic volume changes across different markets amid previous disease outbreaks. As shown in Figure 1, in the worst scenario which occurred in 2003 SARS outbreak,

<sup>1</sup> Hong Kong is a Special Administrative Region of China, and has substantial flight services to the mainland. These flights are reported as “regional” or “mainland” routes officially, but are also frequently reported as international services by many industrial agencies because passport control and immigration check are involved. For convenience such operations may be referred to as “regional” or “international” in this paper.

the Chinese domestic market almost fully recovered within seven months. However, COVID-19 is much worse than any previous pandemic in size and scope (in terms of traffic volume reduction and the number of markets affected). Therefore, we need to look beyond the historical pattern to understand and predict the recovery path in the aviation industry.

**Figure 1: Impact of Past Disease Outbreaks on Aviation**

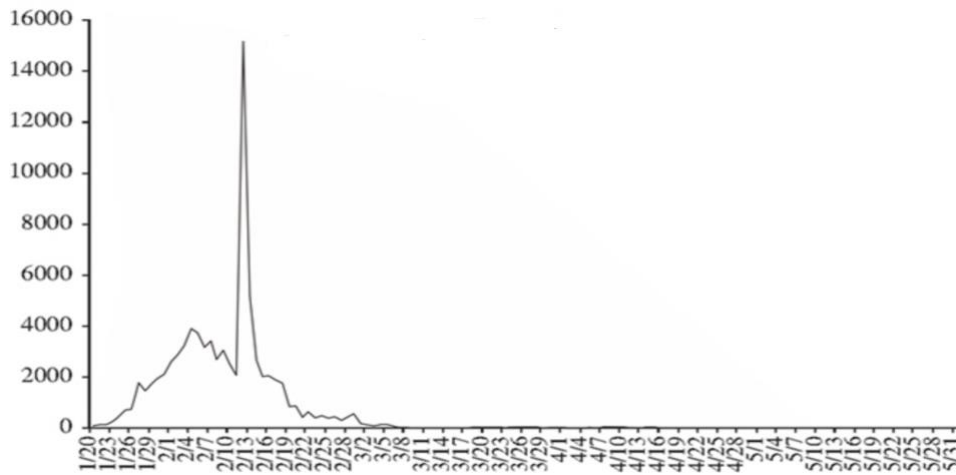


Source: Pearce (2020a) based on IATA statistics.

While many aviation markets are still in a lock-down mode, certain countries are experiencing fast recoveries. China was the first major market badly hit by the pandemic. COVID-19 cases were first identified in the city of Wuhan in December 2019 and within a month in January 2020, the government announced the possibility of human-to-human transmission. On January 23<sup>rd</sup>, Wuhan, the capital city of the Hubei province with a population of more than 11 million, was locked down to prevent the virus transmission. In the following weeks, many more cases were identified across many cities in China. Figure 2 shows the daily new confirmed COVID-19 cases in China during January 20<sup>th</sup> to May 31<sup>st</sup>. Other cities with identified cases of COVID-19 patients in Hubei province were added by the Chinese reporting agency on February 12<sup>th</sup>, which caused a sharp increase in daily confirmed cases that day.

The rise in new COVID-19 cases in January and February lead to a substantial drop of traffic in all transport modes and especially aviation. Since early Feb 2020 most international airlines reduced or totally suspended services to China. Several governments, including United States, Australia, Russia and Italy, imposed travel restrictions or closed their border with China entirely.

**Figure 2: Daily confirmed COVID-19 cases in China**  
(20 Jan – 31 May 2020)



Source: State Council Information Office’s white paper on COVID-19, published 7 June 2020.<sup>2</sup>

Right before the disease breakout, during the Chinese New Year period the daily flight number was about 17,000 country wide, carrying close to 2 million passengers a day. Country wide, the total flight number kept decreasing following the Wuhan lock down on January 23<sup>rd</sup>, reaching the lowest point of 3,931 flights on February 13<sup>th</sup>, about 23% of the pre-pandemic level. Figure 3 depicts the flight numbers at the four major hub airports in mainland China, namely Beijing Capital, Shanghai Pudong, Guangzhou Baiyun, and Shenzhen Baoan. As shown below, the total number of flights experienced an off-the-cliff drop, reaching its minimum in mid-February.

**Figure 3: Daily flight number at the four Chinese hub airports (23 Jan - 7 June 2020)**



Source: Flight master (a Chinese travel data company)

A slow recovery started in March when the number of new COVID-19 cases got close to zero, with daily average flight number reaching 6,538. At the four major hub airports in China, traffic volume started to oscillate for two months, reaching its lowest point in early April. A turning point occurred on April 8<sup>th</sup>, when the Wuhan lockdown was removed, a milestone event in the

<sup>2</sup> Published in Chinese at [http://www.gov.cn/zhengce/2020-06/07/content\\_5517737.htm](http://www.gov.cn/zhengce/2020-06/07/content_5517737.htm)

national pandemic control. From that day, only the individuals who have “health codes” were permitted to leave the city. The health code collects some basic personal information, and tracks whether the holder came into contact with any COVID-19 patients in the past 14 days. This should have been an important factor that lead to an increase in the flight number to 6,950 in April, and 8,900 in May. On May 15<sup>th</sup>, the daily flight number exceeded 10,000 for the first time since February 1<sup>st</sup>, about 60% of the pre-pandemic level (State Council 2020a).

