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Analyzing Hong Kong's inbound tourism: The impact of the COVID-19 pandemic

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ABSTRACT

This study empirically investigates the determinants and drivers of Hong Kong's inbound tourism using data from January 2019 to December 2020. Five of Hong Kong's major regional tourism source markets are selected: Japan, Malaysia, the Philippines, Singapore, and South Korea. Our empirical results suggest that the COVID-19 pandemic has had significant negative impacts on the tourism and aviation sectors in Hong Kong that are asymmetric in the source and destination countries. In addition, international travel control imposed by the Hong Kong government is often defined according to the pandemic situation in the tourism source countries, Hong Kong's inbound visitor volume is also significantly affected by the Hong Kong government's response to COVID-19 infection cases in the tourism origin markets. Our empirical results also suggest that the flying distance to Hong Kong and high tourism costs in Hong Kong reduced visitor arrival demand, whereas increased aviation services and tourism market potential contributed to tourism growth. These results suggest that the tourism industry and government agencies should cooperate to recover when the pandemic is under good control, so that Hong Kong will be regarded as a preferred and safe destination for travelers and visitors. Our study emphasizes the complementarity between pandemic control and tourism recovery. Pandemic control involves extra tests and quarantine requirements on passengers, more vigorous border control. These operational and associated financial requirements call for government support to the tourism and aviation sectors in the early stage of recovery to create a positive feedback loop.

1. Introduction

Tourism has been a strategic pillar industry in Hong Kong, given its significant contribution to the local economy. Prior to the COVID-19 pandemic, the city had broad international appeal, attracting 58.47 million and 65.15 million overseas tourists in 2017 and 2018, respectively [1]. The tourism industry contributed approximately 5% of Hong Kong's gross domestic product (GDP) in 2018 and employed around a quarter of a million people [2]. Given such importance of tourism, the COVID-19 pandemic has not only led to severe losses in the tourism sector but also had major impacts on Hong Kong's economy, especially related sectors such as retailing, catering, and hotel services. Before the pandemic, regional and intercontinental travelers mostly arrived in Hong Kong by air, except for tourists from mainland China, who mostly used land transport [3]. However, various travel restrictions, notably cross-border regulation, social distancing requirements, and quarantine rules, have significantly reduced the number of inbound international visitor arrivals. There have been catastrophic losses in the aviation and tourism industries in Hong Kong [4,5].

Promising recovery patterns have been observed in a few domestic markets, including mainland China and the United States, owing to pandemic control and the availability of effective vaccines [6]. There are high expectations that a "new normal" will emerge as travel restrictions are relaxed and quarantine arrangements revised for international travel. However, it remains unclear what kind of new normal will be reached or how international air travel and tourism can reboot post-COVID-19 pandemic. Answers to these questions are important to open economies such as Hong Kong, Singapore, and Dubai in particular, and the global tourism and aviation industries in general. This study contributes to a better understanding of these issues by empirically examining the key determinants and drivers of Hong Kong's inbound tourism from its key regional tourism source markets (Japan, Malaysia, the

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Philippines, Singapore, and South Korea), using data covering the period before and during COVID-19. In addition to an updated assessment of Hong Kong's inbound tourism amid the outbreak, it also aims to contribute to the formation of an appropriate policy and managerial strategy for better recovery post-pandemic.

The remainder of this paper is organized as follows. Section 2 provides an overview of Hong Kong's inbound tourism from key markets and challenges before and during the COVID-19 era. Section 3 reviews the seat capacity changes from key inbound markets. Based on such background information, Section 4 discusses the factors that affect visitor flows as identified by previous studies, and explores the impact of COVID-19 on inbound tourism. Sections 5 and 6 introduce the methodologies and data used in this study, and the empirical results, respectively. Section 7 discusses the findings and concludes the study with recommendations for policymakers and tourism stakeholders.

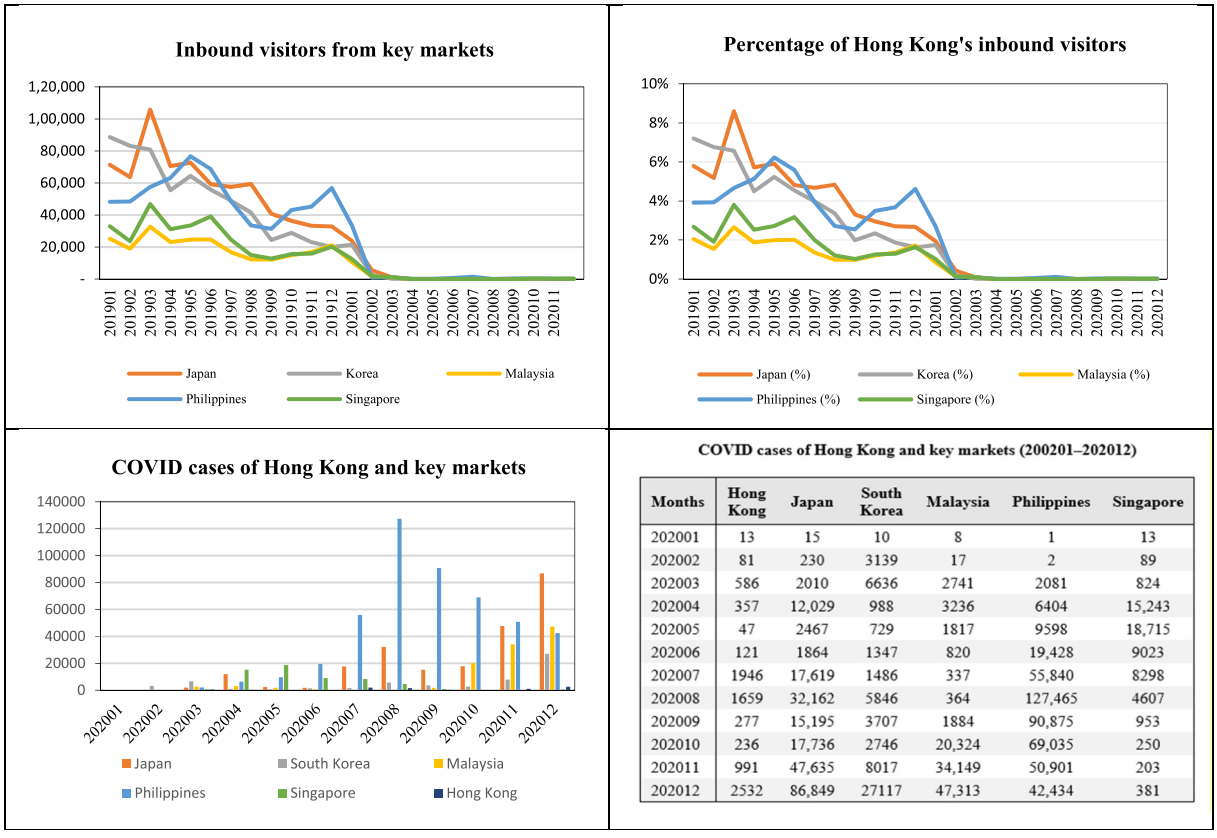
2. Overview of Hong Kong's inbound tourism from the key markets

