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Air travel choice, online meeting and passenger heterogeneity – An international study on travellers' preference during a pandemic

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ABSTRACT

This study empirically identifies business travellers' preferences during the COVID-19 pandemic across different regions. A stated preference study was conducted during April to June 2021 on respondents in the U.S., the city of Shanghai in mainland China and Hong Kong. Generalised mixed multinomial logit (GMXL) models are estimated incorporating attributes of travel characteristics, severity levels of the pandemic, and health control measures at the airport. When an online meeting is inapplicable, respondents from Shanghai and Hong Kong highly value health control measures, and are not sensitive to the time spent at airport health checkpoints. In comparison, U.S. respondents are averse to the time spent for health check, the reporting of personal information, travel history, symptoms, and the requirements of compulsory mask wearing and onsite sample testing. However, when online meeting is applicable, all the respondents show no appreciation for health control measures, while the U.S. respondents are twice more averse to the time spent at airport health checkpoints. Online meeting reduces the intention of international business travel amid the pandemic for passengers in Shanghai and Hong Kong, but imposes no significant effects on U.S. travellers. Such significant heterogeneity in traveller preference partly explains the different recovery patterns observed in various aviation markets, and justifies individualized travel arrangements and service priority in fulfilling pandemic control requirements across different regions. Our study also suggests that there are commonly accepted areas for global cooperation such as the sharing of vaccination record, and the option of online meeting calls for convenient travel arrangements amid pandemic to all countries.

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1. Introduction

Due to the COVID-19 pandemic and travel restrictions triggered by it, the demand for air travel has dropped dramatically, impairing the viability of many companies in the aviation industry world-wide. The recovery in air travel has been stagnating. Industry-wide revenue passenger kilometres (RPKs) reduced by 69.7% in 2020 year-on-year. Overall, air passenger traffic slumped by 66% in 2020, which is by far the sharpest decline in aviation history (IATA, 2021). Moreover, passenger's behavioural changes owing to the COVID-19 pandemic and containment measures have led to a remarkable drop in travel demand (OECD, 2020), and such changes could be enduring. For instance, health risk screening measures (e.g., health declaration, virus testing, vaccine passport) might be incorporated as routine operations at airports, in a way similar to the security check requirements introduced in the aviation industry after the 9/11 terrorist attack. Yet, people's travel intention could reduce remarkably due to the increased monetary costs and inconveniences. It is important to identify and achieve the optimal balance between pandemic control vs smooth travel arrangements.

Furthermore, the usage of online meeting platforms has surged during the pandemic (Gough and Rosenfeld, 2006; Gray et al., 2020). IATA (2020a) indicated that the prevalence of online meetings during the COVID-19 pandemic could be one major obstacle to the recovery of air travel, especially for business trips. Business travellers need to deliberate the trade-off between the advantages (e.g., convenience, flexibility, time- and cost- savings) and disadvantages (e.g., lack of face-to-face relationships, feel disconnected, ineffective, unproductive) of online meetings (Aseniero et al., 2020; Mason and Leek, 2012; Rogelberg et al., 2012), whereas such a decision could be significantly influenced by the (perceived) travel risk amid a pandemic and the costs/benefits associated with health control measures. In addition, although organizations such as the World Health Organization (WHO) and the International Air Transport Association (IATA) issued common guidelines on pandemic control measures,¹ there are significant differences in the health control measures used and pandemic control strategies adopted across the countries and airports around the world. If passenger preferences are quite different across regions, then certain individualized travel arrangements and operations may be allowed. For example, given resource constraints, priority can be given to reducing health screening time at airports if passengers are very sensitive to it. Whereas in markets passengers appreciate strict health control measures, more space and equipment may be secured to implement requirements such as social distancing, onsite tests, more detailed travel history and health status reporting, etc.

Therefore, it is necessary to assess the effects of health control and online meetings on air travel choices in an integrated model, preferably on passengers with heterogeneous travel preferences in different regions. Such a quantitative analysis identifies the key determinants of passenger travel utility, enhances the understanding of travel demand, and contributes to the design of health screening measures that optimally balancing the requirements of pandemic control vs convenient travel arrangements. It also answers the important question whether policy makers and international organizations should allow more individualized arrangements in achieving some common standards. Such findings are expected to provide an evidence base for the development of regulatory policy and managerial strategy to maximize the recovery rate of international travel while achieving effective pandemic control.

This study aims to achieve these objectives by investigating the effects of additional travel requirements and online meetings on air travel choices by passengers using a stated preference (SP) experiment. Data are collected from passengers in China (both mainland and Hong Kong) and cities in the U.S. using the same survey instrument to enable a cross-cultural comparison of the changes in air travel behaviour. The governments of mainland China, Hong Kong Special Administrative Region, and the U.S. have pursued quite different strategies in response to the COVID-19 crisis, which led to varying impacts on health and economy (Czerny et al., 2021). The different cultural backgrounds are also expected to enhance passenger heterogeneity, which facilitates the econometric identification.

The remainder of this paper is organized as follows. Section 2 presents a literature review. Section 3 explains the data collection process, data analysis method, and sample used in the study. The results are presented and discussed in Section 4 and 5, respectively. Finally, Section 6 concludes the paper with a summary of main findings and implications.

2. Literature review

By the end of December 2020, over 83 million cases of COVID-19 have been reported worldwide, including more than 1.9 million deaths. Indeed, the COVID-19 pandemic has led to the most severe health and economic crisis around the world. It was expected that the response measures derived from the past experience (e.g., the SARS epidemic in 2003, H1N1 2009 and MERS Flu 2015, see Chung, 2015; Zeng et al., 2005) would help keep the aviation industry on the road to recovery. However, the full recovery of air travel remains a huge challenge as it would be a long journey to prevail over this global health crisis.

To ensure a safe travel during the pandemic, airport authorities and local governments have implemented a variety of prevention and control measures, which may have two- side effects on travel intention. Specifically, the additional travel requirements at airports (e.g., compulsory mask wearing, health declaration, virus test report, proof of vaccination, etc.) may elevate travel costs and inconveniences, while they also help reduce passengers' health-related travel risk (Cohen et al., 2016; IATA, 2020b; Neuburger and Egger, 2020). Such trade-offs between safety and convenience (or the associated monetary cost and travel time) would be influenced by risk attitudes that are rooted in specific social and cultural backgrounds (Chan et al., 2020b; Lund and Rundmo, 2009; Mouter et al., 2017). Falk et al. (2018) conducted a global preference survey in seventy-six countries and found substantial between-country variation in risk preferences. The authors revealed that African and South American countries showed high levels of risk tolerance, while Eastern and Southern Asian populations are rather risk averse. Boksberger et al. (2007) revealed that air passengers with an Asian

¹ For example, guidance on infection prevention and control measures on COVID-19 issued by WHO, and the guidance for cabin operations during and post pandemic issued by IATA.

background perceived higher physical, psychological, and social risks, reflecting higher sensitivities to safety and security issues, when compared to the Australian and European counterparts.

With findings in previous literature, it is not surprising that recent studies identified divergent attitudes towards prevention and control measures across countries. For example, residents in the East are more supportive to the anti-epidemic measures promulgated by their governments (e.g., China and Vietnam, see [Nguyen et al., 2020](#); [Xing et al., 2021](#)). More residents in Western countries show negative attitudes towards mandatory mask wearing and vaccination policies, as they consider these measures as infringements of their rights (e.g., the U.S. and Germany, see [Rieger, 2020](#); [Smith et al., 2021](#)). Moreover, [Chan et al. \(2020a\)](#) investigated the effects of risk attitudes towards social mobility at the country and regional level in the context of COVID-19 pandemic. The authors observed that risk-seeking regions perceive higher opportunity costs of staying at home (i.e., reduction in mobility), while risk-averse regions are more responsive to precautionary strategies and prone to maintain lower levels of mobility. This highlights the need for comparative studies on the effects of introducing health risk screening measures at airports on travel behaviour across countries and cultures.

There is a body of research focused on the effects of e-commerce and information and communication technology (ICT) on the changes in activity and travel behaviour ([Loo and Wang, 2018](#); [Irawan et al., 2021](#)). In particular, e-learning, online shopping, and working from home (WFH) have surged during the pandemic and caused significant impact on out-of-home activities ([Shamshiripour et al., 2020](#); [Beck and Hensher, 2020](#); [Hensher et al., 2021](#)). As WFH has become the ‘new normal’ and advanced ICT tools enable efficient online meetings, a decline in air travel demand could be anticipated. [IATA \(2020a\)](#) believes that the recovery of business travel would be further delayed, as online meeting offers a good substitute to face-to-face meeting. On the other hand, researchers have also suggested that a face-to-face communication would be more effective under certain circumstances, underlining the irreplaceable role of face-to-face relationship in global business life ([Mason and Leek, 2012](#); [Miller, 2003](#)). Besides, it is irrational to assume a global simultaneous popularization of online meetings and identical users’ experiences in different countries. For instance, WFH is one of the most popular Western human resource management practices in recent years. While, due to cultural reasons, both superiors and subordinates in a Chinese company attach great importance to the power of supervision, which slows down the development of remote office in China before the COVID-19 pandemic ([Raghuram and Fang, 2014](#)). COVID-19 has been the catalyst to the prosperity of video conferencing market in China, and Chinese employees tend to appreciate more flexibility, more relaxed environment, and increased productivity for online meetings and teleworking ([Pänttjä and Wu, 2021](#)). In contrast, American employees started to complain about the low efficiency and loss of productivity, and feel disconnected with reliance on online meetings ([Aseniero et al., 2020](#); [Wu and Chen, 2020](#)). In this context, the impact of online meetings on businesses travel intention at regional or country levels remains unclear due to limited research.