Passenger volume decreased more significantly than capacity. At the lowest point on February 13<sup>th</sup>, passenger volume reduced to 0.13 million or 7.5% of the pre-pandemic level, which is much lower than the corresponding 23% level of pre-pandemic flight number. Average daily passenger volume increased to 0.46 million in March, 0.52 million in April, and 0.79 million in May. On June 5<sup>th</sup>, daily passenger volume reached 1.04 million, about 61.5% of the level in 2019. Average load factor also increased to 70% (State Council 2020c). Part of this recovery is due to aggressive pricing and promotion by airlines. For example, in June China Eastern introduced a product called “Wild your weekend” allowing the purchaser to fly for free during weekends throughout the year. The product, sold at about US\$480 and was so popular that the quota of 100,000 was sold out in a few days.

While daily confirmed cases nation-wide reached very low numbers in March, the recovery in air traffic was weak and unstable at first. This could be due to the overall concern among people over flying and travel restrictions imposed in a number of cities in China. In a survey conducted by IATA (2020), 58% of the respondents indicated that they avoided air travel, with 33% indicating future avoidance to reduce the risk of contracting COVID-19. The main concerns over airport use are: (a) being in a crowded bus/train on the way to the aircraft (59%); (b) queuing at check-in/security/border control or boarding (42%), and (c) using airport restrooms/toilet facilities (38%). The main concerns for on board aircraft use are: (a) sitting next to someone who might be infected (65%); (b) using restrooms/toilet facilities (42%), and (c) breathing the air on the plane (37%).

The recovery has been mostly limited to the Chinese domestic market. Table 2 compares the number of scheduled flights to the number of flights that have been carried out by the top 10 Chinese airlines as of June 7<sup>th</sup>, 2020. It shows that international flights stayed at the very low level, most likely because of the strict bilateral route/flight/capacity control. Overall, airlines have a lot of unused capacity because the average daily aircraft utilization remained at an extremely low level. As of June 7<sup>th</sup>, daily aircraft utilization was 5.4 hours for narrow-body aircraft, and 4.1 hours for wide-body aircraft. These numbers increased to 6.5 hours and 4.9 hours in late July, respectively. Even though the aviation market recovery has been sustainable, it has stayed almost exclusively in the domestic market.

**Table 2. Scheduled and performed flight number by the top 10 Chinese airlines**  
(As of 7 June, 2020)

Airline Code	Scheduled Flights		Actual Flights		Actual-Schedule Ratio	
	Int'l/Regional	Domestic	Int'l/Regional	Domestic	Int'l/Regional	Domestic
CZ	340	2216	9	1505	2.6%	67.9%
MU	81	1850	7	1346	8.6%	72.8%
CA	268	1355	26	902	9.7%	66.6%
ZH	29	780	0	554	0.0%	71.0%
HU	18	536	1	471	5.6%	87.9%
MF	23	624	5	514	21.7%	82.4%



SC	22	585	0	492	0.0%	84.1%
3U	4	516	0	464	0.0%	89.9%
9C	68	413	6	371	8.8%	89.8%
FM	7	271	2	196	28.6%	72.3%

Note: CZ=China Southern, MU=China Eastern, CA=Air China, ZH=Shenzhen Airlines, HU=Hainan Airlines, MF=Xiamen Airlines, SC=Shandong Airlines, 3U=Sichuan Airlines, 9C=Spring Airlines, FM=Shanghai Airlines

Source: Flight master (a Chinese travel data company)

Cargo operations performed very different from passenger operations and much better in China (and, as will be discussed later, in the world). Total cargo tonnage reached 0.55 million tons in May, which reflects a relatively modest decline of 12% compared to the same period in the previous year. This modest decline can be attributed to a sharp increase in the use of dedicated freighter aircraft by 21.8% to 0.23 million tons, which could partly compensate the loss in aircraft belly capacity associated with the reduction in passenger flight numbers (State Council 2020b).

## 2. Policy and regulation changes in the Chinese aviation market

The Chinese aviation market recovery pattern may provide useful insights into markets elsewhere. The Chinese aviation sector has ranked as the world's second largest market since 2005, second only to the United States. Price competition in the China's domestic airline markets are largely deregulated (Zhang and Round, 2008, 2011; Lei and O'Connell, 2011; Liu and Oum, 2018); airlines have established both extensive domestic and international networks, especially at major airports which have developed into major international hubs (Wang et al. 2014b; Alder et al. 2014; Fu et al. 2015b). Leading Chinese carriers achieved good productivity growth over the past decades, with average costs staying at fairly competitive level thanks to the country's relatively low input prices (Wang et al. 2014a; Yan et al. 2019). These features make China a useful reference market for the aviation industry. In contrast, there are some distinctive features related to low cost carriers (LCCs), high-speed rail and the regulatory depth we should keep in mind when making a comparison.

