

# Travel Mode Choice for Domestic Intercity Travel: A Case Study in Suzhou, China

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#### **Keywords:**

## Travel mode choice, Highspeed rail, Air travel, Binary logistic regression.

#### Abstract.

This study examines how residents in Suzhou, China choose between different travel modes for domestic intercity travel. Suzhou provides an interesting case study because of its developed high-speed rail (HSR) network and proximity to three major airports. Semi-structured qualitative interviews were administered to 158 participants to obtain information about their most recent intercity trip and important factors for choosing travel modes. The interviews were thematically analysed, and participants were coded as being in or out of themes to allow for chi-squared tests of independence (to examine associations between themes and demographic variables) and binary logistic regressions (to predict travel mode choice based upon themes). The findings show that accessibility, convenience, and price increase the likelihood of a participant having chosen HSR. However, the more important contribution is methodological, highlighting the importance of studying actual behaviours (rather than attitudes and preferences) and avoiding the issues of self-generated validity and construct creation.

#### Kata Kunci:

Pilihan mode perjalanan, Rel kecepatan tinggi, Perjalanan udara, Regresi logistik biner.

#### Abstrak.

Studi ini mengkaji bagaimana penduduk di Suzhou, China memilih antara mode perjalanan yang berbeda untuk perjalanan domestik antar kota. Suzhou memberikan studi kasus yang menarik karena jaringan kereta berkecepatan tinggi (HSR) yang dikembangkan dan kedekatannya dengan tiga bandara utama. Wawancara kualitatif semi terstruktur dilakukan kepada 158 peserta untuk mendapatkan informasi tentang perjalanan antar kota terbaru mereka dan faktor-faktor penting untuk memilih mode perjalanan. Wawancara dianalisis secara tematis, dan peserta diberi kode sebagai masuk atau keluar dari tema untuk memungkinkan tes independensi chi-kuadrat (untuk menguji hubungan antara tema dan variabel demografis) dan regresi logistik biner (untuk memprediksi pilihan mode perjalanan berdasarkan tema). Temuan menunjukkan bahwa aksesibilitas, kenyamanan, dan harga meningkatkan kemungkinan peserta memilih HSR. Namun, kontribusi yang lebih penting adalah metodologis, menyoroti pentingnya mempelajari perilaku aktual (daripada sikap dan preferensi) dan menghindari masalah validitas yang dihasilkan sendiri dan penciptaan konstruk.

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#### 1. Introduction

Intermodal competition has been a topic of interest for many years, and in recent times there has been a particular focus on competition between air travel and high-speed rail (HSR) given the expansion of the latter in a push to reduce carbon emissions associated with air travel (Dobruszkes, 2011; Li et al., 2021). China has seen the rapid expansion of its HSR networks since 2004 when the programme was launched by the Chinese government. Originally, the HSR network was aimed at relieving 90% of the demand for the then conventional rail network due to ongoing capacity issues (Ren et al., 2020; Wang et al., 2017). The launch of the Mid- and Long-term Rail Network Plan (MLTRNP) in 2016 meant expanding the total track length to 30,000km by 2020 in an attempt to

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cover all of the major cities in Mainland China using the 8+8 network (made up of eight vertical and eight horizontal corridors) (A. Zhang et al., 2019; Zhang et al., 2017). The establishment of HSR can not only relieve capacity issues with conventional rail systems, but also support regional development through improved convenience and intercity transportation (Ren et al., 2020).

Air travel in China has also seen rapid growth since its deregulation in the early 2000s (Zhang & Zhang, 2016). The increase in the number of airline services saw a reduction in airfares, which in turn allowed more people to travel by air (Wang et al., 2018). However, it was not just competition between airlines that put price competition upon China's airlines, but also competition with HSR. This resulted in some airlines permanently exiting some short- and medium-haul routes such as Shanghai-Nanjing and Guangzhou-Wuhan (Chen, 2017; Fu et al., 2012).

Intermodal competition, particularly between HSR and air travel, can also be observed in other countries. For example, in 2011, more than 80% of the passengers travelling between Tokyo and Osaka travelled with Shin-kan-sen, the high-speed rail service in Japan (Takebayashi, 2014). In Korea, the introduction of the Korea Train Express (KTX) operations between Seoul and Daegu in 2004 saw a dramatic decrease in demand for air travel on the same route (Park & Ha, 2006). Lee et al. (2016) find a similar effect when examining a hypothetical HSR route between Seoul and Jeju. In Europe competition between HSR and air travel has also affected routes such as Frankfurt-Cologne and Madrid-Barcelona (Behrens & Pels, 2012).