Hong Kong, with its blend of Eastern and Western cultures, has established a reputation as a "shopping paradise", attracting millions of tourists every year for shopping and sightseeing [7]. A total of 11.87 million inbound visitor arrivals to Hong Kong by air transport was recorded in 2019. This was followed by a significant decrease in 2020, with only 0.85 million recorded due to the COVID-19 pandemic [8]. Data were compiled for Hong Kong's five key inbound tourism source markets (Japan, Malaysia, the Philippines, Singapore, and South Korea) from January 2019 to December 2020, based on well-recognized sources of the Hong Kong Tourism Board. Hong Kong had undergone a very difficult time from June 2019 onwards with intermittent protests, illustrating a stable downward trend of total inbound visitor arrivals throughout 2019. As part of the pandemic control efforts, 6 of the 13 border control points in Hong Kong were suspended on January 30, 2020, followed by transport service suspension at 4 control points. A mandatory two-week quarantine was first introduced for visitor arrivals from high-risk countries and subsequently extended to arrivals from all countries [9]. Since then, most people arriving in Hong Kong were visiting families and relatives or traveling for other essential reasons, reducing tourism travel (holidays and vacations) to almost zero.

Fig. 1 summarizes Hong Kong's inbound visitors from key markets from 2019 to 2020. The three largest regional markets were Japan, South Korea, and the Philippines, which jointly accounted for 17.1% of the market share in the first six months of 2019, followed by two regional markets, Malaysia and Singapore, with shares between 2.1% and 2.9%. As protests took place in Hong Kong from mid-2019 to early 2020, there was a general downward trend, although temporary increases in visitors from Malaysia, the Philippines, and Singapore were observed from September to December 2019. As January 2020 began with the COVID-19 pandemic, the unprecedented global health and social emergency exerted profound negative impacts on Hong Kong's inbound tourism. By mid-2020, Hong Kong had endured lockdowns for several weeks (the closure of restaurants and of recreational and entertainment facilities), widespread travel restrictions, and airport and border closures. These measures substantially reduced the number of inbound visitors and, hence, inflows from all five key markets.

3. Overview of seat capacity changes from key markets to Hong Kong

Visitor arrivals account for a significant share of Hong Kong International Airport (HKIA) passenger throughput. As observed in many markets, tourism is one of the key business activities facilitating the growth of Hong Kong's aviation sector (e.g., [3,10,11]). In recent years, low-cost carriers (LCCs) have played a significant role in developing Hong Kong's



COVID cases of Hong Kong and key markets (200201–202012)

Months	Hong Kong	Japan	South Korea	Malaysia	Philippines	Singapore
202001	13	15	10	8	1	13
202002	81	230	3139	17	2	89
202003	586	2010	6636	2741	2081	824
202004	357	12,029	988	3236	6404	15,243
202005	47	2467	729	1817	9598	18,715
202006	121	1864	1347	820	19,428	9023
202007	1946	17,619	1486	337	55,840	8298
202008	1659	32,162	5846	364	127,465	4607
202009	277	15,195	3707	1884	90,875	953
202010	236	17,736	2746	20,324	69,035	250
202011	991	47,635	8017	34,149	50,901	203
202012	2532	86,849	27117	47,313	42,434	381

Fig. 1. Hong Kong's inbound visitors from key markets and COVID cases. (January 2019–December 2020.)

aviation and tourism sectors, complementing the extensive networks and operations of incumbent dominant full-service carriers (FSCs) [11,12]. Fig. 2 summarizes the airline seat capacity of key markets serving Hong Kong from 2019 to 2020. In 2019, airline scheduled seats of the five key markets accounted for approximately 30.7% of Hong Kong's total (14.1 million seats), peaking at 40.0% (1.65 million seats) in October 2019. At the beginning of 2020, airline scheduled seats of these five key markets slipped from 1.28 million seats in December 2019 to 0.22 million seats in March 2020. It is clear that Hong Kong's aviation sector suffered major devastation within a short period as COVID-19 spread across the globe. This has negative feedback effects on Hong Kong's inbound air travel demand: the declines in aviation supply and flight frequency have led to reduced airline competition and service quality [13–15], further inhibiting travel demand. Reduced flight volume also implies fewer flight-connection opportunities, and thus reduces transfer passenger volumes via HKIA.

In terms of airline scheduled seats of the sampled markets, the top three in 2019 were Japan, the Philippines, and South Korea, accounting for 13.3% (6.1 million seats), 5.5% (2.5 million seats), and 5.0% (2.3 million seats) of Hong Kong's total, respectively. Fig. 2 further classifies scheduled seat capacities offered by FSCs and LCCs, as they provide differentiated services with distinctive networks [16,17]. On the one hand, LCCs often have significant traffic stimulation effects with their low fares. Thus, the loss of LCC services may lead to a significant decline in travel volumes, especially for price-sensitive leisure travelers. On the other hand, with hub-and-spoke networks, FSCs can combine traffic volumes at individual spoke markets, thus providing extended connectivity to a large number of destinations. As illustrated in Fig. 2, FSCs successfully controlled and dominated all five key markets, with shares ranging from 66.4% to 87.6% of scheduled seats serving Hong Kong. In terms of LCC services, they showed stable downward trends and remained mostly below 1 million seats except for the Japanese market, which reached 1.7 million seats in 2019. Since the start of the COVID-19 pandemic, the number of scheduled seats served by both FSCs and LCCs has fallen sharply. The number of scheduled seats served by LCCs decreased to zero for an extended time in the second half of 2020. The notable exception was the South Korean market, where LCC services still accounted for 53.3% of the market in 2020 amid the pandemic.

4. Literature review

Air transport and tourism are generally mutually dependent [3,18]. On the one hand, air transport facilitates tourism, since aviation services provide accessibility over large spatial networks; on the other hand, much of the demand for air transport services is derived from tourism activities (e.g., [19–23]). However, such mutual dependence ensures a

Fig. 2. Airline scheduled seat capacity in key markets serving Hong Kong. (January 2019–December 2020.)

negative feedback loop amid major recessions or a pandemic like COVID-19, causing catastrophic impacts on the aviation and tourism sectors. For a reasonable specification of empirical models, this section first reviews previous discussions of the determinants of inbound tourism, followed by an analysis of the relationship between pandemics and tourism.