Low cost carriers (LCCs) are well developed in almost all sizable markets in North America, Europe, Australia and ASEAN countries (Windle and Dresner, 1995, 1999; Mason and Alamdari, 2007; Fu et al. 2011; Hanaoka et al. 2014; Fageda et al. 2015). In comparison, partly due to various legacy regulation, notably those related to route entry into congested hub airports and the lack of competition in the input market, the LCC sector remains underdeveloped in China (Fu et al. 2015a; Wu et al 2020).

The competition between high speed rail (HSR) and airlines can be observed in many markets including Europe and Japan (Dobruszkes, 2011; Behrens and Pels, 2012; Fu et al. 2014; Albalade et al. 2015). However, the HSR network is much more extensively developed in China, and thus the air-HSR competition can be more significant and frequent (Fu et al. 2012; Zhang et al. 2017, 2019a, 2019b, 2020; Su et al. 2020).

The Civil Aviation Administration of China (CAAC) possesses substantial regulatory power and maintains close relationships with the aviation industry. For instance, the executives of the largest three airlines (i.e. Air China, China Southern, China Eastern), which are all majority state-owned, often take senior positions at CAAC at a certain point in their career. The CAAC is often willing to support the airlines when they run into financial difficulty. Nonetheless, the CAAC can still be heavy-handed in regulation. For example, Fu et al. (2020) noted that in its effort to reduce flight delay, the CAAC adopted an "outcome-based" regulation. Airlines are

required to cancel those flights that did not meet the on-time performance target set by CAAC. Similarly, airports will be required to reduce allowable capacities if congestion is considered excessive by the CAAC. While such a strict regulatory power has been quite effective in reducing congestion, it may be regarded as unfair, because delay and congestion are often caused by various reasons, some of which may be beyond airlines or airport managers' control. It is also not consistent with the fundamental principles of airport slot allocation, namely the "historic precedence" (also known as the "grandfather rule") and the "use-it-or-lose-it rule". Although the CAAC usually tries to maintain policy consistency, when it aims to achieve an important objective, the regulator can change existing rules or introduce new rules to address primary concerns.

Fu et al. (2020) argued that such an "outcome-based" regulation is two-sided. On the one hand, this allows the regulator to quickly and effectively achieve the primary policy objectives. In the case of congestion regulation, the most delayed flights are removed at peak hours until the target on-time-performance is achieved; thus, the fulfillment of the policy target/outcome is virtually guaranteed, sometimes with operational and/or policy innovations.<sup>3</sup> On the other hand, the *ad hoc* decision process can introduce significant uncertainty in airlines' planning process, distorting normal operations and increasing associated costs in the long term.<sup>4</sup> Moreover, there could be a fairness issue associated with it such as when airlines/airports are penalized for problems beyond their control as was already mentioned for the case in which airlines or airports miss congestion targets.

Similar decision-patterns can be observed in the CAAC's pandemic responses. Policy objectives can be quickly changed and "outcome-based" regulation was introduced into the international market. Below we summarize the shifting policy objectives during Feb – July 2020. This summary indicates the government's attempt to micro-manage the airlines and airport services in order to achieve their policy objectives and to deal with the conflicting needs for improving international connectivity for economic/social reasons and for tightly controlling the spread of COVID-19 virus cases.

#### ***Reducing costs and promote industry growth: Feb–July 2020***

When the pandemic hit the aviation sector, China introduced policies and supporting schemes in order to help airlines and airports reduce their costs. On February 8<sup>th</sup>, airlines were exempted from the "Civil Aviation Development Fund" fees (State Council 2020d). The fund is managed by the central government, and can be used on aviation infrastructure, subsidy to regional airlines and small airports, emission reduction, etc. Its revenue comes from two major sources: (a) airport fees collected from passengers, with a standard rate of RMB50 (about US\$7)<sup>5</sup> for domestic flights and RMB 90 (about US\$13) for international flights; and (b) fees paid by airlines, based on aircraft Maximum Take Off Weight (MTOW) and stage length, adjusted for different routes (e.g. lower fees for routes to less developed provinces). Those measures were estimated to reduce airlines' costs by RMB0.6 billion per month (State Council 2020e). In addition, some moderate reductions (mostly in the range of 8-10%) of air traffic control (ATC) fees, landing charge, fuel charge etc., were also introduced, effective from January 23<sup>rd</sup> (State Council, 2020f).

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<sup>3</sup> In comparison, proposals and discussions of airport slot auction has been discussed since the 1980s in the United States, but even trial operations have not been tested. In contrast, slot auctions have been tested in China at Guangzhou Baiyun International Airport in 2015.