A good understanding of these issues not only contributes to the better development of regulatory policy and pandemic control as explained in the introduction section, but also helps the aviation industry to design better recovery strategy. A good understanding of passenger preference helps airlines to provide the most appreciated services to different types of customers, especially for carriers provide differentiated services. For example, whereas full-service carriers offer high quality services and larger network coverage via connection services, low-cost carriers focus more on point-to-point travel to price sensitive travelers appreciate low-cost options ([Fu et al., 2011, 2015, 2019](#); [Wang et al., 2017](#); [Tu et al., 2020](#)). The extended traffic and revenue losses caused by pandemic also impose significant financial challenges to airport investments, which are usually large and lump, thus involving significant uncertainty and risks ([Xiao et al., 2016, 2017](#)). The complex airport ownerships and regulation make the decision process even more complicated ([Yang and Fu, 2015](#)). A better modelling of travel demand and (possible continued) health screening operations help airports to better plan their operation and infrastructures in the long term. However, other than [Fu et al. \(2021\)](#) and [Chen et al. \(2022\)](#) that discussed these issues using a relatively small sample from Hong Kong, few systematical investigations are available.

3. Methodology

To address the research gaps identified above, this study will ask potential business travelers from three regions to make their air travel choice under two conditions – online meeting inapplicable vs online meeting applicable. Such an approach allows us to identify the key determinants of passenger utility as well as the changes amid a pandemic. The research method is explained in detail below.

3.1. The sample

The data were collected from an online survey conducted in April to June 2021 involving respondents residing the Chinese metropolitan cities of Shanghai and Hong Kong, and multiple cities in the U.S. during June 2021. China and the U.S. are the two largest aviation markets in the East and West, with different cultural values, political governance, COVID-19 pandemic severity (e.g., daily confirm cases, case fatality rate, etc.), and most importantly very different response strategies. With its “zero COVID strategy”, China has adopted one of the most stringent pandemic response and management strategies in the world, which contribute to better results of approximately 3 deaths per million residents up until 30 October 2021. Following the “live with the virus” approach, the U.S. has had comparatively loose restrictions which result in approximately 2239 deaths per million residents ([WHO, 2021](#)). American travellers are likely to behave differently from their Chinese counterparts due to the discrepancy in risk perception of the pandemic and attitudes towards health control measures ([Fang et al., 2016](#); [Ioannou et al., 2020](#); [Xing et al., 2021](#)). Chinese may be more likely to embrace additional travel requirements, as they are more obedient to regulations issued by the governments. Hong Kong’s pandemic control strategy was initially somewhere in between mainland China and the U.S. but has gradually moved towards the “zero COVID strategy” as it aims for a travel bubble with the mainland. The majority of its population has Chinese cultural background but has been an internationally open economy for a long time. It also relies heavily on aviation for business and tourism travels ([Tsui et al., 2021a](#),

2021b). Therefore, it is also included in our study.

The participants were recruited using a professional data collection company ([Credamo.com](https://www.credamo.com)). Respondent who aged below 18 or did not have the experience in international business trip before COVID-19 pandemic were excluded. The total sample consisted of 1300 respondents with over 400 from each region. Table 1 presents the demographic and employment characteristics of the U.S., Shanghai (mainland China) and Hong Kong respondents. In general, the gender distribution of respondents does not vary substantially by country/region. The majority of our respondents were aged between 26 and 45, which is reasonable compared with the statistics reported in previous air travel research (Liu and Mc Kercher, 2016; Vlachos and Lin, 2014). Moreover, a very high proportion of the respondents in our sample have attained tertiary education. This is not uncommon especially when targeting the response from business air travellers (Vlachos and Lin, 2014; Millán et al., 2016). It is worth noting that compared with the Shanghai and Hong Kong samples, the U.S. sample tends to be older and has a larger share of respondents with secondary education or below. In terms of the respondent's employment characteristics, the majority of them are full-time employees in wholesale, retail, trading, tourism, financing, and business services industries.

3.2. Attitudinal variables

Respondents were presented eight questions and required to rate their level of agreement with each statement on a zero-to-ten-point scale (0 = strongly disagree; 10 = strongly agree). The attitudinal responses were estimated using a factor analysis to extract the latent variables, see Table 2. The data sampling adequacy, suitability of factor analysis, and scale reliability are evidenced by the results of the Kaiser-Meyer-Olkin (KMO) Test (i.e., value close to 1), Bartlett's test of sphericity (i.e., p value < 0.000), and Cronbach's alpha, correspondingly. Based on Kaiser's rule (i.e., eigenvalues > 1), two factors are identified for the U.S., Shanghai, and Hong Kong samples, which explain 71.98%, 62.81%, 61.77% of the variance, respectively. Factor 1 is labelled as "Technology Acceptance in Online Meeting", which incorporates five items gauging the perceived ease of use and overall usefulness of the online meeting tool. Factor 2 (with three items) is labelled as "Preference for Face-to-Face Communication".

3.3. The stated preference experiment

In this study, a stated choice experiment is used to examine the trade-offs between health control measures, severity level of the disease, travel cost, and travel time. The SP choice sets are presented based on a hypothetical scenario of an international business travel during the COVID-19 pandemic. In each travel choice scenario, two unlabelled alternatives showing possible ways in which they

Table 1
Profile of Respondents by Regions.

Variable	Count (Percentage)		
	U.S.	Shanghai	Hong Kong
Demographics			
Gender			
Male	193(49.3%)	263(52.6%)	216(54%)
Female	207(51.7%)	237(47.4%)	184(46%)
Age			
18–25	38(9.5%)	29(5.8%)	27(6.75%)
26–35	141(53.3%)	370(74.0%)	278(69.5%)
36–45	116(29.0%)	74(14.8%)	88(22.0%)
46–55	64(16.0%)	27(5.4%)	7(1.75%)
Above 56	41(10.2%)	—	—
Education			
Tertiary	222(55.5%)	480(96%)	396(99%)
Secondary or below	178(44.5%)	20(4%)	4(1%)
Marital status			
Married	268(67.0%)	354(70.8%)	314(78.5%)
Single	132(33.0%)	146(29.2)	86(21.5%)
Employment characteristics			
Employment type			
Full-time employee	295(73.8%)	443(88.6%)	230(57.5%)
Employer or manager	41(10.3%)	34(7.2%)	110(27.5%)
Self-employed	35(8.8%)	6 (1.2%)	55(13.8%)
Others	29(7.3%)	17(4.6%)	5(1.3%)
Industrial Classification			
Manufacturing	81(20.3%)	20(4.0%)	98(24.5%)
Construction	14(3.5%)	28(5.6%)	30 (7.5%)
Wholesale, retail and import/export trades, restaurants, and hotels	60(15.0%)	100(20.0%)	107(26.8%)
Financing, insurance, real estate, and business services	111(27.8%)	229(45.8%)	109(27.3%)
Others	134(33.5%)	123(24.6%)	56(14.0%)
Sample size	400	500	400

Table 2
Factor Analysis of Communication-Related Values.

Latent Variables	The U.S.			Shanghai (mainland China)			Hong Kong		
	Mean(s.d.)	Factor 1	Factor 2	Mean(s.d.)	Factor 1	Factor 2	Mean(s.d.)	Factor 1	Factor 2
Technology Acceptance of Online Meeting									
The online meeting tool allows me to organize meetings any time (24/7).	7.84 (1.27)	0.812		8.57 (0.93)	0.752		8.52 (1.06)	0.740	
The online meeting tool is user friendly.	7.81 (1.28)	0.858		8.70 (0.83)	0.737		8.62 (1.00)	0.806	
It is easy to prepare an online meeting.	7.71 (1.33)	0.865		7.63 (1.28)	0.735		8.06 (1.57)	0.646	
I will recommend my colleagues and friends to use online meeting tool.	7.70 (1.34)	0.853		8.40 (1.00)	0.751		8.64 (1.12)	0.766	
In general, I consider online meeting platforms/applications as useful.	7.86 (1.20)	0.797		8.71 (0.87)	0.724		8.76 (1.04)	0.814	
Preference for Face-to-Face Communication									
I prefer face-to-face communication rather than online communication.	6.91 (1.64)		0.847	7.17 (1.36)		0.904	7.37 (1.62)		0.902
I like meeting new people in different locations.	6.94 (1.58)		0.808	7.73 (1.26)		0.780	8.21 (1.28)		0.614
Instead of staying at home or office, I prefer to go out and meet people.	6.86 (1.65)		0.904	7.41 (1.34)		0.916	7.69 (1.59)		0.907
Correlations									
Factor 1		1.000	0.125		1.000	0.176		1.000	0.195
Factor 2		0.125	1.000		0.176	1.000		0.195	1.000
Eigenvalues									
		3.67	2.09		3.02	2.01		3.12	1.82
Percentage of variance explained									
		45.81%	26.17%		37.70%	25.11%		38.98%	22.79%
Cronbach's alpha									
		0.89	0.82		0.79	0.84		0.79	0.84

Note: zero-to-ten measurement scale.