4.1. Determinants of inbound international tourism

In the air transport and tourism literature, it is generally acknowledged that air accessibility and seat capacity have promoted tourism growth (e.g., [23,24]). In particular, the development of LCCs has had substantial impacts on tourism demand regarding inbound air travelers and the promotion of tourist destinations, since LCCs provide more affordable air travel (e.g., [24–26]). In addition, bilateral trade volume (some researchers have used air cargo volume as a proxy because of data availability) was found to be a significant determinant of inbound tourism in many prior studies (e.g., [10,23,27]). It is also notable that income variables (e.g., GDP per capita and the customer price index (CPI)) have also affected the number of inbound tourists to destinations (e.g., [10,28,29]). Prior studies have also considered the issue of exchange rates when analyzing international tourism, as it can be treated as a pull and/or push factor in tourism demand [26,30]. Moreover, many studies have highlighted the tourism price variables that affect inbound tourist flows, such as transportation costs, accommodation costs, and food and beverage prices (e.g., [31,32,33]). Apart from the aforementioned factors, a group of non-economic factors such as travel distance [10,29], common language and cultural links [10,34], visa restrictions [35,36], and exogenous shocks and crisis events (e.g., earthquakes, global financial crises, SARS outbreaks, and political protests) [37,38,39] have also been studied as important factors affecting inbound tourism.

4.2. Impact of COVID-19 on inbound tourist arrivals

According to the World Tourism Organization (UNWTO), the tourism industry is facing the most pressing challenges of the global COVID-19 pandemic [40]. It is important to note that the international tourism sector has been exposed to a wide range of crises (the SARS outbreak, tsunamis, etc.) in the past few decades, yet none had subjected international tourism to such a deep shock, likely due to the unprecedented travel restrictions and border closures implemented by governments globally [41,42]. Early research noted that international tourist flows, especially air travel, played an essential role in the rapid spread of COVID-19, and restrictions on international air travel have been widely accepted as one of the most effective measures to reduce imported cases (e.g., [43–45]). Beh and Lin [46] analyzed data from seven ASEAN countries and confirmed the adverse effects of the COVID-19 pandemic on their tourism sectors. They highlighted the importance of disinfecting airplanes and airport terminals to prevent contamination. It is clear that because of travel restrictions and lockdowns, global tourism has slowed significantly. Since COVID-19 transmission is heavily reliant on human mobility and physical interaction, many airlines have adopted specific seating policies inside the cabin to maintain social distance, which have caused further declines in seat capacity supply and passenger volume [46,47]. Moreover, recent evidence confirmed the link between perceived safety risks and traveling intention; that is, the riskier a destination is perceived to be with regard to COVID-19, the less likely tourists to visit it [48,49]. Additionally, because the COVID-19 virus is widely acknowledged as highly contagious, social gatherings will aggravate the spread of virus [50]. High population density of a destination increases tourists' safety risk perceptions of the destinations, thereby discouraging their willingness to travel to the destination. [51]. Thus, the effects of travel safety plays a negative role in tourism demand under this serious public health crisis.

It is worth noting that perceived safety risks associated with air travel (i.e., in-flight transmissions) are considered to influence travelers' decisions to travel to a destination [48,52]. In the early stage of the COVID-19 pandemic, some countries adopted lockdown measures and travel restrictions to restrict mobility and prevent the spread of the virus in avoiding large outbreaks [53]. For those countries which have struggled in fighting the pandemic, their infection cases may impose perceived travel risks to potential travelers and visitors in terms of their health and wellbeing, which can result in lower travel demand [54]. On the other hand, Hyams et al. [55] posited that an unknown deadly virus usually instils a high level of stress, fear and risk in the community. As the spread of the COVID-19 virus is closely linked to travel, infectious travelers may pose risks for seeding outbreaks in the community and across the border, particularly when the local infection prevalence and vaccination rate is low [56]. With an increasing number of people being vaccinated worldwide, many countries have considered reopening their borders and relaxing international travel restrictions [57]. Still, some studies have suggested that the negative impact of COVID-19 on the tourism industry worldwide will continue in the long run (e.g., [6,42,58]).

5. Data definitions and empirical models

In view of the possible determinants of tourist flows and air travel, as reviewed in the previous section, Table 1 summarizes the definitions

Table 1
Variable definition and data sources.

Time series and variables	Definitions	Data sources
$ln(Visitor)_{ijt}$	The logarithm of inbound visitors by air to Hong Kong from country j in month t (in number)	HKTB
HKG_COVID_{it}	The confirmed COVID cases of Hong Kong in month t (in number)	Data.GOV.HK
$Country\_COVID_{jt}$	The confirmed COVID cases of country j in month t (in number)	GitHub
$ln(airfare)_{ijt}$	The logarithm of average airfare to Hong Kong from country j's airports in month t (in USD)	IATA
$ln(skj\_seat)_{ijt}$	The logarithm of total scheduled airline seat capacity to Hong Kong from country j's airports in month t (in seat number)	OAG
$\%of\ LCC\_seat_{ijt}$	The share of low-cost carriers' scheduled seat capacity to Hong Kong from country j's airports in month t (in %)	OAG
$ln(fly\_dist)_{ijt}$	The logarithm of average great circle flying distance to Hong Kong from country j's airports in month t (in kilometre)	OAG
$ln(mkt\_pot)_{ijt}$	The logarithm of preceding period of total scheduled seat capacity of country j's airports to Hong Kong in month t (in seat number)	OAG
$ln(HKG\_CPI)_{it}$	The logarithm of composite price index of Hong Kong in month t (in number)	HKSCD
EX_{ijt}	The exchange rate between Hong Kong dollar and country j's currency in month t (HKD vs. the origin country's currency)	HKSCD
$Protest_i$	Dummy variable for political protests occurred in Hong Kong from July 2019 to March 2020, coded to 1 within this period and 0 otherwise	HKG govt website & media reports
$OxCGRT_i$	Hong Kong governments' responses to the COVID-19 pandemic in terms of international travel control. It is coded as 0 (no measures), 1 (screenings), 2 (quarantine arrivals from high-risk countries), 3 (ban on high-risk regions), and 4 (total border control)	OxCGRT

Remarks: HKTB, Hong Kong Tourism Board; IATA, International Air Transport Association; OAG, Official Airline Guide; HKSCD, Hong Kong Census and Statistics Department; HKG govt, Hong Kong government website; OxCGRT, The Oxford Covid-19 Government Response Tracker.

Table 2
Descriptive statistics of variables.