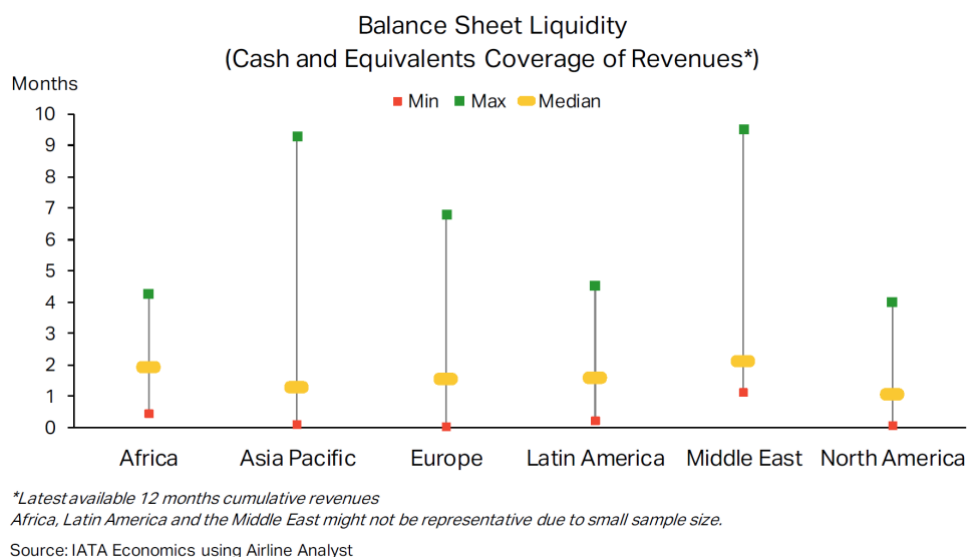
<sup>4</sup> For example, airlines may be forced to increase scheduled flight time (i.e. increase buffer time) to achieve nominal on-time performance.

<sup>5</sup> As of July 2020, the exchange rate between Chinese RMB to US dollar is about 7.02 to 1.

While these support measures were helpful, they are certainly far from enough to keep the aviation sector afloat. The CAAC noted on July 10<sup>th</sup> that the Chinese aviation industry lost RMB74 billion (about US\$10.6 billion) in the first 6 months of 2020, with about RMB40 billion loss incurred in the first quarter. The sustained loss imposes significant financial pressure on airlines. At the end of the first quarter of 2020, the Cash Ratio (i.e. ratio of cash and equivalent to current reliability) of the top four airlines were quite low. Except for Air China whose ratio was at 0.13, all other three airlines (i.e., China Eastern, China Southern and Hainan Airlines) had ratios below 0.1.<sup>6</sup> This implies that airlines need to secure more cash or capital injection to survive financially.

Low cash reserve has been a common challenge to airlines around the world. IATA (2020b) computed the ratio of airlines' cash and equivalents to average monthly revenue as reported in Figure 4. On average, airlines' cash can only last for 2 months if revenue flow stops entirely. Indeed, many airlines had to resort to government supports, or file for bankruptcy protection within a couple of months of the pandemic.

**Figure 4: Liquidity of airlines in different markets**  
(Computed by IATA in March 2020 based on most recent financial data available)



Because most major airlines in China are majority state owned, they are less likely to bankrupt. However, if many airlines face significant losses, mergers and consolidation at major scale cannot be ruled out, as witnessed in the early 2000s, for example (Yan et al. 2019). The fourth largest airline, Hainan Airlines, experienced significant financial hardship even before the pandemic. Unless some sort of capital injection is arranged, industry consolidation may be necessary. Meanwhile, the Chinese government plans to make capital investment worth RMB100 billion into the aviation industry in 2020, in an effort to boost the sector amid significant country-wide demand reduction.

In addition to the financial supports identified above, CAAC also provided some flexibilities in schedule change, on-time-performance regulation, slots allocation and routes development within the domestic market. These measures removed unnecessary regulations at a time of low

<sup>6</sup> Calculated by the Institute for Aviation Research based on airlines' data at the end of the first quarter of 2020.

congestion and dynamic changes. They provide some assistance to airlines, but are unlikely to help airlines improve their financial viability significantly.

***Promote international connectivity: March 2020***

One month after the Wuhan lockdown, the pandemic in China was under control. On March 11<sup>th</sup> the nation-wide confirmed (local) cases dropped to single digit numbers. During this period many international airlines suspended or reduced their services to mainland China.

A subsidy program for international scheduled services was introduced on March 4<sup>th</sup>, 2020. Both Chinese and foreign airlines are eligible to apply for this subsidy. On routes served by multiple airlines, each airline can receive RMB 0.0176 (US\$0.0025) per available seat kilometer (ASK). If the route is served by one carrier, the subsidy increases to RMB0.0528 (US\$0.0075) per ASK. A priority is given to maintain international connectivity especially on relatively thin routes with only one carrier.