While there have been many studies on competition between HSR and air travel, this study employs quite a different approach to past research. Firstly, much of the past research on competition between HSR and air travel has used techniques such as stated preference, future travel intentions or other attitudinal measures (e.g., Li & Sheng, 2016; Pan & Truong, 2020). There is a potential issue with such techniques in that preferences, intentions and attitudes have consistently been shown to be poor predictors of actual consumer behaviours (Chandon et al., 2005; Higham et al., 2016; Juvan & Dolnicar, 2014). Instead, this study uses the most recent trip to study choice behaviours because this was a real behaviour based upon actual reasons. Secondly, many studies use surveys with predetermined questions to study choices, either based on past studies or the opinions of experts (e.g., Danapour et al., 2018; Ren et al., 2020). Such approaches can lead to issues of self-generated validity and construct creation, where attitudes and beliefs are created as a result of doing the survey (because participants are forced to respond to things that may not exist in their long-term memory) as opposed to the survey measuring already existing attitudes and beliefs (Feldman & Lynch, 1988; Forbes & Avis, 2020).

This study avoids these issues through the use of semi-structured interviews with open-ended questions, where participants are not restricted in any respect as to how they answer. Finally, most of the past research on HSR vs. air travel competition examines particular city pairs (e.g., Behrens & Pels, 2012; Gundelfinger-Casar & Coto-Millán, 2017; Ma et al., 2019). This study uses Suzhou as a case study to examine domestic intercity travel within Mainland China to capture different perspectives on why residents there choose different travel modes. Suzhou is an ideal study location because it has a highly developed HSR network (Wang et al., 2020; Zhou & Zhang, 2021), has three airports nearby (Shanghai Hongqiao, Shanghai Pudong, and Sunan Shuofang), a population of over 10 million, and has experienced rapid economic development and subsequent increases in demand for intercity travel (Chung et al., 2020; Lin et al., 2020). Thus, this study aims to contribute to the literature through the use of different instruments for data collection and through using a single city as the study location. While focussing on intermodal competition between HSR and air travel, it also allows for participants using other transport modalities to be studied. The specific research question this work aims to answer is: How do Suzhou residents choose between different modes of transportation for intercity travel vithin Mainland China?

#### 2. Literature Review

The literature on intermodal competition has highlighted the importance of the transport attributes for passengers. To begin with, passengers are examined to be most sensitive to the price, access time and frequency of services (Park & Ha, 2006). If the HSR fares are increased, the likelihood of passengers choosing air travel also increases (Jung & Yoo, 2014). That means, the price can be an attractive feature of HSR services. However, price is not a determinant in the paper of Behrens and Pels (2012) since the HSR fare relative to airfare is almost constant over time. In addition to these studies which focussed on the price difference between HSR and air services, there is also a marked difference between HSR fares and conventional rail fares. Even though passengers can take conventional trains with a very low price, additional transfers and long travel times are still required. Based on the case of underdeveloped and Western regions of China, for places where HSR is not accessible, passengers may have to book conventional rail services (Ren et al., 2020). In this situation, they are provided a sleeping berth for overnight travel at lower prices. Even though the HSR services are available, the high fares will reduce the purchasing behaviours. Hence, the affordability of HSR fares can be a problem, making some passengers feel excluded.

A number of studies examine how the accessibility concerns impact upon passengers' travel behaviours. Bel (1997) compared the impacts of access time and travel time on both airlines and HSR services. These two factors are statistically insignificant for short-haul air services, however, for shorthaul HSR services, the access time and travel time demonstrate considerable impacts on travel demand. It appears that HSR services are subject to the changes in accessibility and travel time. Jung and Yoo (2014) discussed the accessibility concerns with the consideration of demographic variables for a better understanding of preferences for different market segments. They found that longer access times would result in higher chances of business passengers choosing Low-Cost Carriers (LCCs) and HSR. In the study of Yang and Zhang (2012), it was shown that access time is a determining factor for whether passengers choose air travel or not. That means, based on these studies, access time is key to the desirability of HSR services. Shaw et al. (2014) stated that it is impracticable to have a single indicator to measure the accessibility directly for decision making. They incorporated travel time, cost and distance in order that accessibility among cities can be evaluated. Apart from access time, Wen et al. (2012) examined the impacts of access modes, including access time, access costs, parking costs and waiting time. HSR passengers were found to be the most sensitive to access costs. Access distance is another component of accessibility. Bilotkach et al. (2010) pointed out that both access distance and the effectiveness of the road network should be considered. The access distance remains constant while the effectiveness of the road network could affect the volume of traffic, which, in turn, affects access time.