Cumulative % of variance explained by two factors = 71.98%, 62.81%, 61.77%.

might make this journey are provided, as well as a ‘no choice’ alternative (i.e., a no-travel option). The alternatives are described by eight different attributes. The selected attributes and their corresponding levels are set based on the current practice for air travel (i.e., new safety protocol which includes health control procedures) and extensive literature review (as shown in Table 3, see Fu et al., 2021 and Chen et al., 2022 for more details). A screenshot of a sample SP question is provided in Fig. 1.

Quarantine measures significantly inhibit passengers’ travel intention; therefore many governments were committed to building the quarantine-free travel bubbles among countries for the recovery of tourism during the pandemic (Gu et al., 2021). Manca et al. (2021) indicate that the air travelers in the U.K. were concerned about the need for quarantine, while no significant effect was

Table 3
Attributes and Levels for SP Games.

Attributes considered	Levels
Disease information	
Daily confirmed cases of current city (per 100 k residents)	105010
Daily confirmed cases of destination city (per 100 k residents)	1005010
Case fatality rate (CFR)	0.1%, 1%, 10%
Travel characteristics	
Average time to pass through the health and security checks	20, 40, 60 min
Increased cost of ticket to cover the health control measures	65, 125, 400 USD
Health Control measures	
Health declaration	Provide vaccination record Provide personal information, self-reported travel history, symptoms No need to declare your health condition
Mask requirement	No mask requirements Compulsory at the airport, but no requirements during flight Compulsory mask-wearing during flight and airport
Onsite Health Check	No need to undertake any onsite health check Temperature screening Tests involving sample collection

Scenario 1/6:

Despite the widespread outbreak, business travel has not come to an absolute standstill. People are still undertaking essential business trips. However, online meetings have become popular and widely used in business collaborations. Therefore, travelers are often faced with the dilemma of whether to proceed with their plans or not.

Imagine that the travel restrictions are lifted now, and you plan to make an international business trip by air. We would like you then to consider three ways in which you might make this journey.

Please select one option considering the following descriptions.

	Option A	Option B	Option C
Disease Information			
Daily confirmed cases of current city (per 100k residents)	50	50	I would choose not to fly under these conditions
Daily confirmed cases of the destination city (per 100k residents)	10	100	
Global average case fatality rate (CFR _a)	10% (there is one death among 10 confirmed cases)	0.1% (there is one death among 1000 confirmed cases)	
Travel characteristics			
Average time to pass through the health and security checks	40 minutes	20 minutes	
Increased cost of ticket to cover the health control measures	125 USD	125 USD	
Health Control Measures			
Health declaration	Provide personal information, self-reported travel history, symptoms	Provide vaccination record	
Mask requirement	Compulsory mask-wearing during flight and airport	Compulsory at the airport, but no requirements during flight	
Onsite Health Check	Temperature screening	Tests involving sample collection	
When an online meeting is not applicable for this business negotiation:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
When an online meeting is applicable:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Fig. 1. Sample of Choice Scenario for the SP Game.

identified for the variable “dislike of quarantine” on their air travel choice. The authors claimed that this is because there was no enforcement of quarantine rules in the U.K. at the time of data collection. Tsui et al. (2021) reveal that the stringent quarantine rules in Hong Kong (e.g., two weeks quarantine at hotels) have led to a severe reduction in the number of inbound international visitor arrivals. However, due to pandemic control and the increasing vaccination rates, promising patterns of recovery have been documented in a few local aviation markets, such as those to the U.S. and mainland China. Expectations for a “new normal” are high. Travel restrictions have been relaxed and quarantine measures for international travel have been revised in some countries. For example, South Korea offers quarantine exemption for fully vaccinated travelers effective Apr 21st, 2022 (Embassy of the Republic of Korea to the Republic of Singapore, 2022). Many European countries, Australia and Singapore are also open to fully vaccinated travelers without the requirement of quarantine. In the case of Singapore, passengers who are not vaccinated or not fully vaccinated need to go through a 7-day quarantine, but not necessarily at hotels (Immigration and Checkpoints Authority, 2022). On June 22nd 2021, the U.K. government announced that passengers travelling to England from another country do not need to quarantine upon arrival regardless of the vaccination record (Department for Transport, 2021). Indeed, quarantine measures implemented by different countries could impose significant impacts on travel intention and tourist’s choice of destination. However, it seems that they are likely to be temporary measures and thus not included as attributes. This study focuses on health screening procedures which are likely to be kept as routine airport operations in the new normal.

Note that to examine the effects of online meetings, the respondents are required to make their travel choice given two preconditions, i.e., online meeting inapplicable vs online meeting applicable. Specifically, these two preconditions are distinguished by whether an online meeting can be used to replace air travel to achieve the same trip outcomes. For example, the “inapplicable” situation refers to the scenario in which an online meeting is not an ideal replacement of air travel. It may be due to onsite work, negotiation for business conflicts, and lack of indispensable or quality IT supports, etc. In contrast, “applicable” situations refer to the cases that having an online meeting instead of air travel will achieve the same trip outcomes. Note that the situations have not been clearly specified because this study aims to gauge an overall and general perception from the respondents.

A Bayesian D-efficient design was applied in this study (Beck et al., 2018; Hensher and Rose, 2007; Ho et al., 2018). The design was generated based on the assumption of an MNL model specification and the normally distributed priors obtained in previous relevant market (Fu et al., 2021). 250 draws using Halton sequences are performed for prior distributions. The software package Ngene 1.2 (ChoiceMetrics, 2018) was used to produce 24 scenarios, which were blocked into four sets of six choice tasks. The online survey platform randomly allocates one of the four blocks of six SP scenarios to our respondents, leading to a total of 15,600 valid choice observations.

3.4. Model specification

In this study, we collected the data from multiple cities in the U.S., Shanghai, and Hong Kong, thus that the data are pooled from three SP sources. Consideration should be given to the differences in the variance structure associated with the unobserved effects for each dataset when pooling multiple data sources (Hensher, 2012; Mulley et al., 2018). Therefore, neither a direct comparison of the parameter estimates from separate models of the three datasets, nor a naive data pooling is not plausible. To account for the preference heterogeneity and scale (error variance) heterogeneity, we formulate a generalised mixed multinomial logit (GMXL) model for the travel choices of respondents. As the SP experiment usually requires repeated measurements, the correlations among multiple responses of a same individual should be recognized. The panel nature of the data and the unobserved heterogeneity across observations are incorporated in our travel choice model.

Based on the formulations of mixed logit model by Train (2003), Hensher and Greene (2003), and generalized MNL model by Fiebig et al. (2010), the structure of GMXL model is discussed in the following paragraphs. We use index i ($i = 1, 2, \dots, I$) for the individuals, j for the alternative ($j = 1, 2, \dots, J$), and q for the choice scenarios ($q = 1, 2, \dots, Q$). As indicated earlier, three alternatives appear in each choice scenario ($J = 3$). Within each of the six scenarios presented, the respondents are asked to state their air travel choice in two preconditions – online meeting inapplicable, and online meeting applicable.

In the framework of mixed MNL model, the probability of individual i choosing alternative j on the q^{th} choice situation can be specified as (see Hensher, Rose, & Greene, 2015):

$$Pr(\text{choice}_{iq} = j | x_{iqj}, z_i, \nu_i) = \frac{\exp(V_{iqj})}{\sum_{j=1}^J \exp(V_{iqj})} \tag{1}$$

where:

$$V_{iqj} = \beta'_i x_{iqj}$$

$$\beta'_i = \beta + \Delta z_i + \Gamma \nu_i$$

x_{iqj} = levels of M attributes describing alternative j in the q^{th} choice scenario assessed by individual i , $\nu_i = (M \times 1)$ -column vector with zero means, known variances, and zero covariance, $z_i =$ a set of T characteristics of individual i affecting the mean of the preference parameters.

In this formulation, Δz_i denotes the observed heterogeneity, while $\Gamma \nu_i$ embodies the unobserved heterogeneity. β , Δ (the $M \times T$ matrix of parameters), and Γ (the non-zero elements of the lower triangular Cholesky matrix) are the parameters to be estimated.

Furthermore, scale heterogeneity – that is, the variance of an error term in utility function, can be accommodated into the model by random alternative-specific constants. The specification is further modified as (see Greene and Hensher, 2010, Hensher et al., 2015): $\beta_i = \sigma_i[\beta + \Delta z_i] + [\omega + \sigma_i(1 - \omega)]\Gamma \nu_i$, $\sigma_i = \exp[\bar{\sigma} + \delta' \gamma_i + \tau h_i]$, where σ_i denotes the individual-specific standard deviation of the idiosyncratic random error term, while $\bar{\sigma}$ is the mean parameter in this standard deviation. δ and τ are the coefficients in the observed heterogeneity and unobserved heterogeneity in the scale term, respectively. γ_i denotes a set of individual characteristics probably overlapped with z_i . h_i is the unobserved heterogeneity with the assumption of standard normal distribution. Finally, ω denotes a weighting parameter indicating how variance in residual preference heterogeneity varies with scale ($0 \leq \omega \leq 1$).