***Control international traffic: March - July 2020***

The virus quickly transmitted to the rest of the world and spread at an increasing rate in March 2020. As more countries experienced sharp increases in COVID-19 cases, the priority quickly shifted from promoting international connectivity to tightly controlling international air passenger services. Although previously the subsidy policy was announced for March 4<sup>th</sup> - June 31<sup>st</sup> period, the CAAC announced on March 26<sup>th</sup> the following rules to control international services: (a) each Chinese airline can only continue to serve one route/destination for each foreign country (an airline can serve multiple countries). No more than one flight can be offered per week; (b) each foreign airline can only maintain one route/destination to mainland China, with a maximum of one flight per week, and (c) all airlines should ensure social distancing on board, and the load factor cannot exceed 75 percent. This policy is designed to maintain minimum connectivity (CAAC, 2020).<sup>7</sup>

As pandemic control situation varies substantially across countries, CAAC introduced new rules on international services on June 4<sup>th</sup>. The policy has a strong similarity with an “outcome-based” rationale with a “circuit breaker” mechanism as follows: (a) arrival passengers are subjected to COVID-19 testing in China. If no passenger is tested positive for three consecutive weeks on a particular route, the airline is allowed to increase one more flight per week, capped at 2 flights per week, and (b) if the number of infected passengers reached 5, the airline’s operation on this route will be suspended for one week. If the number of infected passengers reached 10, the flight operation will be suspended for 4 weeks. After the suspension period, the airline can resume service with one flight per week (State Council 2020g). Despite efforts such as maintaining social distancing and passenger protection measures, airlines have limited control over the number of infected passengers on a flight. In a sense, letting an airline to bear almost all the risks is not entirely fair. The limit of one flight per week also seems to be arbitrarily chosen. Nevertheless, this policy ensures that routes to pandemic hot spots can be quickly shut down as needed.

The provision of international flights is also constrained by the capacity of COVID-19 testing and/or quarantine requirements at destination cities. For example, because Beijing faced shortage in quarantine capacity, it was decided that most inbound flights to Beijing will stop first at 12 other airports, where passengers would receive COVID-19 testing and custom

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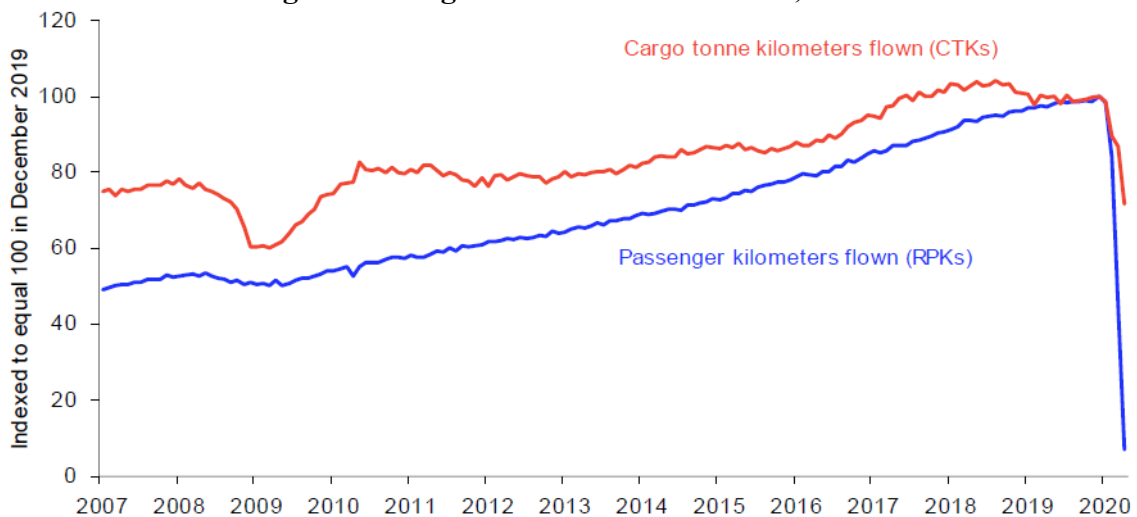
<sup>7</sup> This rule is frequently referred as the “five one” policy for short (i.e. one airline can serve one destination in one foreign country, limited to one flight per (one) week).

clearance, before they can continue their trip to Beijing. Another example is China Eastern Airlines. The airline’s flights to Tokyo had no infected passengers during the period of June 15<sup>th</sup> – July 5<sup>th</sup>. Thus, the airline should have been granted one more weekly flight on this route. However, because Shanghai has a severely limited supply of COVID-19 testing, the airline obtained a permission to serve the Xi’an – Tokyo route instead (State Council 2020h).