The impacts resulting from the introduction of HSR have been explored in several studies. Albalate et al. (2015) examined the importance of frequency and capacity from the perspective of European airlines. They considered that flight frequency is a primary element of air services since more frequent flight operations can reduce the possibility of delays. In terms of the capacity that is measured via the number of seats available on that route, it is reduced by airlines when competing with HSR. Others such as Bilotkach et al. (2010) agreed with the significance of flight frequency as well. Airlines tend to increase the frequency of flights for more market share. Researchers like Wang et al. (2017) and Zhang et al. (2017) discussed the impacts of HSR from the standpoint of market demand. Wang et al. (2017) summarised that HSR and air transport could coexist on some routes with heavy demand. For those routes with poor demand, only the travel mode that has higher operational and cost efficiency will be adopted. Zhang et al. (2017) shared this view and implied that, for those routes with thick markets that have more competition and demand, more HSR services are required to prevent the price war among different service providers.

The effects of connectivity resulting from HSR emergence can be both positive and negative. Albalate et al. (2015) compared the traffic of hub airports and non-hub airports. After the introduction of HSR operations, the air traffic of hub airports is growing, especially for those with on-site HSR stations as the HSR services can feed more traffic to hubs. Takebayashi (2014) evaluated the possibility of collaboration between HSR and airlines, drawing a conclusion that improved connectivity can provide more benefits for international passengers. Airlines are in a dominant position for international services, particularly network carriers which serve both domestic and international markets. Connectivity is considered to be the key to air-HSR integration (AH integration). Li and Sheng (2016) recognised that to derive the economic benefits of AH integration, problems like luggage services, ticket prices and competition need to be dealt with. Furthermore, the transfer time is another key point. If the transfer time is beyond a specific range, AH services will lose their competitiveness. From the perspective of passengers, the total en-route time of AH services matters more than travel costs. We can hence gain an understanding that the AH integration is more relevant to shorter en-route time, improved connectivity and transfer services.

Though most of the airlines focus on temporary actions in the short-run by decreasing capacity and prices in response to HSR competition, Jiang and Zhang (2016) thought that the airlines can be motivated to develop hub-and-spoke networks and cover more fringe markets as a result of HSR competition. They used an analytical model to discuss the long-term strategies of airlines in response to HSR competition from the perspective of network structure and market coverage. Because of the regulation of airspace for military functions and the dominant position of state-owned carriers, Chinese carriers lack the incentive to develop hub-and-spoke networks and serve small fringe markets. The upshot is that HSR is only economically feasible for specific trunk routes, whereas airlines can establish more extensive networks where smaller markets can be covered for long-term survival, particularly for LCCs.

The impacts of HSR development do not just affect intermodal competition, but also public welfare. Ren et al. (2019) found that both the economic activities and frequency of travel have risen significantly because HSR has stimulated travel demand and added more convenience to people's discretionary activities. Yang and Zhang (2012) proposed a model to discover the relationship between the mode speed, the fare and the social welfare of HSR and air travel. If there is more attention paid to social welfare, the HSR fare will decrease. Under such circumstances, the airlines also decrease fares in response to competing with HSR. If HSR is faster, the marginal operating cost is higher, resulting in an increase in rail fares. As a consequence, the airlines tend to increase the fares in response. If the speed advantage of air travel is not that obvious, the airfares will be lower to attract passengers. In short, the reduction of HSR fares is more associated with social welfare and also drives airlines to lower prices in response. If HSR fares go up, the great speed advantage of air travel brings about more demand. HSR can also promote public welfare via accessibility. Martínez Sánchez-Mateos and Givoni (2012) suggested that the potential for HSR benefits is not only just based on infrastructure. More specifically, for such a huge infrastructure, discussion should not only focus on the rail itself, but also on its impact on surrounding regions. Shaw et al. (2014) conceptualised this effect as "corridor effect". That means, the establishment of HSR networks can improve intercity travel directly or indirectly. In spite of those cities with HSR stations, those cities without an HSR station still can also benefit from the improved travel time and accessibility. Consequently, people can transfer from secondary cities to an HSR hub.

As highlighted in the introduction section, this study aims to add to the current literature on intermodal competition for intercity travel by examining the case of Suzhou in China. While Suzhou itself is an interesting city to study, the more important aspect of this research is to apply a different method of studying intermodal competition. It is possible that extant literature may be suffering from issues related to the attitude-behaviour gap, self-generated validity and/or construct creation (Chandon et al., 2005; Feldman & Lynch, 1988; Forbes & Avis, 2020; Juvan & Dolnicar, 2014). Thus,

a fresh examination of intermodal competition using different methods and analyses may provide new insights into this interesting area of research.