Based on the discussion and extension of Fiebig et al. (2010) and Greene and Hensher (2010), τ is further set as a function of a series of dummy variables that recognize the heterogeneous scales across different datasets (i.e., $\tau = \tau + \lambda d_k$, $\lambda =$ data-set specific scale parameter, $d_k =$ dummy variable taking the value of 1 for data source k , and 0 otherwise). Eventually, the simulated log likelihood function is written as:

$$\log L = \sum_i \log \left\{ \frac{1}{R} \sum_{r=1}^R \prod_{q=1}^Q \prod_{j=1}^J Pr(j, x_{iq}, \beta_{ir})^{c_{iqj}} \right\} \tag{2}$$

where:

$$\beta_{ir} = \sigma_{ir}[\beta + \Delta z_i] + [\omega + \sigma_{ir}(1 - \omega)]\Gamma \nu_{ir}$$

$$\sigma_{ir} = \exp \left[-\tau^2/2 + \delta' \gamma_i + \tau h_{ir} \right]$$

ν_{ir} and h_{ir} = the R simulated draws on ν_i and h_i ,
 $c_{iqj} = 1$ when individual i choose alternative j in q^{th} choice scenario, and 0 otherwise,

$$Pr(j, x_{iq}, \beta_{ir}) = \frac{\exp(\beta_{ir}' x_{iqj})}{\sum_{j=1}^J \exp(\beta_{ir}' x_{iqj})} \tag{3}$$

The software package *NLOGIT 6.0* is used to estimate the GMXL model.

4. Estimation results

4.1. The choice to travel when an online meeting is not applicable

In this study, air travel choice for business purpose is examined as a function of the considered factors including severity levels of the pandemic (i.e., daily confirmed cases of current and destination cities, and case fatality rate), travel characteristics (i.e., increased ticket cost and the average time to pass through the health and security checks), and health control measures at the airport (i.e., health declaration, mask-wearing requirements, and onsite health checks). Table 4 presents the estimation results of the GMXL model.

When the option of an online meeting is not applicable, respondents from the studied three regions are less likely to choose the no travel option as they perceive the need for business communication in the absence of a good substitute. Regarding to our design attributes, it is expected that the increases in air ticket price due to the (extra costs of) health control measures at the airport, and the average time spent at checkpoints would lead to lower utility. The parameter estimates of our model partially confirm this hypothesis, indicating that respondents across all regions prefer not to spend much money on the health control measures for the air travel. However, the coefficients of time for Shanghai and Hong Kong are not statistically significant, suggesting that the respondents are not sensitive to the time spent at airport checkpoints. In addition, another hypothesis that respondents will be deterred by the increases in daily confirmed cases and case fatality rate is confirmed by the negative signs for the attributes of disease information, except for the U.S. sample. Our results show that the increase in COVID-19 cases in travel destination does not significantly reduce the travel intention of U.S. respondents.

The influence of health declaration requirements on individual preference is statistically significant in Shanghai and Hong Kong, while the respondents in the U.S. perceive health declaration in a different way. Specifically, the respondents in Shanghai and Hong

Table 4
Results of GMX with Scale Heterogeneity within and between three pooled datasets (online meeting inapplicable).

Attributes	the U.S.		Shanghai		Hong Kong	
	Coeff.	Z value	Coeff.	Z value	Coeff.	Z value
ASC _{no travel}	-1.634***	-4.33	-0.637***	-3.02	-0.688***	-3.14
Daily confirmed cases of current location	-0.002***	-2.73	-0.002***	-3.02	-0.002**	-2.57
Daily confirmed cases of destination	-0.001	-1.14	-0.008***	-11.82	-0.008***	-10.29
Case fatality rate (CFR)	-0.007***	-17.72	-0.007***	-17.72	-0.007***	-17.72
Average time to pass through the health and security checks	-0.007**	-2.54	-0.001	-0.54	-0.001	-0.47
Increased cost of ticket to cover the health control measures	-0.003***	-5.24	-0.001***	-3.19	-0.001**	-2.15
Health Declaration						
<i>No declare requirements</i>						
Provide vaccination record	0.039	0.43	0.591***	8.09	0.574***	7.19
Provide personal information, self-reported travel history, symptoms	-0.245**	-2.44	0.446***	5.89	0.406***	4.93
Mask Requirement						
<i>No mask requirements</i>						
Compulsory mask-wearing during flight and airport	-0.619***	-5.31	0.541***	8.98	0.541***	8.98
Compulsory at the airport, but no requirements during flight	-0.460***	-3.92	0.497***	8.16	0.497***	8.16
Onsite Health Check						
<i>No requirements</i>						
Tests involving sample collection	-0.187*	-1.77	0.452***	8.75	0.452***	8.75
Temperature screening	-0.239**	-2.26	0.084*	1.72	0.084*	1.72
Personal Characteristics						
Preference to face-to-face meeting	2.193***	8.22	0.011	0.31	0.011	0.31
Male traveller	0.654***	3.24	-0.020	-0.25	-0.020	-0.25
Older (>55 years old)	-1.440***	-4.88	--	--	--	--
Secondary Education or below	-0.395**	-2.15	0.419	1.61	--	--
Random parameter standard deviations						
Tests involving sample collection	--	--	0.452***	8.75	0.452***	8.75
Preference to face-to-face meeting	2.193***	8.22	--	--	--	--
Variance Parameter in Scale (τ)	2.634*** (13.99)					
Heterogeneity in GMXL scale factor (The U.S.)	0.450*** (6.33)					
Heterogeneity in GMXL scale factor (Shanghai)	0.007 (0.07)					
Nr. of observations	7800					
Nr. of respondents	1300					
Model fits						
Log-likelihood at zero	-8409.67					
Log-likelihood at convergence	-7489.45					
McFadden Pseudo-R ²	0.12					

Note: ***, **, * Significance at 1%, 5%, 10% level.

Kong show a preference for providing a vaccination record for health declaration whilst a statistically significant impact of such requirement on the U.S. respondents was not found. Also, it appears that the U.S. travellers have a statistically significant disutility for providing personal information, travel history, and symptoms for health declaration, while Shanghai and Hong Kong prefer such requirement. Interestingly, while our U.S. sample show statistically significant disutility for the compulsory mask-wearing requirements at the airport and during flights, their Shanghai and Hong Kong counterparts favour this measure. For the effects of the onsite health check, the Shanghai and Hong Kong respondents are supportive to the tests involving sample collection, while the U.S. respondents are against measures of testing and temperature screening. The effects of personal characteristics on the travel choice are also examined in this study. Our results reveal that, for the U.S. sample, male travellers or/and those who show a preference for face-to-face communication are more likely to travel for business during COVID-19, when an online meeting is not a good substitute. On the other hand, the U.S. travellers who are older than 55 and with lower education level (secondary or below) are more likely to choose the ‘not travelling’ alternative. Yet, such effects are not statistically significant for Shanghai and Hong Kong. Overall, passengers in Shanghai and Hong Kong are more supportive to health control measures even if they involve extra costs, time, and inconveniences.

4.2. The choice to travel when an online meeting is applicable

The GMXL model is also estimated for the travel choice made for business purpose when an online meeting can achieve the same trip outcomes. The coefficient estimates in Table 5 indicate that the Chinese respondents show higher intention to choose the “no travel” alternative with the availability of online meetings. The results of alternative-specific constants also suggest a larger increase in the potential business travellers in Shanghai calling off an international travel when they have an option of online meeting, compared to Hong Kong. On the other hand, the alternative-specific constant for “no travel” is not statistically significant for the U.S. sample, suggesting that the U.S. travellers does not show a significantly higher intention to discard a business travel even if an online meeting is

Table 5
Results of GMX with Scale Heterogeneity within and between three pooled datasets (online meeting applicable).

Attributes	the U.S.		Shanghai		Hong Kong	
	Coeff.	Z value	Coeff.	Z value	Coeff.	Z value
ASC _{no travel}	-0.439	-1.30	5.348***	12.21	2.571***	6.33
Daily confirmed cases of current location	0.000	-0.59	0.000	-0.59	0.000	-0.59
Daily confirmed cases of destination	-0.001	-0.91	-0.001	-0.91	-0.001	-0.91
Case fatality rate (CFR)	-0.002***	-3.58	-0.002***	-3.58	-0.002***	-3.58
Average time to pass through the health and security checks	-0.009***	-3.45	0.003	1.30	0.003	1.30
Increased cost of ticket to cover the health control measures	-0.002***	-3.60	0.000	0.94	0.000	0.94
Health Declaration						
No declare requirements	Reference	--	Reference	--	Reference	--
Provide vaccination record	0.072	0.78	0.325***	2.65	0.205**	2.06
Provide personal information, self-reported travel history, symptoms	-0.011	-0.12	0.262**	2.08	0.224**	2.13
Mask Requirement						
No mask requirements	Reference	--	Reference	--	Reference	--
Compulsory mask-wearing during flight and airport	-0.019	-0.21	0.159*	1.91	0.159*	1.91
Compulsory at the airport, but no requirements during flight	0.124	1.61	0.124	1.61	0.124	1.61
Onsite Health Check						
No requirements	Reference	--	Reference	--	Reference	--
Tests involving sample collection	0.095	1.23	0.095	1.23	0.095	1.23
Temperature screening	0.116	1.61	0.116	1.61	0.116	1.61
Personal Characteristics						
Technology Acceptance of Online Meeting	1.500***	3.73	-1.500***	-6.78	-1.500***	-6.78
Random parameter standard deviations						
Technology Acceptance of Online Meeting	--	--	1.500***	6.78	1.500***	6.78
Variance Parameter in Scale (τ)	2.263*** (93.57)					
Heterogeneity in GMXL scale factor (The U.S.)	-0.754*** (-21.30)					
Heterogeneity in GMXL scale factor (Shanghai)	0.042*** (3.37)					
Nr. of observations	7800					
Nr. of respondents	1300					
Model fits						
Log-likelihood at zero	-7312.63					
Log-likelihood at convergence	-4781.92					
McFadden Pseudo-R ²	0.35					

Note: ***, **, * Significance at 1%, 5%, 10% level.

applicable.