**Support of freight operations: March – July, 2020**

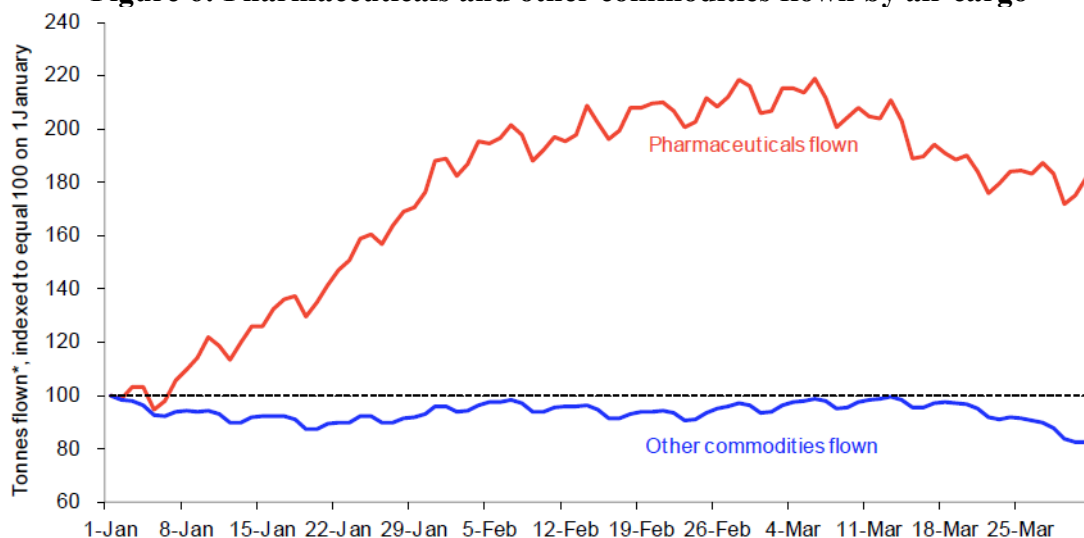
The COVID-19 impact is much less on cargo than on passenger traffic (Pearce, 2020b). Relative to the numbers in the previous year, the global cargo tonne kilometers (CTKs) were down by “only” 28% in April compared to the decline of 95% in the global passenger kilometers flown. Figure 5 illustrates the difference in the effect of COVID-19 on passenger and cargo traffic. Figure 6 indicates that the relatively moderate effect of COVID-19 on air cargo traffic can partly be explained by the increasing demand to fly medical supplies which was at times twice as high relative to last year’s numbers (Pearce, 2020b).

**Figure 5: Cargo tonne kilometers flown, billion**



Source: Pearce (2020b) based on IATA statistics.

**Figure 6: Pharmaceuticals and other commodities flown by air cargo**



Source: Pearce (2020b) based on Cargo IS..

For air cargo markets, it is important to distinguish between belly cargo capacity and freighter capacity and the effect of COVID-19 has been different for these two types of capacities. More specifically, the overall capacity decrease in May was 34.7%, which was mainly due to a 66.4% belly cargo capacity decline due to the passenger flight cancellations. In contrast, freighter capacity increased by 25.2% during this time and reached almost record high cargo load factors as reported in Figure 7(a). The international available CTK from belly capacity and freighter are reported as in Figure 7(b).

**Figure 7: Air cargo market performance**

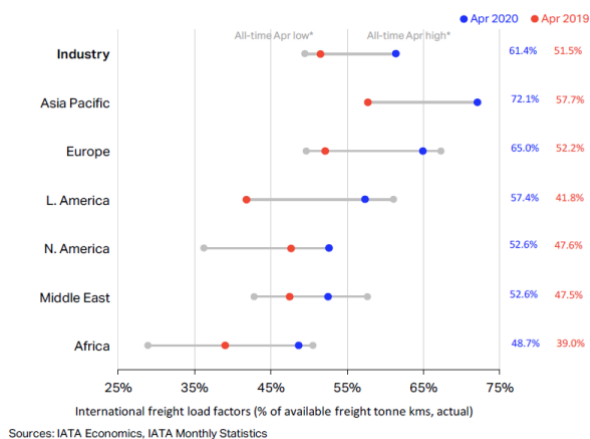


Figure 7(a) Freight load factor

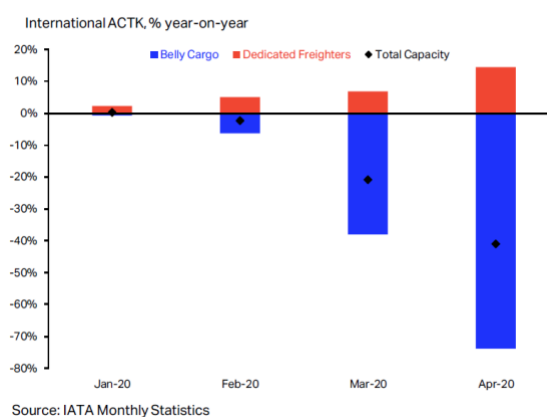


Figure 7(b) Int'l cargo capacity change

Source: IATA (2020d)

A similar pattern has been observed for the Chinese aviation market, with freighter-carried cargo reaching 0.25 million tons in March, a 28.4% increase compared to the previous year. To support cargo operations, the Chinese government announced the following financial incentives to support the conversion of passenger cabin for cargo carriage, valid during April – June 2020: (a) 80% of the conversion costs will be subsidized, capped at RMB 0.8 million for narrow body aircraft, and RMB1.45 million for wide-body aircraft. (b) for cargo flights without passenger services, different per-flight subsidies are eligible for both Chinese and foreign airlines. For example, for flights with stage lengths above 10,000 km, a subsidy of RMB 30,000 will be paid for operation using an aircraft with MTOW below 200 tons. If the aircraft's MTOW is above 200 tons, the subsidy is RMB 60,000 per flight (State Council 2020i).

In addition to financial support, CAAC also provides some operational flexibility to cargo services. For example, it is required that each airline serves one of the two airports in Beijing (i.e. Beijing Capital or Beijing Daxing). However, in May 2020, this constraint was removed for cargo flights. It was also announced that 7th freedom flights will be progressively liberalized in the Hainan province, for both passenger and cargo services.