Time series and variables	Observations	Mean	Standard deviation	Maximum	Minimum	Skewness	Kurtosis
All periods (before and after the COVID-19 pandemic eras)							
$Visitor_{ijt}$[a]	120	21,810	25,692.99	105,797	5	1.06	0.26
HKG_COVID_{it}	120	369	689.01	2532	0	2.05	3.06
$Country\_COVID_{jt}$	120	7860	19,927.60	127,465	0	3.64	14.94
$airfare_{ijt}$	115	214.28	69.05	424.68	111.44	0.78	0.06
skj_seat_{ijt}	120	140,141	154,344.07	940,752	4985	2.06	5.99
$\%of\ LCC\_seat_{ijt}$	120	25.78	20.15	96.70	0	0.93	1.39
fly_dist_{ijt}	120	1176	262.30	1495	619	−0.91	0.93
mkt_pot_{ijt}	120	376,938	184,263.31	844,547	126,843	1.37	0.60
HKG_CPI_{it}	120	111.22	2.23	113.30	105.40	−1.53	1.26
EX_{ijt}	120	1.56	2.19	5.82	0.01	1.19	−0.24
$Protest_i$	120	0.38	0.49	1	0	0.52	−1.76
$OxCGRT_i$	120	1.35	1.45	4	1	0.31	−1.71
Before the COVID-19 pandemic era							
$Visitor_{ijt}$[a]	60	41,579	22,337.54	150,797	12,189	0.69	−0.18
HKG_COVID_{it}	60	0	0	0	0	–	–
$Country\_COVID_{jt}$	60	0	0	0	0	–	–
$airfare_{ijt}$	60	206.36	70.26	424.68	111.44	0.80	0.33
skj_seat_{ijt}	60	235,196	156,473.88	940,752	92,203	2.21	6.15
$\%of\ LCC\_seat_{ijt}$	60	27.44	8.10	35.99	11.09	−1.19	−0.20
fly_dist_{ijt}	60	1163	244.30	1383	724	−0.96	−0.60
mkt_pot_{ijt}	60	376,938	185,042.43	844,547	126,843	1.39	0.68
HKG_CPI_{it}	60	111.49	1.23	112.90	109.20	−0.44	−1.28
EX_{ijt}	60	1.57	2.22	5.80	0.01	1.20	−0.21
$Protest_i$	60	0.50	0.50	1	0	0	−2.07
$OxCGRT_i$	60	0	0	0	0	–	–
The COVID-19 pandemic era							
$Visitor_{ijt}$[a]	60	5768	18,281.84	105,797	5	4.09	17.64
HKG_COVID_{it}	60	737	825.35	2532	13	1.07	−0.29
$Country\_COVID_{jt}$	60	15,721	25,986.19	127,465	1	2.43	6.30
$airfare_{ijt}$	55	222.92	67.27	391.09	117.43	0.84	−0.13
skj_seat_{ijt}	60	45,085	72,017.54	423,974	4985	3.75	15.68
$\%of\ LCC\_seat_{ijt}$	60	24.12	27.35	96.70	0	0.97	−0.15
fly_dist_{ijt}	60	1189	280.60	1495	619	−0.92	−0.63
mkt_pot_{ijt}	60	376,938	185,042.43	844,547	126,843	1.39	0.68
HKG_CPI_{it}	60	110.95	2.89	113.30	105.40	−1.17	−0.49
EX_{ijt}	60	1.54	2.17	5.82	0.01	1.21	−0.20
$Protest_i$	60	0.25	0.44	1	0	1.18	−0.62
$OxCGRT_i$	60	2.70	0.85	4	0	−1.60	3.51

Remarks: All figures are the original figures.
[a] Inbound visitors to Hong Kong include visitors who visited Hong Kong with different purposes (e.g., vacations, business, visiting friends and families, enroute and others) [8].

and sources of the variables used in our empirical analysis. The balanced panel data from January 2019 to December 2020 cover both the pre-COVID-19 and COVID-19 eras in Hong Kong.[1] For Hong Kong's five key tourism source markets being studied, 120 country-month observations were included in our sample. Among all the variables of interest, the confirmed COVID-19 cases in Hong Kong and the five selected markets are the focus of this study.

Table 2 presents descriptive statistics of the variables of interest for three periods: (i) all periods (before and after the COVID-19 pandemic eras); (ii) before the COVID-19 pandemic era; and (iii) after COVID-19 pandemic era. With respect to the statistics of all periods (before and after COVID-19 pandemic eras), the average number of inbound visitors to Hong Kong from the five selected markets was 21,810 over the sampled period, with a standard deviation of 25,692.99. The monthly averages of the two key variables of interest (confirmed COVID-19 cases in Hong Kong and in the five selected markets) are 369 and 7860, with standard deviations of 689.01 and 19,927.60, respectively. These variables are used as proxies for COVID-19 pandemic conditions. The preceding period's total scheduled seat capacity is used as a proxy for the market size of Hong Kong's inbound travel market, with a mean of 376,938 per month over the sampled period. Two socioeconomic variables (Hong Kong's composite price index and its exchange rate of Hong Kong dollar vs. the origin country's currency) capture travel demand and cost-related effects. Moreover, political protests and international travel control imposed by the Hong Kong government to measure the effects of geopolitical issues on travel and tourism demand. Overall, there are substantial variations across the dataset, which should allow us to identify the significant determinants and drivers of Hong Kong's inbound tourism during the sampled period.

We use the unbalanced panel model specifications to identify the determinants and drivers of Hong Kong's inbound tourism. Among others, prior studies suggested three reasons that make panel regression an appropriate econometric method in this study: (i) The dataset covers Hong Kong's five key tourism source markets. There are significant variations across observations that facilitate empirical identification; (ii) the method should be able to control the heterogeneity across the sampled markets and over time, and unobserved effects in the dataset; and (iii) it usually produces consistent estimates in the presence of risks of omitted variables and serial correlation in the unobservables (e.g., [22,50–64]). A static panel model as specified in Model (1) is adopted for empirical test.

$$\begin{aligned} ln\,(Visitor)_{ijt} = {} & \beta_0 + \beta_1 HKG\_COVID_{it} + \beta_2 Country\_COVID_{jt} \\ & + \beta_3\, ln\,(airfare)_{ijt} + \beta_4\, ln\,(skj\_seat)_{ijt} \\ & + \beta_5 \%of\ LCC\_seat_{ijt} + \beta_6\, ln\,(fly\_dist)_{ijt} \\ & + \beta_7\, ln\,(mkt\_pot)_{ijt} + \beta_8\, ln\,(HKG\_CPI)_{it} + \beta_9 EX_{ijt} \\ & + \beta_{10} Proetst_i + \beta_{11} OxCGRT_i + \varepsilon_{ijt} \end{aligned} \quad (1)$$

[1] Hong Kong recorded its first confirmed COVID-19 case on 23 January 2020.