In this context, respondents across regions seem less sensitive to the information of daily confirm cases, while still they are discouraged from having an air travel for business purpose due to the increase in case fatality rate. The U.S. respondents show statistically significant disutility for the increased ticket cost to cover the health control measures and the time spent at airport checkpoints, while the Shanghai and Hong Kong sample are not sensitive to the cost and time. In addition, the Chinese respondents still show higher tolerance for the health declaration measures and mask-wearing requirements, compared to the U.S. sample. Interestingly, we found that the Chinese respondents who have higher technology acceptance level for online meetings are more likely to cancel their travel, while the U.S respondents show strong intention to travel even they have high acceptance level.

4.3. Willingness to pay

Based on the results of parameter estimation from the GMXL models, travellers’ willingness to pay (WTP) for the health control services were calculated in the context of business trip. Standard errors of WTPs were estimated through a WALD procedure to assess the significance level of the test. Table 6 reports the WTP estimates for the three regions given the applicability of online meeting. Overall, the WTP estimates vary across traveller subgroups due to the preference heterogeneity. Note that the U.S. respondents in general show disutility for health control measures, while the Shanghai and Hong Kong respondents show their preferences. As such, WTP of the U.S. respondent is interpreted as the monetary value that travellers need to be compensated to undergo additional process for air travel during COVID-19 pandemic while maintaining the same utility level (Hensher et al., 2015; Chen et al., 2022). On the other hand, WTPs of the Shanghai and Hong Kong respondents are best interpreted as the monetary value that travellers are willing to sacrifice to obtain the health control services. In plain words, respondents in US perceive the extra travel requirements as extra burden and costs, whereas those in Shanghai and Hong Kong perceive them as the extra services improving travel safety.

The estimation results in Table 6 suggest that when an online meeting is inapplicable, the WTP for the time saved at health checkpoints at the airport is US\$ 2.34/min for the U.S. respondents, while that of the Shanghai and Hong Kong residents are not statistically significant. In terms of providing vaccination record for health declaration, the WTP of the U.S. travellers is found not statistically significant. In addition, the U.S. respondents need to be compensated by (or the perceived costs are) US\$ 80.93, US\$ 152.02–204.74, US\$61.71, and US\$78.95, for the requirements of providing personal information, travel history and symptoms, compulsory mask wearing, test involving sample collection, and temperature screening, respectively.

In contrast, respondents in Shanghai and Hong Kong showed a statistically significant utility in providing vaccination record, having a WTP of US\$ 428.19 and US\$ 571.22 respectively. The results also suggest that the Shanghai and Hong Kong respondents have a WTP of US\$ 323.13 and US\$ 403.69 correspondingly for the requirement of providing personal information, travel history and symptoms. Moreover, the Shanghai and Hong Kong respondents are willing to pay an additional US\$ 360.08–392.08 and US\$ 494.47–538.41 respectively for the compulsory mask wearing requirements. As for the onsite health checks, they show a perceived

Table 6
Wald Test for WTP of the Respondents.

Attributes	Region	Without online meeting		With online meeting	
		WTP (US\$)	Z value	WTP (US\$)	Z value
VTTS	U.S.	2.34***	3.23	4.34***	3.10
	Shanghai	n.s.	n.s.	n.s.	n.s.
	Hong Kong	n.s.	n.s.	n.s.	n.s.
Health Declaration Provide vaccination record	U.S.	n.s.	n.s.	n.s.	n.s.
	Shanghai	428.19***	2.69	n.s.	n.s.
	Hong Kong	571.22**	1.91	n.s.	n.s.
Provide personal information, self-reported travel history, symptoms	U.S.	-80.93***	-2.89	n.s.	n.s.
	Shanghai	323.13**	2.47	n.s.	n.s.
	Hong Kong	403.69*	1.77	n.s.	n.s.
Mask Requirement Compulsory mask-wearing during flight and airport	U.S.	-204.74***	-5.12	n.s.	n.s.
	Shanghai	392.08***	2.72	n.s.	n.s.
	Hong Kong	538.41*	1.95	n.s.	n.s.
Compulsory at the airport, but no requirements during flight	U.S.	-152.02***	-4.38	n.s.	n.s.
	Shanghai	360.08***	2.64	n.s.	n.s.
	Hong Kong	494.47*	1.91	n.s.	n.s.
Onsite Health Check Tests involving sample collection	U.S.	-61.71**	-2.02	n.s.	n.s.
	Shanghai	327.64***	2.90	n.s.	n.s.
	Hong Kong	449.92***	2.04	n.s.	n.s.
Temperature screening	U.S.	-78.95**	-2.51	n.s.	n.s.
	Shanghai	n.s.	n.s.	n.s.	n.s.
	Hong Kong	n.s.	n.s.	n.s.	n.s.

Note: VTTS value of time saved at the health and security checkpoints,

***, **, *Significance at 1%, 5%, 10% level,

n.s. No statistically significant WTP estimates were found.

value of US\$ 327.64 and US\$ 449.92 for the test involving sample collection, while their WTPs for a temperature screening at airport are not statistically significant. Interestingly, the results of our WALD tests revealed that the WTPs for health control measures become insignificant when an online meeting becomes applicable. For the U.S. respondents, the WTP for the time saved at health checkpoints at the airport increases to US\$ 4.34/min when an online meeting is applicable.

5. Discussion

When an online meeting is not applicable, the results of our quantitative analysis revealed that the U.S. respondents perceived a value for the time saved at health and security checkpoint, while the Shanghai and Hong Kong respondents seem indifferent about saving time at the airport checkpoint when traveling during the pandemic. This discrepancy is likely attributed to the differences in perceived health risk and sensitivity to travel time amongst the respondents across the studied regions. Bruine de Bruin (2021) conducted a national survey in the U.S. and revealed that residents in general have a good mental health and perceive low health risk to the COVID-19 crisis. On the other hand, Chan et al. (2020a) reported that over 90% of the interviewed respondents in Hong Kong acknowledged the significant negative impacts of COVID-19 on their community. Also, they believed that COVID-19 is highly infectious compared with SARS and seasonal influenza, suggesting a higher risk perception. Similarly, Shanghai residents suffered from fear and anxiety during the pandemic and perceived very high health risk. This might be attributed to the dense population of Shanghai and its higher proportion of the ageing population. In addition, as a major trading city and financial hub, Shanghai has a large number of migrants and labours from other cities of China, which might increase the viral transmission rate (Chu et al., 2021). Despite the actual pandemic outbreak situation in Shanghai and Hong Kong has been significantly better than that in the U.S. (in terms of infection case number and death tolls), the perceived severity level and fear for the disease are stronger among respondents in Shanghai and Hong Kong, compared with the U.S. respondents. Our results suggest that even the Shanghai and Hong Kong respondents who believe that face-to-face communication is more effective do not have significantly higher intention to travel for business during the COVID-19, while such effects are statistically significant for the U.S. sample.

In this context, our Chinese respondents may consider the time spent at the airport checkpoints necessary to reduce health-related travel risk. In other words, for the Chinese travellers, reducing the time at the checkpoints may not bring net benefit, as they perceive the time spent as necessary for the effectiveness of the preventive and control measures against the COVID-19 pandemic. As our U.S. respondent do not favour the additional travel requirements and hope to reduce the time spent at the airport checkpoint, the efficiency of these procedures is of great importance. From another perspective, the difference in the value of time saved could also be explained by how business travellers perceive the ownership of their travel time (Lyons et al., 2007; Gustafson, 2012). It is likely that our U.S. sample tend to regard their business travel time as belonging to their employers, thus having a statistically significant WTP for the time saved since they will be compensated by the company.

For the requirement of providing a vaccination record, the WTP estimate was found the highest in Hong Kong, followed by Shanghai, while the potential business travellers in the U.S. did not possess a statistically significant WTP. Indeed, the WTP for COVID-19 vaccination varies across countries or regions as resident's perceived different severity level of the disease and show different acceptance level of the vaccine (García and Cerda, 2020; Hou et al., 2014; Wang et al., 2021). During the survey period, the percentage of people who are fully vaccinated in Shanghai reached 78%, suggesting a fairly high acceptance level of the COVID-19 vaccine among the residents (Shanghai Municipal Health Commission, 2021). However, despite the decreases in local cases, Shanghai presents a higher imported case risk of COVID-19 from inbound international flights owing to its position as a leading global aviation hub (Zhang et al., 2020). Similarly, Hong Kong is also facing a very high imported case risk due to its superior international air connectivity and relatively loose restriction on the inbound flights at the time of survey (Zhang et al., 2020). During the survey period, the number of daily confirmed cases outside China (e.g., the U.S., Brazil, India, Italy, U.K., etc) has exceeded that inside the nation. As for Hong Kong, the total number of imported COVID-19 cases was 376 during the survey period (i.e., Apr. to Jun. 2021), while the number of total local confirmed cases was 107 (CPH, 2021). Therefore, to the Shanghai and Hong Kong respondents, the requirement of providing vaccination records for international air travel can be an effective policy not only to protect themselves as outbound travellers but also to help monitor the inbound travellers.