### 3. Discussions

Compared to most other major economies, the aviation sector in China's domestic services recovered at a much faster rate. At the end of July, it recovered at around 70-80% of the pre-pandemic level in the domestic market. Our review of the market performance and government policies led us to the following conclusions:

### ***Market recovery pattern***

It took at most 7 months for the aviation industry to fully recover from the previous virus outbreaks. However, the impact of COVID-19 will be much more severe in terms of depth and scope. The observations from the Chinese domestic market suggest that once the pandemic is under control, there will be a reasonably quick recovery. As shown in Figure 3, it took about 4 months (i.e. March to June) for the key routes to return to about 70-80% of the pre-pandemic level. There was a time lag for passengers to return to the travel market. The nation-wide infection number went down to a single digit as early as March 11<sup>th</sup>, and domestic aviation market started to recover as early as mid-February. However, sustained growth was only observed since early April. It takes time for passengers to regain confidence in airline services.

More importantly, transportation services could facilitate the spread of the virus when a pandemic is not under control. Zhang et al. (2020) found that frequencies of air flights and HSR services out of Wuhan were significantly associated with the number of COVID-19 cases in destination cities. The presence of an airport or HSR station in a city is associated with the rate at which the virus spreads. In addition, the pandemic emerges in large cities earlier than in small cities as GDP is positively associated with the rate at which the virus spreads. This is an important reminder: the aviation industry knows that travel demands are higher in metropolitan areas with large population and higher GDP levels. Restarting the aviation industry too soon and too fast may facilitate the spread of the virus and as a result may cause even further reduction in travel demand. This is consistent with the findings of Oum and Wang (2020) who analyzed the socially optimal lockdown and travel restrictions by utilizing a striking similarity between the market failure caused by the negative external cost imposed on other people by a potential COVID-19 carrier person and the market failure caused by the negative external cost a driver imposes on other drivers on the street. Their analysis shows that severity of lockdowns and travel restrictions (and associated violation penalty) need to be higher in larger cities and in areas with higher population density. The growth in the Chinese domestic aviation market was sustainable because there were no major COVID-19 outbreaks in China since March.<sup>8</sup>

It is clear that the demand for air cargo markets also suffered from the pandemic, but at a much lesser rate. As belly capacity is normally used to carry close to 50% of the cargo, the removal of passenger flights on most international routes has reduced the supply of cargo capacity, hence driving up the demand for freighters. This trend will likely to continue in incoming months, partly due to less strict regulations on all cargo flights (including cargo only services using passenger aircraft). However, airlines should be cautious placing too many freighter conversion orders, if they believe belly capacity will eventually pick up with passenger flights recovery. As a result, airlines may set aggressive prices for their belly capacities. In addition, airline bankruptcy and liquidation are likely to reduce price of aircraft capacity in the short run. Overall, airlines need to consider multiple factors, including their financial strength, freighter prices, cargo demand and network development before committing to more freighter capacity.

### ***What is the right government policy?***

While China reacted early to provide support to the aviation industry, our review suggests that the policy objectives have been quickly changing in response to the pandemic development and travel demands. In just two weeks, CAAC's policy priority has shifted from promoting international connectivity to tightly controlling passenger flow (i.e. the "five one" policy on international flight) in March 2020. The financial supports and fee reductions were helpful, but

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<sup>8</sup> There were some small and moderate outbreaks. However, with heavy-handed lockdown and regulation they were contained within weeks.

far from being sufficient because of the enormous losses incurred by the aviation industry. Thus, it is a matter of time before a significant capital injection is needed to the aviation sector.

Governments around the world have resorted to different forms of financial support. The Italian government decided to nationalize Alitalia,<sup>9</sup> whereas the Hong Kong government became a major share-holder of Cathay Pacific in an effort to keep the airline afloat. Norway, Sweden and Denmark provided credit guarantees to Norwegian Air and SAS, respectively. The US government allocated \$62 billion funds for airlines out of the \$2.2 trillion package of the CARES (Coronavirus Aid, Relief, and Economic Security) Act. US\$25 billion of this airline funds<sup>10</sup> was earmarked as the government's loan to airlines who are willing to issue the warrants which allow the government to buy the airline's 'non-voting share' at the current heavily discounted share price within the next three years. This way the U.S. tax payers will be able participate in the airline's profit when airlines recover from the current crisis and thus stock prices increase. The rest of the airline funds are offered as partial wage subsidies requiring airlines continue to employ their workers without lay-offs (Oum, 2020).

Although quite a few governments own airlines shares,<sup>11</sup> majority of Chinese airlines are owned by the central or local governments. The Chinese government can thus either support all of them, or encourage market consolidation. The latter could be controversial as these largest airlines all have weak balance sheets. Based on historical observation, however, CAAC is likely to stand by the side of the "Big Three" carriers (i.e. Air China, China Southern and China Eastern), effectively picking the winners or survivors.

It is also unclear to what extent regulators should control airline operations. The Chinese government has been quite aggressive in pandemic control, from the early lockdown of Wuhan, to the "five one" policy imposed on international routes. An increase in airlines' capacity/frequency on international market is related to the COVID-19 testing results that are largely beyond airlines control. Should other governments follow the same strategy?