Table 3
Correlation matrix of variables of interest.

Time series and variables	HKG_COVID_{it}	$Country\_COVID_{jt}$	$ln(airfare)_{ijt}$	$ln(skj\_seat)_{ijt}$	$\%of\ LCC\_seat_{ijt}$	$ln(fly\_dist)_{ijt}$	$ln(mkt\_pot)_{ijt}$	$ln(HKG\_CPI)_{jt}$	EX_{ijt}	$Protest_i$	$OxCGRT_i$
HKG_COVID_{it}	1.000										
$Country\_COVID_{jt}$	0.425	1.000									
$ln(airfare)_{ijt}$	0.145	0.099	1.000								
$ln(skj\_seat)_{ijt}$	−0.603	−0.380	−0.079	1.000							
$\%of\ LCC\_seat_{ijt}$	−0.108	−0.309	−0.264	−0.116	1.000						
$ln(fly\_dist)_{ijt}$	0.026	−0.297	0.671	−0.049	−0.076	1.000					
$ln(mkt\_pot)_{ijt}$	0.024	−0.038	0.591	0.210	−0.094	0.425	1.000				
$ln(HKG\_CPI)_{it}$	−0.300	−0.098	−0.110	0.071	0.069	−0.010	−0.107	1.000			
EX_{ijt}	−0.049	−0.033	0.106	0.072	0.020	0.063	0.203	−0.081	1.000		
$Protest_i$	−0.302	−0.267	−0.230	0.144	0.035	−0.029	−0.092	0.307	−0.075	1.000	
$OxCGRT_i$	00570	0.346	0.1611	−0.755	−0.133	0.037	0.037	0.002	−0.082	−0.317	1.000

where i and j denote destination and origin market (i.e., Hong Kong and its five key tourism source markets) in month t, respectively. β_s are the coefficients to be estimated, and ε_{ijt} is the error term. ln denotes the logarithm. Note that all of the variables of interest were transformed into the logarithmic form (see Table 1), except for HKG_COVID_{it}, $Country\_COVID_{jt}$, $\%of\ LCC\_seat_{ijt}$, $Protest_i$, EX_{ijt}, and $OxCGRT_i$, and thus the coefficients of explanatory variables can be interpreted as demand elasticities with respect to the variables (e.g., [65–67]). The dependent variable is monthly inbound visitors to Hong Kong from the five key Asian tourism source markets. As mentioned, the most important explanatory variables are confirmed COVID-19 cases in Hong Kong (HKG_COVID_{it}) and the tourism source markets ($Country\_COVID_{jt}$). In summary, explanatory variables include: (i) COVID-19 cases recorded in Hong Kong and the selected markets; (ii) airline demand and supply factors: airfare, airline scheduled seat capacity, proportion of LCCs' scheduled seat capacity, and flying distance to Hong Kong; (iii) market potential (market size) of Hong Kong's inbound tourism; (iv) socioeconomic and tourism variables that are likely to affect inbound visitor flows, which include Hong Kong's composite price index[2] and exchange rate; and (v) political protests occurred in Hong Kong and the Hong Kong government's response to the COVID-19 pandemic in terms of international travel control.

In addition, the tourism literature suggests that a distinctive characteristic of tourist flows is the tendency of repeated visits to a destination and habit persistence (e.g., [68–73]), such as tourists or holidaymakers who wish to return to a popular place for holidays or vacations. Song et al. [73] incorporated this characteristic in tourism demand models using the lagged dependent variable in modeling and forecasting for Hong Kong tourism demand. Fleissig [69] also suggested that the largest habit persistence was observed for air transportation. Theoretically, the static panel model above could be subject to misspecification if such persistent effects across time (i.e., repeated visitors) are misspecified. Importantly, not including such a characteristic in analyzing visitor flows to Hong Kong (i.e., lagged effects from the previous period) in Model (1) may lead to overestimated parameters, because both the immediate (direct) and lagged (indirect effects) effects would be included [68]. Therefore, a dynamic specification including the lagged value of $ln(Visitor)_{ijt}$ as an explanatory variable ($ln(Visitor)_{ijt-1}$) is also estimated using the same dataset. The dynamic generalized method of moments (GMM) panel model is specified in Model (2):

$$\begin{aligned} ln\,(Visitor)_{ijt} = {} & \beta_0 + \beta_1\, ln\,(Visitor)_{ijt-1} + \beta_2 HKG\_COVID_{it} \\ & + \beta_3 Country\_COVID_{jt} + \beta_4\, ln\,(airfare)_{ijt} \\ & + \beta_5\, ln\,(skj\_seat)_{ijt} + \beta_6 \%of\ LCC\_seat_{ijt} \\ & + \beta_7\, ln\,(fly\_dist)_{ijt} + \beta_8\, ln\,(mkt\_pot)_{ijt} \\ & + \beta_9\, ln\,(HKG\_CPI)_{it} + \beta_{10} EX_{ijt} + \beta_{11} Proetst_i \\ & + \beta_{12} OxCGRT_i + \varepsilon_{ijt} \end{aligned} \quad (2)$$

6. Estimation results and empirical findings

The empirical models in this study aim to identify the determinants and drivers of Hong Kong's inbound visitors from the five key Asian tourism source markets, with a focus on the effect of the COVID-19 pandemic. As mentioned in Section 5, exogenous shocks, aviation-related and socioeconomic, and tourism variables are considered in this study, which may affect Hong Kong's inbound tourism.

6.1. Multicollinearity, panel data unit root tests and endogeneity test

To estimate the panel model in Models (1) and (2), the correlation between all the selected explanatory variables was tested, which limits the possibility of multicollinearity and the use of classic regression model [74]. Table 3 shows that the correlation matrix among the explanatory variables, and it can be seen that no significant problem of high correlation arises, with the highest value of −0.755. Moreover, all the variables of interest (dependent and explanatory variables) need to be stationary to be free from the problem of spurious correlation (e.g., [63,67,75]). Therefore, the panel unit root tests (augmented Dickey–Fuller, ADF; Phillips–Perron, PP) were performed to check

Table 4
Summary of panel unit root tests for variables.