Likewise, the Shanghai respondents are willing to pay for the requirement of providing personal information, travel history, and symptoms for health declaration, while the U.S. subsample needs to be compensated to follow this procedure. Indeed, previous studies have revealed that travellers in western countries are more privacy sensitive and strive to protect personal information and defend liberty (Beck et al., 2018; Frimpong, 2011; Ioannou et al., 2020). Xing et al. (2021) conducted a comparative analysis to examine the effects of cultural differences on the public attitudes towards pandemic control measures in the U.S. and China. The results suggest that Chinese residents are less privacy-conscious and show a higher acceptance level of the national policies. The discrepancy in attitudes could be attributed to the prevalence of individualistic culture in the U.S. versus the collectivist culture in China (Fang et al., 2016).

Furthermore, our Chinese respondents show preference for the compulsory mask-wearing requirements while their U.S. counterparts have statistically significant disutility. This is because Chinese residents in general regard mask-wearing as an effective prevention measure to contain the spread of coronavirus, while there are some debates in mask wearing among the U.S. population (Xing et al., 2021). The dedication to mask wearing and other health control measures among Hong Kong respondents might also be attributed to the painful experiences learnt during the SARS outbreak in the city in 2003, which imposed serious social and economic impacts (Hung, 2003). The risk perception of the public is rooted in their knowledge, attitudes, and beliefs about infectious diseases, deriving from previous experience of the health crisis (i.e., the 2003 SARS) (Cheng et al., 2020; Chan et al., 2021; Kwok et al., 2020). After the SARS outbreak, the Hong Kong government established the Centre for Health Protection (CHP), which is committed to enhancing the effectiveness of the infection prevention and control interventions. Therefore, even before COVID-19, the public

awareness of personal hygiene standards was relatively high owing to the frequent educational and promotional campaigns (Chan et al., 2021). In this sense, there are historical differences; for example, mainland China and Hong Kong have gone through SARS epidemic, while the U.S. has been spared. This could have affected both public health measures and public perception of the need for various measures.

On the other hand, a mandatory mask wearing requirement could be perceived as an infringement of human rights in western countries (Rieger, 2020; Smith et al., 2021). Also, the negative WTP of the U.S. sample can be attributed to the inconsistent recommendations on mask-wearing announced by the health authorities. For example, Feng et al. (2020) observed that the U.S. authorities were once against the practice of healthy people wearing face masks, and the guides on mask wearing are sometimes different among states and federal governments. On the other hand, mainland China adopted a risk-based approach to offer recommendations for the use of face masks by the general public and medical staff. Also, Hong Kong government has issued a regulation (took effect on 23 July 2020) to impose compulsory mask wearing requirement in public places, and the maximum penalty for breaching requirements is a fine at level 3 (HK\$10,000 or about US\$1,400). Apart from penalties, the positive values of WTP for mask wearing can be perceived as a kind of social responsibility, for the protection of others (Lee, 2021), which can also be related to collectivist culture. In future studies, as the experience with COVID-19 pandemic could in principle change the attitudes of the U.S. residents in the near future (Xu and Cheng, 2021), it will be worthwhile repeating the survey in the U.S. several years down the road.

As for the effects of online meeting, some industry observers argue that travel demand would decrease significantly, especially for business travel (IATA, 2020a). Yet, the impacts of online meetings to the aviation industry could be temporary. Indeed, our results indicate that the Shanghai and Hong Kong respondents would have higher intentions to travel by air during the pandemic and show preferences for the health control services at the airport when an online meeting is not applicable. Yet, they are prone to call off a business travel when the online meeting offers a good substitute to face-to-face meeting. On the other hand, we also found that the impact of online meetings on the air travel choice of the potential business travellers in the U.S. is relatively small compared with Shanghai and Hong Kong. In particular, even though they were told that an online meeting is applicable, the U.S. residents did not show a strong intention to choose not to travel.

Aseniero et al. (2020) indicated that employees in the U.S. tend to perceive themselves as unproductive and feel disconnected when using the online meeting platforms for business communication. In contrast, the Chinese employees believe that online meetings provide a relaxed environment, flexibility, and increased productivity (Pänttjä and Wu, 2021). Moreover, studies on the privacy sensitivity of passengers in the U.S. and other Western countries, such as those referenced earlier, indicate that there is a trade-off between convenience and protection of personal information when using online meeting platforms. Besides, the disadvantages of online meetings include network disconnection, hardware failure, hacker attack, and other security issues (D'Anna et al., 2020).

Consistently, our results reveal that the U.S. respondent still prefer to have a business travel even though they have high acceptance level of online meeting, while opposite effects were found for their Chinese counterparts who are more concerned about safety risks amid a pandemic. Unlike the sudden surge of online meetings in China during the pandemic, teleworking and work-from-home have been one popular human resource management practice in the West in the past decade. To some extents, the development progress of the new working mode and ICT tools is relatively more advanced in the Western developed countries. Online meeting platforms promote the connection of people who are far apart and help establish a more decentralized network and supply chain on a global scale, which could have increased rather than replaced the desire for face-to-face meetings among our U.S. respondents. For our Shanghai and Hong Kong sample, it is entirely possible that the impact of reducing travel intention due to the availability of online meeting options would be short-term, as ICT tools could be a complement rather than a substitute for travel as witnessed for communication tools such as telephone, fax, and email.

Interestingly, we found no significant WTPs for the requirements of health declaration, compulsory mask wearing, and onsite health check when the respondents were told an online meeting is applicable. One possible explanation is that online meetings serve as good substitute for business travel. Thus, the benefits for implementing the health control measures decline or become insignificant.

6. Conclusion and recommendations

The COVID-19 pandemic has brought unprecedented negative impacts to the aviation industry. To facilitate the recovery of international travel, this study investigates passenger preference toward new travel requirements in the presence or absence of online meeting option. A stated choice approach is applied to collect the responses from three study areas (i.e., the U.S., Shanghai, and Hong Kong). Potential business travellers are targeted. The preference heterogeneity and scale heterogeneity are accommodated using the generalized mixed logit (GMXL) model.

When an online meeting is inapplicable, respondents from all three regions exhibit disutility for the increased ticket cost associated with health control measures. While the U.S. respondents perceived a value of US\$ 2.34/min for the time saved, the Shanghai and Hong Kong respondents seem indifferent about saving time at the health checkpoints. In general, the U.S. travellers perceive health control measures as extra costs and burden, while respondents in Shanghai and Hong Kong favour those additional requirements as measures promoting travel safety. Specifically, the U.S. travellers need to be compensated to accept the “requirements” of health declaration, the compulsory mask-wearing, and onsite health checks. In contrast, the Shanghai and Hong Kong sample are willing to pay for such health control “services”.

When an online meeting becomes applicable, respondents in Shanghai and Hong Kong show strong tendency of replacing business travel with online meeting. In comparison, online meeting option does not significantly reduce the U.S. travellers' intent for business trips. However, the WTP for the time saved at health checkpoints nearly doubled for the U.S. respondents, meaning they are less tolerable to time spent on health control measures.

For passengers in mainland China and Hong Kong, strict health control measures could increase rather than reduce the demand for business travel. They do not mind providing personal information for pandemic control purpose. In comparison, U.S. travellers are much more averse to the extra time and costs associated with health control measures, including the provision of personal data. The heterogeneity is also evidenced by the effects of online meeting option, which do not significantly change U.S. travellers' intention of business travel, but significantly reduce the intention of those in Shanghai and Hong Kong.

The results obtained in our study contribute to a better understanding of passenger preferences amid the pandemic, and offer some policy insights too. For example, the heterogeneity among travellers is consistent with the different pandemic control policies across regions. Passengers in mainland China and Hong Kong are much more risk averse to pandemic risks and more supportive to health control measures. They are more likely to replace business travel with online meeting. Therefore, the recovery of business travel in the region could be longer than expected. Despite the extra costs and time involved, strict health screening and reporting requirements are justified which could facilitate travel demand recovery. In the U.S. markets, regulators should streamline the screening process whenever possible, and should minimize the collection of personal information and extra charges to passengers. Business travel is likely to recover fast as passengers may regard online meeting as imperfect substitutes, which is good news to the region's aviation industry.

Although our conclusions are obtained with updated data and relevant econometric analysis, some potentially important factors are not examined given we our focus on the effects of introducing routine health screening procedures at an airport in the 'new normal'. In future study, it would be worthwhile to explore the effects of quarantine measures imposed by different countries on traveler's choice of destination. It would be also useful to include other destination-related factors, such as travel insurance availability and various government response strategies (e.g., Zero-COVID policy vs Coexisting with COVID).

With COVID-19's world-wide impacts, coordinated global efforts should be made for reaching a new normal. There is a need for common guidelines and targets internationally. On the other hand, countries have been pursuing quite different approaches in pandemic control. Our study suggests that the divergences in travel control are supported, at least partially, by significant heterogeneity among passengers in different regions. Therefore, individualized travel arrangements are likely to persist. Regulatory policy development should take into account of the heterogeneity across countries. Reaching a good balance between common standards vs country heterogeneity would not be easy, and calls for more advanced studies in related fields.

7. Author statement

All authors in this study have contributed significantly. Specifically, each author's main contribution is listed as follows, which doesn't fully summarize precisely the overall contribution.