## 3. Method

## 3.1 Participants

There were 158 Suzhou residents that participated in this study. All participants were Chinese citizens. The gender of participants was evenly split with 79 males (50%) and 79 females (50%). The mean age of the participants was 35.73 years (SD = 12.93, range = 16 - 70). Table 1 shows other key demographic variables of participants.

Table 1. Participant Information

Demographic variable	Number of participants (%)
Travel frequency	* * * * * /
Once a year	57 (36.08%)
2 to 3 times a year	36 (22.78%)
4 to 6 times a year	40 (25.32%)
More than 6 times a year	25 (15.82%)
The most recent travel	,
Within last week	4 (2.53%)
Within last fortnight	13 (8.23%)
Within last month	35 (22.15%)
Within last year	81 (51.27%)
More than 1 year ago	25 (15.82%)
Purpose of travel	,
Leisure	51 (32.28%)
Business	41 (25.95%)
VFR (i.e., visiting friends and relatives)	29 (18.35%)
Others (e.g., conference)	28 (17.72%)
Education	9 (5.70%)
Occupation	,
Employed	94 (59.49%)
Student	17 (10.76%)
Unemployed	15 (9.49%)
Full-time parent or Homemaker	14 (8.86%)
Self-employed	12 (7.59%)
Retiree	6 (3.80%)
Travel preference	,
HSR	115 (72.78%)
Air travel	31 (19.62%)
Personal vehicles	12 (7.59%)

### 3.2 Materials

Semi-structured interview questions were asked to participants to obtain the data for this study. These were administered in Mandarin to participants (see Appendix A), however, are also provided in English for the purposes of this publication (see Appendix B). There are several reasons why the questions have been designed in such a way. Firstly, the questions primarily focus on each participant's most recent intercity trip within Mainland China. Because intentions do not accurately predict real behaviours (Chandon et al., 2005; Juvan & Dolnicar, 2014), examining a real past behaviour can provide greater insight into the drivers of that particular behaviour. Such an approach

was used by Henderson et al. (2019) when studying airline brand choice, where they noted that there were differences between their study and the extant literature because behavioural constraints (such as flight availability) are not captured by attitudinal measures such as stated preference. The interview questions specifically cover the reasons for mode choice for the most recent intercity trip within Mainland China to provide a behavioural measure. However, important factors for mode choice are also collected more generally so that there is an attitudinal measure to compare with. Secondly, all of the questions are open-ended and do not lead participants towards any particular answer. This is critical for avoiding the issues of self-generated validity (Feldman & Lynch, 1988) and construct creation (Forbes & Avis, 2020), where the findings of studies can be due to questioning participants about things that do not already exist in long-term memory or which they might not have otherwise thought about if not directly prompted by the researcher.

The collection of qualitative data is useful because it provides a rich account of the participant's most recent intercity trip within Mainland China and allows participants to explain their decision-making in their own words. This study adopts a heterophenomenological epistemology, which contends that every person lives in their own subjective reality and that understanding this subjective reality is the key to understanding human consciousness (Dennett, 1991). Importantly, it contends that people's subjective realities can be studied objectively despite there sometimes being a difference between someone's subjective reality and what could be described as objective reality (Dennett, 1991). For example, it is a well-established fact that air travel is the safest mode of commercial transportation (Oster et al., 2013; Stoop & Kahan, 2005), yet approximately 10 - 35% of the general population avoid flying or find it psychologically uncomfortable to fly because of a phobia of flying (Oakes & Bor, 2010). In this example, the subjective reality of those with the fear of flying is the stronger determinant of their behaviours rather than the objective reality that flying is very safe. The openended qualitative nature of the questions in this study allows the collection of participant's subjective realities, which are then analysed objectively and without distortion from the researchers through thematic analysis.

### 3.3 Procedure

The sampling method which was employed in this study was convenience sampling in Suzhou, Jiangsu province of the People's Republic of China. The researcher walked within the Suzhou Centre Mall, including the Northern Region, the Southern Region and the Atrium, and collected data from passers-by. In terms of the public place for data collection, the Suzhou Centre Mall is located at the Industrial District, relatively speaking, the centre of Suzhou. Therefore, it can be argued that the sample would represent a valuable cross-section of Suzhou residents. For the purposes of this study, residents from the four county-cities, Taicang, Kunshan, Zhangjiagang and Changshu, which are administered by Suzhou government, but not part of Suzhou proper, were excluded.