Time series and variables	Level		First-differencing	
	ADF	PP	ADF	PP
$ln(Visitor)_{ijt}$	0.9988	0.9988	0.0000***	0.0000***
HKG_COVID_{it}	0.9552	0.9552	0.0001***	0.0001***
$Country\_COVID_{jt}$	0.9820	0.9820	0.0000***	0.0000***
$ln(airfare)_{ijt}$	0.0325	0.0325	0.0000***	0.0000***
$ln(skj\_seat)_{ijt}$	0.9969	0.9969	0.0000***	0.0000***
$\%of\ LCC\_seat_{ijt}$	0.9765	0.9765	0.0000***	0.0000***
$ln(fly\_dist)_{ijt}$	0.8283	0.5283	0.8283	0.0000***
$ln(mkt\_pot)^a_{ijt}$	1.0000	1.0000	0.0000***	0.0000***
$ln(HKG\_CPI)_{jt}$	0.0000***	0.0000***	0.0000***	0.0000***
EX_{ijt}	0.9826	0.9826	0.0000***	0.0000***
$OxCGRT_i$	0.9746	0.9746	0.0000***	0.0000***

Remarks: The values indicate p-values. The test is shown for the constant only. *** indicate the rejection of the null hypothesis (H_0) that the variable has a panel unit root at 1% significance level. ADF, augmented Dickey–Fuller; PP, Phillips–Perron. Dummy variable of $Protest_i$ is not tested for unit roots.

[2] This study uses composite price index because at the time of data collection Hong Kong Census and Statistics Department published consumer price index for package tours only up to February 2020 [78].

Table 5
Estimation results of Hong Kong's inbound visitors from key Asian markets (January 2019–December 2020).

	Static panel RE model (1A)	Static panel FE model (1B)	2SLS panel RE model (1C)	2SLS panel FE model (1D)	Robustness check GMM dynamic panel model (2)
Dependent variable	$ln(Visitor)_{ijt}$				
Explanatory variables	Coefficients	Coefficients	Coefficients	Coefficients	Coefficients
Constant	47.612***	47.103***	41.305***	40.604***	67.697***
$ln(Visitor)_{ijt-1}$	–	–	–	–	0.327***
HKG_COVID_{it}	−0.0003***	−0.0002***	−0.0002*	−0.0002*	−0.00005*
$Country\_COVID_{jt}$	−8.73e-06***	−0.00001***	−9.82e-06***	−0.0001***	−9.40e-06**
$ln(airfare)_{ijt}$	−0.223	−0.243	−0.188	−0.210	0.282
$ln(skj\_seat)_{ijt}$	1.400***	1.423***	1.612*** [a]	1.642*** [b]	1.254***
$\%of\ LCC\_seat_{ijt}$	−1.449	−1.430	−1.298	−1.145	−1.704
$ln(fly\_dist)_{ijt}$	0.709	1.251	0.971	1.558	−5.377***
$ln(mkt\_pot)_{ijt}$	0.114	0.113	0.244	0.246	0.354*
$ln(HKG\_CPI)_{it}$	−10.113***	−10.002***	−8.772***	−8.762***	−8.925***
EX_{ijt}	−1.61e-07	−1.95e-07*	−2.33e-07	−2.59e-07*	−1.039
$Protest_i$	0.102	0.087	0.109	0.092	−0.070
$OxCGRT_i$	−0.590***	−0.582***	−0.574***	−0.565***	−0.510***
R^2	0.570	0.571	0.568	0.566	–
No. of observations	110	110	110	110	105
Sargan statistic (*p*-value)	–	–	–	–	0.359
AB(1) test *p*-value	–	–	–	–	0.044
AB(2) test *p*-value	–	–	–	–	0.538

Remarks: *, ** and *** indicate the explanatory variable is significant at the 0.10, 0.05, and 0.01 significance levels, respectively. Results for the first-stage regression analysis for 2SLS panel RE and FE models are unreported for the sake of brevity. [a] and [b] are estimated with an IV of $ln(skj\_seat\_other\_market)_{ijt}$ for $ln(skj\_seat)_{ijt}$ using the 2SLS-IV approach. The GMM dynamic panel model with $ln(Visitor)_{ijt-1}$ and $ln(Visitor)_{ijt-2}$ produced similar results of the GMM dynamic panel model with $ln(Visitor)_{ijt-1}$. Estimation results of the GMM dynamic panel model with two lags (*t-1, t-2*) of the dependent variable do not suggest qualitative change neither.

whether the variables of interest were stationary (see Table 4). Most variables were found to be non-stationary, except for $ln(HKG\_CPI)_{it}$. First-differencing was applied to convert non-stationary variables to stationary ones, whereas $ln(mkt\_pot)_{ijt}$ was twice-differenced to be stationary. In addition, there might exist a two-way relationship between inbound tourism demand and airline scheduled seat capacity in the dataset [76]. To verify the endogeneity problem of $ln(skj\_seat)_{ijt}$, we use the Durbin-Wu-Hausman test. The test results (*p*-values) of Durbin chi-2(1) = 0.0032 and Wu-Hausman = 0.0050, which confirmed the endogeneity of $ln(skj\_seat)_{ijt}$. The two-stage least square (2SLS) method with instrumental variable (IV) is frequently used to resolve the endogeneity problem, especially in the tourism and airline studies (e.g., [67,76,77]). Therefore, an IV of $ln(skj\_seat\_other\_market)_{ijt}$ is introduced to Model (1) to solve the endogeneity problem related to $ln(skj\_seat)_{ijt}$.[3]

6.2. Empirical results of static and 2SLS panel models

The estimation results of static and 2SLS panel models are presented in Table 5 (Models 1A–1D).[4] Overall, both the static and 2SLS panel models (RE and FE specifications) provide fairly consistent and robust estimation results. Our focus is on the two COVID-19 variables, HKG_COVID_{it} and $Country\_COVID_{jt}$, which are negative and statistically significant in both models. This is consistent with our expectation that the COVID-19 cases of Hong Kong and the five key markets adversely affected Hong Kong's inbound visitors from those tourism source markets. This is supported by Ye and Law [79], who suggested that Hong Kong suffered heavily from the COVID-19 pandemic. Zhang et al. [57] also claimed that Hong Kong faced the highest risk of imported COVID-19 cases due to its superior international air connectivity and looser restrictions on inbound flights. These results are expected and intuitive.