CRedit authorship contribution statement

Tiantian Chen: Conceptualization, Methodology, Validation, Resources, Data curation, Writing – original draft, Writing – review & editing. **Xiaowen Fu:** Conceptualization, Methodology, Validation, Resources, Writing – original draft, Writing – review & editing, Project administration. **David A. Hensher:** Conceptualization, Methodology, Validation, Resources, Writing – original draft, Writing – review & editing. **Zhi-Chun Li:** Conceptualization, Methodology, Validation, Resources, Writing – original draft, Writing – review & editing. **N.N. Sze:** Conceptualization, Methodology, Validation, Resources, Writing – original draft, Writing – review & editing.

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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References

- Embassy of the Republic of Korea to the Republic of Singapore (2022, March 24th). Quarantine for unvaccinated/partially vaccinated travellers entering Korea. Retrieved April 20, 2022, from https://overseas.mofa.go.kr/sg-en/brd/m_2444/view.do?seq=761451.
- Aseniero, B.A., Constantinides, M., Joglekar, S., Zhou, K., Quercia, D., 2020, October. MeetCues: Supporting online meetings experience. In: 2020 IEEE Visualization Conference (VIS). IEEE, pp. 236–240.
- Beck, M.J., Hensher, D.A., 2020. Insights into the impact of COVID-19 on household travel and activities in Australia-The early days under restrictions. *Transp. Policy* 96, 76–93.
- Beck, M.J., Rose, J.M., Merkert, R., 2018. Exploring perceived safety, privacy, and distrust on air travel choice in the context of differing passenger screening procedures. *J. Travel Res.* 57 (4), 495–512.
- Boksberger, P.E., Bieger, T., Laesser, C., 2007. Multidimensional analysis of perceived risk in commercial air travel. *J. Air Transp. Manage.* 13 (2), 90–96.
- Bruine de Bruin, W., 2021. Age differences in COVID-19 risk perceptions and mental health: Evidence from a national US survey conducted in March 2020. *J. Gerontol.: Ser. B* 76 (2) e24–e29.

- Chan, H.Y., Chen, A., Ma, W., Sze, N.N., Liu, X., 2021. COVID-19, community response, public policy, and travel patterns: A tale of Hong Kong. *Transp. Policy* 106, 173–184.
- Chan, E.Y.Y., Huang, Z., Lo, E.S.K., Hung, K.K.C., Wong, E.L.Y., Wong, S.Y.S., 2020. Sociodemographic predictors of health risk perception, attitude and behavior practices associated with health-emergency disaster risk management for biological hazards: the case of COVID-19 pandemic in Hong Kong, SAR China. *Int. J. Environ. Res. Public Health* 17 (11), 3869.
- Chan, H.F., Skali, A., Savage, D.A., Stadelmann, D., Torgler, B., 2020. Risk attitudes and human mobility during the COVID-19 pandemic. *Sci. Rep.* 10 (1), 1–13.
- Cheng, K.K., Lam, T.H., Leung, C.C., 2020. Wearing face masks in the community during the COVID-19 pandemic: altruism and solidarity. *The Lancet*.
- Chen, Tiantian, Fu, Xiaowen, Hensher, David A., Li, Zhi-Chun, Sze, N.N., 2022. The effect of online meeting and health screening on business travel: A stated preference case study in Hong Kong. *Transp. Res. Part E: Logist. Transp. Rev.* 164, 102823.
- Chu, Q., Gu, T., Li, A., Chen, J., Wang, H., Liu, N., ... & He, Y., 2021. Perceived effectiveness of public health measures and positive attitudes during a pandemic: a large cross-sectional study in Shanghai, China. *BMJ open*, 11, 5, e047231.
- Chung, L.H., 2015. Impact of pandemic control over airport economics: Reconciling public health with airport business through a streamlined approach in pandemic control. *J. Air Transp. Manage.* 44, 42–53.
- Cohen, N.J., Brown, C.M., Alvarado-Ramy, F., Bair-Brake, H., Benenson, G.A., Chen, T.-H., Demma, A.J., Holton, N.K., Kohl, K.S., Lee, A.W., McAdam, D., Pesik, N., Roohi, S., Smith, C.L., Waterman, S.H., Cetron, M.S., 2016. Travel and border health measures to prevent the international spread of Ebola. *MMWR Suppl.* 65 (3), 57–67.
- Shanghai Municipal Health Commission. (2021, June 29). *COVID-19 vaccination rate in Shanghai*. Retrieved July 5, 2021, <http://wsjkw.sh.gov.cn/xwfb/20210629/4d50e79d4e7c4547929e2bb55798c7b1.html>.
- CPH (Centre for Health Protection). (2021). *Previously Reported COVID-19 Cases (database)*. https://www.chp.gov.hk/files/xls/previous_cases_covid19_tc.xlsx.
- Czerny, A.I., Fu, X., Lei, Z., Oum, T.H., 2021. Post pandemic aviation market recovery: experience and lessons from China. *J. Air Transp. Manage.* 90.
- D'Anna, G., D'Arco, F., Van Goethem, J., 2020. Virtual meetings: a temporary choice or an effective opportunity for the future? *Neuroradiology* 62 (7), 769–770.
- Department for Transport. (2021, June 22) *Travel to England from another country during coronavirus (COVID-19)*. Retrieved April 20, 2022, from <https://www.gov.uk/guidance/travel-to-england-from-another-country-during-coronavirus-covid-19>.
- IATA Economics. (2020a, July 28). *Recovery Delayed as International Travel Remains Locked Down*. <https://www.iata.org/en/pressroom/pr/2020-07-28-02/>.
- IATA Economics. (2020b, July 7). *Traveler Survey Reveals COVID-19 Concerns*. <https://www.iata.org/en/pressroom/pr/2020-07-07-01/>.
- IATA Economics. (2021, February 3). *Air Passenger Market Analysis-December 2020*. <https://www.iata.org/en/iata-repository/publications/economic-reports/air-passenger-monthly-analysis-december-2020/>.
- Falk, A., Becker, A., Dohmen, T., Enke, B., Huffman, D., Sunde, U., 2018. Global evidence on economic preferences. *Q. J. Econ.* 133 (4), 1645–1692.
- Fang, X., Lederer, A.L., Benamati, J.S., 2016. The influence of national culture on information technology development, implementation, and support challenges in China and the United States. *J. Glob. Inform. Technol. Manage.* 19 (1), 26–43.
- Feng, S., Shen, C., Xia, N., Song, W., Fan, M., Cowling, B.J., 2020. Rational use of face masks in the COVID-19 pandemic. *Lancet Respirat. Med.* 8 (5), 434–436.
- Fiebig, D.G., Keane, M.P., Louviere, J., Wasi, N., 2010. The generalized multinomial logit model: accounting for scale and coefficient heterogeneity. *Market. Sci.* 29 (3), 393–421.
- Frimpong, A., 2011. Introduction of full body image scanners at the airports: a delicate balance of protecting privacy and ensuring national security. *J. Transport. Secur.* 4 (3), 221–229.
- Fu, X., Dresner, M., Oum, T.H., 2011. Effects of transport service differentiation in the U.S. domestic airline market. *Transport. Res. – Part E* 47 (3), 297–305.
- Fu, X., Lei, Z., Wang, K., Yan, J., 2015. Low cost carrier competition and route entry in an emerging but regulated aviation market - the Case of China. *Transport. Res. – Part A* 79, 3–16.
- Fu, X., Jin, H., Liu, S., Oum, T.H., Yan, J., 2019. Exploring network effects of Point-to-Point networks: An investigation of the spatial patterns of Southwest airlines' network. *Transp. Policy* 76, 36–45.
- Fu, X., Hensher, D., Chen, T., Su, J., 2021. Aviation Market Development in the New Normal Post the COVID-19 Pandemic: An analysis of air connectivity and business travel. *Econ. Res. Inst. ASEAN East Asia Discussion Paper Ser. No.* 400.
- García, L.Y., Cerda, A.A., 2020. Contingent assessment of the COVID-19 vaccine. *Vaccine* 38 (34), 5424–5429.
- Gough, M., Rosenfeld, J., 2006. Video conferencing over IP: Configure, secure, and troubleshoot. Syngress, Rockland, MA.
- Gray, L.M., Wong-Wylie, G., Rempel, G.R., Cook, K., 2020. Expanding qualitative research interviewing strategies: Zoom video communications. *Qualitat. Report* 25 (5), 1292–1301.
- Greene, W.H., Hensher, D.A., 2010. Does scale heterogeneity across individuals matter? An empirical assessment of alternative logit models. *Transportation* 37 (3), 413–428.
- Gu, Y., Onggo, B.S., Kunc, M.H., Bayer, S., 2021. Small Island Developing States (SIDS) COVID-19 post-pandemic tourism recovery: A system dynamics approach. *Curr. Issues Tourism* 1–28.
- Gustafson, P., 2012. Travel time and working time: What business travellers do when they travel, and why. *Time & Soc.* 21 (2), 203–222.
- Hensher, D.A., 2012. Accounting for scale heterogeneity within and between pooled data sources. *Transport. Res. Part A: Policy Pract.* 46 (3), 480–486.
- Hensher, D.A., Greene, W.H., 2003. The mixed logit model: the state of practice. *Transportation* 30 (2), 133–176.
- Hensher, D.A., Rose, J.M., 2007. Development of commuter and non-commuter mode choice models for the assessment of new public transport infrastructure projects: a case study. *Transport. Res. Part A: Policy Pract.* 41 (5), 428–443.
- Hensher, D.A., Rose, J.M., Greene, W.H. (Eds.), 2015. *Applied Choice Analysis*. Cambridge University Press.
- Hensher, D.A., Beck, M.J., Wei, E., 2021. Working from home and its implications for strategic transport modelling based on the early days of the COVID-19 pandemic. *Transport. Res. Part A: Policy Pract.* 148, 64–78.
- Ho, C.Q., Hensher, D.A., Mulley, C., Wong, Y.Z., 2018. Potential uptake and willingness-to-pay for Mobility as a Service (MaaS): A stated choice study. *Transport. Res. Part A: Policy Pract.* 117, 302–318.
- Hou, Z., Chang, J., Yue, D., Fang, H., Meng, Q., Zhang, Y., 2014. Determinants of willingness to pay for self-paid vaccines in China. *Vaccine* 32 (35), 4471–4477.
- Hung, L.S., 2003. The SARS epidemic in Hong Kong: what lessons have we learned? *J. R. Soc. Med.* 96 (8), 374–378.
- Immigration and Checkpoints Authority. (2022, April) *Travelling to Singapore - Overview*. Retrieved April 20, 2022, from <https://safetravel.ica.gov.sg/arriving/overview>.
- Ioannou, A., Tussyadiah, I., Miller, G., 2020. That's private! Understanding travelers' privacy concerns and online data disclosure. *J. Travel Res.* 0047287520951642.
- Irawan, M.Z., Belgiawan, P.F., Joewono, T.B., Bastarianto, F.F., Rizki, M., Ilahi, A., 2021. Exploring activity-travel behavior changes during the beginning of COVID-19 pandemic in Indonesia. *Transportation* 1–25.
- Kwok, K.O., Li, K.K., Chan, H.H.H., Yi, Y.Y., Tang, A., Wei, W.I., Wong, S.Y.S., 2020. Community responses during early phase of COVID-19 epidemic, Hong Kong. *Emerg. Infect. Dis.* 26 (7), 1575–1579.
- Lee, O.E., 2021. Reframing facemasks as tools to balance individualism and social responsibility. *Qualitat. Soc. Work* 20 (1–2), 240–246.
- Liu, A., McKecher, B., 2016. The impact of visa liberalization on tourist behaviors—The case of China outbound market visiting Hong Kong. *J. Travel Res.* 55 (5), 603–611.
- Loo, B.P., Wang, B., 2018. Factors associated with home-based e-working and e-shopping in Nanjing, China. *Transportation* 45 (2), 365–384.
- Lund, I.O., Rundmo, T., 2009. Cross-cultural comparisons of traffic safety, risk perception, attitudes and behaviour. *Saf. Sci.* 47 (4), 547–553.
- Lyons, G., Jain, J., Holley, D., 2007. The use of travel time by rail passengers in Great Britain. *Transport. Res. Part A: Policy Pract.* 41 (1), 107–120.
- Manca, F., Sivakumar, A., Pawlak, J., Brodzinski, N.J., 2021. Will we fly again? Modeling air travel demand in light of COVID-19 through a London case study. *Transp. Res. Rec.* 03611981211025287.
- Mason, K., Leek, S., 2012. Communication practices in a business relationship: Creating, relating and adapting communication artifacts through time. *Ind. Mark. Manage.* 41 (2), 319–332.