On the one hand, the sustained recovery of the Chinese domestic airline market, compared to the shaky and very slow market recovery in other countries, seems to favor a strict control of air travel. This could prevent the creation of "travel bubble" too fast. For example, Australia and New Zealand did a remarkable job on pandemic control at an early stage, which makes these two countries an ideal place to establish a "travel bubble". However, a COVID-19 outbreak in Melbourne in July 2020 quickly spread to other cities including Sydney and as a result, travel restrictions were imposed even within Australia. Similar proposals were made between Hong Kong and mainland China. However, with the new wave of COVID-19 outbreak in Hong Kong in July, the proposal has been postponed. The evidence presented above supports "proactive" tight travel controls. On the other hand, the pandemic strategies are different across countries. Mainland China, for example, had almost full control of the pandemic and tried to contain the virus at a relatively early stage. In many other countries, however, the target is to "flatten the curve", so that the outbreak is contained at a level that can be handled by the health

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<sup>9</sup> See report at <https://www.bloomberg.com/news/articles/2020-03-17/italy-ok-s-virus-relief-from-alitalia-takeover-to-babysitters>

<sup>10</sup> See report at <https://www.forbes.com/sites/willhorton1/2020/04/15/how-the-us-is-distributing-airline-bailout-funds-in-covid-19-relief-deal/#5799c28d63a1>

<sup>11</sup> Among others, Air New Zealand, Finair, Alitalia, Singapore Airlines, Emirates are majority owned by their governments. SAS Group is partially owned by the governments of Sweden and Denmark with a 14.82% and 14.24% holding, respectively. Governments of France and the Netherlands own 14.3% and 14% shares of Air France - KLM.



care system, while essential economic activities could be restored early. As a result, the aviation industry should focus on the prevention of the infection at airports and on-board aircraft, with capacity and flight frequency “reactively” adjusted in response to travel demands. The CAAC’s tight regulations of the international market does not come without a price. For example, many Chinese passengers have been stranded overseas due to a significant shortage of flight capacity. In comparison, the British government established “travel corridors” facilitating air travel among destinations that have reasonably good control of the pandemic.

In our view, for economies that achieved or aim to achieve full control of the pandemic (e.g. New Zealand, Australia, Canada, Vietnam), tight regulation may be a better choice. Indeed, many of them have already introduced tight control over international services and strict quarantine requirements. For other countries that adopted country-wide strategy to “live with the virus”, the British style of differentiated treatment (i.e. travel corridors for selected destinations) is probably a more practical choice. However, open economies that rely extensively on aviation and have relatively small domestic market (e.g. the UAE, Singapore, Hong Kong, Korea, Taiwan) face considerable challenges. One of the options is to introduce strict public health control and attempt to boost traveler confidence. For example, Emirates introduced on-site COVID-19 testing.<sup>12</sup> If less intrusive measures can be developed at relatively low cost and quick manner, countries’ aviation and tourism sectors may recover earlier.

### ***What is coming next?***

In previous virus outbreaks, there were no fundamental changes in travel demand because they mainly restrained the supply of (safe) air travel. Therefore, V-shaped recoveries could be observed once the spread of a virus was under control. There are (at least) two passenger demand factors that are likely to delay recovery relative to previous virus outbreaks.

The first is related to the enormous negative effect the pandemic together with trade and geopolitical tension between China and U.S. has on the world economy. Because there is a close positive relationship between economic growth and air travel, this is very likely to substantially slow down the pace of the aviation market recovery. The second is related to the increased use of online meeting platforms during the pandemic which showed that online meetings, conferences, presentations can be adequate substitutes for face-to-face meetings. This trend is likely to continue or, perhaps, grow even after the pandemic problem has been resolved. The change in business habits is, therefore, likely to suppress business travelers’ future demands for air trips attacking a major source of airline revenues.

The pandemic is also likely to have lasting effects on airline and airport operations with increased hygiene requirements inside the aircraft cabin and, for example, permanent thermal screening of passengers at airports which are costly, thus, reducing profits and consumer surplus (despite or, respectively, because of the corresponding ticket price increases). Furthermore, aircraft manufacturers substantially cut future aircraft production, which is likely to increase aircraft cost for airline and aircraft leasing companies once demands have recovered. In contrast, the pandemic boosted e-commerce likely producing a lasting positive effect for air cargo businesses.

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<sup>12</sup> See report at <https://www.emirates.com/media-centre/emirates-becomes-first-airline-to-conduct-on-site-rapid-covid-19-tests-for-passengers/>

Altogether, we expect the aviation industry to experience somewhat fast recovery in 2021 when vaccines and better illness treatments become available. However, with the financial burden caused by debts accumulated with government bailout plans, which will take a toll on airlines' financial positions, and all the other effects mentioned above, we believe that at least three years are required for the aviation industry to return to the 2019 level of activities (similar to recovery time experienced after the 2008 global financial crisis). As many airlines go bankrupt, the industry consolidation makes well managed airlines and those with strong government support profitable in the medium term until more start-up carriers are drawn to the market driving up competition.

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