However, it is interesting and surprising to note that the coefficients for confirmed COVID-19 cases in Hong Kong are about 20 to 60 times larger than the coefficients for the origin countries, depending on the specifications used. That is, there is an asymmetric effect of COVID-19 severity in the origin and destination countries. This is counterintuitive, because a standard-gravity model of travel/transport demand generation would suggest almost identical effects. In addition, travel restrictions are usually imposed based on the pandemic control situation in countries of origin. For instance, the Hong Kong government classified countries into different categories, namely, group A (extremely high-risk), group B (high-risk), group C (medium-risk), and group D (low-risk). The UK government classified countries into "transport corridors" according to the severity of the pandemic. The rule was subsequently suspended due to the global rise in COVID-19 cases and the spread of mutated viruses. In May 2021, the UK Department for Transport released its decision of "red, amber, and green list rules for entering England". Countries are put into different color lists with different travel restrictions. For example, British residents are advised not to travel to red-list countries in accordance with the rule, and even vaccinated arrival passengers and visitors from red-list countries must take a COVID-19 test, book a quarantine hotel package with two COVID-19 tests, and complete a passenger locator form before traveling to the UK.[5] On the one hand, the effects of travel restrictions on the destination country should have been quite significant. On the other hand, since the COVID-19 outbreaks across many countries all happened within a short period, individual country effects are difficult to identify separately. Tourists usually have a stronger preference for destinations with good pandemic control. As a result, Hong Kong's attractiveness to incoming visitors increased significantly when it had better pandemic control and a smaller number of infection cases than other markets. This would explain the asymmetric patterns observed in the estimation results. Further investigation using data from more countries would be

[3] The identifying assumption for developing $ln(skj\_seat\_other\_market)_{ijt}$ as an IV for $ln(skj\_seat)_{ijt}$ is that country-specific airline seat capacities to Hong Kong are independent across the sampled markets. Given this assumption, airline seat capacity of the sampled markets is the valid IV since airline seat capacities of any markets to Hong Kong (1) will be correlated due to the common airline operations to transport travelers and visitors to Hong Kong but (2) will be uncorrelated with country-specific estimation. In addition, the test results of (*p*-values) Durbin chi-2(1) = 0.0851 and Wu-Hausman = 0.1054, which confirmed that all the variables in the 2SLS panel RE and FE models are exogenous (see Table 5).

[4] When estimations are carried out at route level, the variable was treated as a time-invariant variable [53]. In the current study, this variable represents the monthly average of flying distances from all airports of the origin countries to Hong Kong. Therefore, its monthly value change and the coefficient estimates are reported for both the static and 2SLS panel models.

[5] For more details of this rule, see https://www.gov.uk/guidance/red-amber-and-green-list-rules-for-entering-england.

useful to pinpoint such effects on international travel and tourism demand.

The variable of $ln(skj\_seat)_{ijt}$ is statistically significant, with an elasticity range between 1.400 and 1.642 in the static and 2SLS panel RE and FE models. This implies that for every 1% increase in scheduled seat capacity from the selected markets, visitors traveling to Hong Kong for holidays and vacations or other purposes increased by 1.400–1.642%. As discussed, an increase in flight capacity and frequency corresponds to higher service quality and flexibility for travelers and passengers, which also increases connection opportunities in Hong Kong. The impact of the socioeconomic variable of $ln(HKG\_CPI)_{it}$ on Hong Kong's inbound tourism is statistically significant and negative, with an elasticity ranging from −8.762 to −10.113. This suggests that for every 1% increase in Hong Kong's CPI (the proxy for tourism price), the number of visitors from the selected markets reduced by −8.762% to −10.113%. The high cost of visiting Hong Kong has become a major inhibitor for incoming visitors. The tourism board and local industries may consider providing incentive schemes (e.g., discount coupons) during post-pandemic as part of a recovery strategy. In addition, a significant positive coefficient of the socioeconomic and tourism variable, EX_{ijt}, is only reported in the static and 2SLS panel FE models, which suggests that currency depreciation in the tourism source markets will increase the price to visit Hong Kong and thus have a negative effect [80], and is contrast with Cheng et al. [81] who suggested that the exchange rate elasticity to tourism demand is not very significant. Lastly, the variable of $OxCGRT_i$ is statistically significant and negative in the static and 2SLS panel RE and FE models. This implies that when the Hong Kong government imposed international travel control in response to COVID-19, which would have a negative impact on Hong Kong's inbound visitors from the sampled markets.

The market potential variable of $ln(mkt\_pot)_{ijt}$ is insignificant but with a positive coefficient sign, this is likely due to the various travel restrictions imposed by the Hong Kong and origin countries governments, which also changed over the sampled period. As a result, travel demands cannot always be fulfilled. Nevertheless, we still find some (partial) supporting evidence for Hong Kongs to focus on well-developed overseas markets for better recovery after the pandemic. The three aviation-demand variables ($ln(airfare)_{ijt}$, $\%of\ LCC\_seat_{ijt}$, and $ln(fly\_dist)_{ijt}$) are not statistically significant. Regarding the effects of airfare, Kim and Song [82] suggested that the travel cost variable was insignificant in many of the tourism demand models,[6] and Becken and Carmignani [83] found that demand for air travel would be reduced due to higher airfares. It is worth noting that airfare for visitors traveling to Hong Kong increased significantly during the COVID-19 period, leading Asian LCCs to reduce and even cease their flight services serving Hong Kong [84]. This situation is similar to the global air transport in which COVID-19 forced airlines to reduce fleets, stop serving long-haul destinations, etc., leading to diminished air transport capacity [47]. That is, most travelers and visitors were effectively removed from the markets, with the remaining passengers being price insensitive. Lastly, the political protest variable of $Protest_i$ is insignificant. This finding is not consistent with Poon and Koay [39], who found that Hong Kong protests from April to December 2019 have brought an adverse impact on the tourism industry. Again, caution should be exercised, as we are facing a special period in the pandemic.

6.3. Robustness checks

One possible issue in the static and 2SLS panel models above is that the variable of $ln(skj\_seat)_{ijt}$ could be endogenous, which might lead to inconsistent estimates. Apart from using the 2SLS-IV approach to address the endogeneity problem of $ln(skj\_seat)_{ijt}$ in the static panel RE and FE models. For the robustness checks, the GMM panel model is also used to address the endogeneity issue in the static and 2SLS panel models (e.g., [68,85,86–88]). The GMM model tends to offer more robust estimates than ordinary least squares (OLS) and fixed-effect estimates [88], although it may not fully avoid the endogeneity issue. In addition to the GMM specification, the dynamic characteristics of inbound visitor flows (the lagged values of the dependent variable) is also incorporated into the model. The estimation results for the dynamic GMM panel model are presented in Table 5 as a robustness check.