- Millán, A., Fanjul, M.L., Moital, M., 2016. Segmenting the business traveler based on emotions, satisfaction, and behavioral intention. *Psychol. Market.* 33 (2), 82–93.
- Miller, M.B., 2003. The business trip: maritime networks in the twentieth century. *Busin. History Rev.* 77 (1), 1–32.
- Mouter, N., Van Cranenburgh, S., Van Wee, B., 2017. Do individuals have different preferences as consumer and citizen? The trade-off between travel time and safety. *Transport. Res. part A: Policy Pract.* 106, 333–349.
- Mulley, C., Ho, C., Ho, L., Hensher, D., Rose, J., 2018. Will bus travellers walk further for a more frequent service? An international study using a stated preference approach. *Transp. Policy* 69, 88–97.
- Neuburger, L., Egger, R., 2020. Travel risk perception and travel behaviour during the COVID-19 pandemic 2020: a case study of the DACH region. *Curr. Issues Tour.* 1–14.
- Nguyen, T.T.P., Nguyen, L.H., Le, H.T., Vu, G.T., Hoang, M.T., Nguyen, D.N., Le, X.T.T., Tran, B.X., Nguyen, T.T., Pham, Q.T., Ta, N.T.K., Nguyen, Q.T., Latkin, C.A., Ho, R.C.M., Ho, C.S.H., 2020. Perceptions and attitudes toward COVID-19-related national response measures of Vietnamese: Implications for pandemic prevention and control. *Front. Public Health* 8.
- OECD. (2020, October 15) COVID-19 and the aviation industry: Impact and policy responses. Retrieved June 20, 2021, from <https://www.oecd.org/coronavirus/policy-responses/covid-19-and-the-aviation-industry-impact-and-policy-responses-26d521c1/>.
- Pänttälä, K., & Wu, X. (2021). Teleworkers' productivity in turbulent times - A comparative study of employees in Finland and China during the COVID-19 pandemic (Dissertation). Retrieved from <http://urn.kb.se/resolve?urn=urn:nbn:se:uu:diva-447208>.
- Raghuram, S., Fang, D., 2014. Telecommuting and the role of supervisory power in China. *Asia Pacific J. Manage* 31 (2), 523–547.
- Rieger, M.O., 2020. To wear or not to wear? Factors influencing wearing face masks in Germany during the COVID-19 pandemic. *Soc. Health Behav.* 3 (2), 50.
- Rogelberg, S.G., Shanock, L.R., Scott, C.W., 2012. Wasted time and money in meetings: Increasing return on investment. *Small Group Res.* 43 (2), 236–245.
- Shamshiripour, A., Rahimi, E., Shabanpour, R., Mohammadian, A., 2020. How is COVID-19 reshaping activity-travel behavior? Evidence from a comprehensive survey in Chicago. *Transport. Res. Interdisc. Perspect.* 7.
- Smith, L.E., Hodson, A., Rubin, G.J., 2021. Parental attitudes towards mandatory vaccination; a systematic review. *Vaccine* 39 (30), 4046–4053.
- Train, K.E., 2003. Discrete choice methods with simulation. Cambridge University Press.
- Tsui, K.W.H., Fu, X., Chen, T., Lei, Z., Wu, H., 2021. Analyzing Hong Kong's inbound tourism: The impact of the COVID-19 pandemic. *IATSS Res.* 45 (4), 440–450.
- Tsui, W.H.K., Fu, X., Yin, C., Zhang, H., 2021. Hong Kong's aviation and tourism growth - An empirical investigation. *J. of Air Transp. Manage.* 93.
- Tu, N., Li, Z.-C., Fu, X., Lei, Z., 2020. Airline network competition in inter-continental market. *Transport. Res. - Part E* 143.
- Vlachos, I., Lin, Z., 2014. Drivers of airline loyalty: Evidence from the business travelers in China. *Transport. Res. Part E: Logist. Transport. Rev.* 71, 1–17.
- Wang, J., Lyu, Y., Zhang, H., Jing, R., Lai, X., Feng, H., Knoll, M.D., Fang, H., 2021. Willingness to pay and financing preferences for COVID-19 vaccination in China. *Vaccine* 39 (14), 1968–1976.
- Wang, K., Tsui, K.W.H., Liang, L., Fu, X., 2017. Entry patterns of low-cost carriers in Hong Kong and implications to the regional market. *J. Air Transp. Manage.* 64 (B), 101–112.
- WHO (World Health Organization). (2021). WHO Coronavirus (COVID-19) Dashboard. Retrieved from <https://covid19.who.int/>.
- Wu, H., & Chen, Y., 2020, July. The impact of work from home (wfh) on workload and productivity in terms of different tasks and occupations. In *International Conference on Human-Computer Interaction*, pp. 693–706. Springer, Cham.
- Xiao, Y., Fu, X., Zhang, A., 2016. Airport investment with vertical arrangements. *Transport. Res. - Part A* 92, 298–309.
- Xiao, Y., Fu, X., Oum, T.H., Yan, J., 2017. Airport capacity investments with real options. *Transport. Res. - Part B* 100, 93–114.
- Xing, Y., Li, Y., Wang, F.K., 2021. How privacy concerns and cultural differences affect public opinion during the COVID-19 pandemic: a case study. *Aslib J. Inform. Manage.* 73 (4), 517–542.
- Xu, P., Cheng, J., 2021. Individual differences in social distancing and mask-wearing in the pandemic of COVID-19: The role of need for cognition, self-control and risk attitude. *Personality Individ. Differ.* 175.
- Yang, H., Fu, X., 2015. A comparison of price-cap and light-handed airport regulation with demand uncertainty. *Transport. Res. - Part B* 73, 122–132.
- Zeng, B., Carter, R.W., De Lacy, T., 2005. Short-term perturbations and tourism effects: The case of SARS in China. *Curr. Issues Tour.* 8 (4), 306–322.
- Zhang, L., Yang, H., Wang, K., Zhan, Y.i., Bian, L., 2020. Measuring imported case risk of COVID-19 from inbound international flights—A case study on China. *J. Air Transp. Manage.* 89.