Overall, there was no clear evidence of inconsistency. The lagged dependent variable, $ln(Visitor)_{ijt-1}$, has a statistically significant and positive coefficient in the dynamic GMM panel model, with a value of 0.327. This finding is consistent with previous findings of repeated visits and travel (e.g., [3,89–92]). This also confirms the persistence of visitor flows. In addition to the variable of $ln(Visitor)_{ijt-1}$, all the statistically significant variables and their coefficient signs reported in the dynamic GMM panel models agree with those of the static and 2SLS panel RE and FE models, albeit with different magnitudes. Moreover, the significant negative coefficient sign of $ln(fly\_dist)_{ijt}$ is reported in the dynamic GMM model, which suggests that the flying distance between the tourism source markets and Hong Kong reduces inbound visitors to Hong Kong and thus having a negative effect [10,29]. Furthermore, the market potential variable of $ln(mkt\_pot)_{ijt}$ is statistically significant with an elasticity of 0.354. Overall, all these findings of the dynamic GMM model are consistent with the findings of the static and 2SLS panel RE and FE models.

Furthermore, the panel Granger causality test is used to determine the robustness of the causality results obtained by the models as presented in Table 5. The direction of causality established between $ln(Visitor)_{ijt}$ and $ln(skj\_seat)_{ijt}$ is presented in Table 6, which shows that unidirectionally causality running from airline scheduled seat capacity to inbound visitors to Hong Kong during the sampled period.

Table 6
Granger causality between inbound visitors and airline scheduled seats (January 2019–December 2020).

Granger causality	
H_0: $ln(skj\_seat)_{ijt}$ does not Granger-cause $ln(Visitor)_{ijt}$	H_0: $ln(Visitor)_{ijt}$ does not Granger-cause $ln(skj\_seat)_{ijt}$
Rejected (0.000) ***	Fail to reject (0.476)

Remarks: The parentheses indicate *p*-values. *** indicate that the rejection of the null hypothesis (H0) at the 0.01 significance level.

7. Concluding discussion

This study empirically identifies the determinants and drivers of Hong Kong's inbound tourism using data from January 2019 to December 2020. Five of Hong Kong's major regional tourism source markets were selected: Japan, Malaysia, the Philippines, Singapore, and South Korea. Our empirical results suggest that the COVID-19 pandemic has had significant negative impacts on the tourism and aviation sectors in Hong Kong, and such effects were asymmetric for the source and destination countries. The Hong Kong government adopted international travel control and restrictions to prevent and contain the spread of COVID-19 virus that has brought much of inbound tourism to a standstill. International travel control imposed by the Hong Kong government is often defined according to the COVID-19 pandemic situation in the tourism source countries. Therefore, Hong Kong's inbound visitor volume is significantly affected by the Hong Kong government's response to COVID-19 infection cases in the tourism source markets. Given the criticality of the perceived COVID-19 travel risk, the Hong Kong government and policymakers should endeavor to minimize those risks as much as possible. One of the essential measures is to provide potential inbound visitors with trustworthy information of COVID-19 (e.g., Hong Kong's COVID-19 cases/status, sanitary guides, and regulations and intervention measures) to mitigate the negative effects of

[6] Song et al. [63] mentioned that the average economy airfare is not considered a good proxy for the travel cost variable.

COVID-19 and safety concerns on air travel and declining tourism demand. For instance, the Hong Kong government sets regulations and intervention measures for inbound visitors and travelers to prevent and control COVID-19, including negative result proof of a PCR-based test for COVID-19, confirmation of room reservation in a designated quarantine hotel, documentary proof for completion of vaccination [93]. Pandemic control involves extra tests and quarantine requirements on passengers and visitors, more border control measures, and new government regulations [57,94]. Due to the inconveniences and extra costs associated with such requirements, pandemic control has often been regarded as incompatible with or even detrimental to the recovery of the aviation and tourism industries. Our empirical results suggest that they are in fact compatible, as good pandemic control will make Hong Kong a preferred and safe tourism destination.

In addition, our empirical results also suggest that high costs in Hong Kong were detrimental to visitor arrivals, and increased aviation services contributed to visitor arrival growth. These results suggest that the tourism industry and government agencies in Hong Kong should strategically and cooperatively work toward a recovery post-pandemic through recovery marketing to repair Hong Kong's image as Asia's top shopping paradise [95,96]. In line with these views, Sönmez et al. [97] noted that the incorporation of crisis management planning into the overall tourism planning, marketing, and management strategies should facilitate tourism recovery and is of particular importance to tourist destinations whose economies depend on tourism. It is more effective to reserve resources for tourism marketing and promotion when the COVID-19 pandemic is under good and stable control, so that Hong Kong can be regarded as a preferred and safe destination for visitors and travelers from its Asian top tourist source markets and other markets.

Our findings also call for integrated planning and operation in rebooting the aviation and tourism sectors in Hong Kong, which is expected to recover post-pandemic (e.g., [5,98]). On the one hand, effective operations should be implemented to restrict imported COVID-19 cases associated with inbound flights. On the other hand, the Hong Kong government may consider promotional campaigns such as subsidies to passengers or service providers to offset Hong Kong's high costs and extra travel inconveniences. Supports to airlines are also strongly advised, as increased aviation services not only provide travel flexibility to passengers but also offer transfer passengers increased connectivity via HKIA. The latter would provide positive feedback to aviation operations, facilitating self-sustaining recovery by the aviation and tourism industries in Hong Kong. As discussed in Section 3, airline connectivity during the COVID-19 period has declined significantly, with most leading Asian LCCs stopping flight services to Hong Kong. Future growth in Hong Kong's inbound tourism will rely on airline capacity and connectivity recovery. Similar comments were suggested by Eric et al. [99], who noted that the tourism industry is noticeably stimulated by improvements in air connectivity. It is essential for Hong Kong to retain its position as an international hub and maintain its hub-and-spoke network to serve as a critical connection point that consolidates regional traffic to overseas destinations. To this end, the Hong Kong government can influence airline connectivity outcomes by formulating policies that address drivers of connectivity, such as air traffic rights, restrictions on airport use, airport charges, and taxes [90,100]. With the third runway to be added at HKIA in 2024, the aviation industry can support the long-term growth of the tourism sector [3]. Owing to LCCs' low costs and low fares, they are expected to play important roles in stimulating price-sensitive leisure travel to Hong Kong [3]. Therefore, it is important for the Hong Kong government and Hong Kong Airport Authority to design the right aviation policy and market HKIA as the region's aviation hub.

Our study utilizes updated data from well-recognized data sources. Consistent and robust results are obtained using the alternative model specifications. Still some results warrant a more in-depth analysis, as the aviation and tourism sectors did not operate normally during the COVID-19 pandemic. It would be meaningful to include data over a longer period and with more destinations. Since our data reflect actual market performance, they would have missed potential air travel and tourism demand that were not realized due to various travel restrictions. It would be useful to conduct stated preference experiments to better assess the potential demand for Hong Kong's air travel and inbound tourism demand. These studies will be useful extensions to the current analysis.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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