Participants had to be at least 16 years old and reside in Suzhou. They also needed to have had intercity travel experience within Mainland China prior to the interview as this was the focus of the questions. Participants were also asked prior to doing the interview whether they were employed by a transport company, and if they were, they were excluded to prevent biased responses. Informed consent was given verbally by participants after reading an information sheet. The interviews were conducted verbally and recorded. The participants understood that the data collected was anonymised and used only for academic purposes. Afterwards, the recordings were transcribed and translated from Mandarin into English. This study was peer-reviewed prior to its launch, was considered to be low-risk, and was registered as such on the Massey University Human Ethics Database.

## 3.4 Analysis

The interview transcripts were analysed using thematic analysis according to Braun and Clarke's (2006) 15-point checklist for good thematic analysis. Once the qualitative information had been thematically classified, each participant was then coded as to which themes their comments fitted within. This is a form of integrated design whereby qualitative material is collected and coded into categorical data to allow for further quantitative analysis (Basit, 2003; Looker et al., 1989; Srnka & Koeszegi, 2007). Following this coding, chi-squared tests of independence were used to assess whether the themes were associated with particular demographic groups, and binary logistic regressions were performed to try and predict the travel mode used in the participant's most recent trip and preferred travel mode.

#### 4. Results

#### 4.1 Information about travel modes

All of the participants travelled in their most recent intercity trip within Mainland China using one of three transport modalities: air travel, HSR, or personal vehicles (PVs). Because China has trains that function at different speeds, we grouped all train services above 200km/h as being HSR, specifically including two participants (1.27%) that travelled using Chinese Rail of High Speed (CRH). Given that Suzhou does not have its own airport, it is worth noting that participants who travelled via air travel used a different transport modality to get to the airports in nearby cities – for the purposes of this study, this was not treated as intercity travel, but rather out-of-vehicle travel time. Table 2 shows the information about the transport modalities participants used in their most recent intercity trips within Mainland China.

Travel mode and departure point Number of participants (%) 54 (34.18%) Air travel 32 (20.25%) Shanghai Hongqiao Airport 17 (10.76%) Shanghai Pudong Airport Sunan Shuofang 5 (3.16%) **HSR** 84 (53.16%) Suzhou Station 42 (26.58%) Northern Suzhou Station 28 (17.72%) Suzhou Industrial Station 12 (7.59%) Suzhou High-tech Station 4 (2.53%) PV20 (12.65%)

Table 2. Transport modalities and departure points

## 4.2 Comparison between preferred mode and actual mode of transport

Because one of the core arguments to support the method used in this study is that intentions, preferences and attitudes are not very reliable predictors of actual behaviours it is useful to compare the stated preferences of participants against their actual behaviour in their most recent intercity trip within Mainland China. A chi-squared test of independence shows that stated preference and the travel mode used in the most recent trip are statistically significantly associated with each other,  $\chi^2(4) = 10.883$ , p = 0.028, with a small effect size (Cramer's V = 0.262). The reason for the small effect size becomes apparent when viewing a cross-tabulation of participants' preferred travel mode against the travel mode they used in their most recent trip. This cross-tabulation is shown in Table 3, which

shows that only 55.70% of the actual behaviours in the most recent trip were predicted by the participants' preferences.

Table 3. Cross-tabulation of preferred travel modes against actual travel modes

Preference	Mode	in most recen	Percentage Predicted by	
	Air travel	HSR	PV	Preference
Air travel	18	9	4	58.06%
HSR	33	68	14	59.13%
PV	3	7	2	16.67%
Total Predicted	18	68	2	55.70%

## 4.3 Reasons for most recent travel mode choice

The mean number of reasons for mode choice was 2.10 (SD = 0.67) per participant. The thematic analysis revealed 12 themes for reasons, as well as those that could not be categorised. Table 4 presents these themes, along with subthemes, the number and percentage of participants in each theme, and real example quotes from the interview transcripts that help illustrate what fits within each subtheme. Table 5 presents the results of the chi-squared tests of independence to show which themes and demographics are associated with each other.

### 4.4 Important factors for choosing travel mode

The mean number of important factors for mode choice was 2.53 (SD = 0.62) per participant. The thematic analysis revealed 10 themes for important factors. Table 6 presents these in the same way as Table 4. Table 7 presents the results of the chi-squared tests of independence to show which themes and demographics are associated with each other.

#### 4.5 Reasons for important factors

The mean number of reasons for important factors was 2.14 (SD = 0.74) per participant. The thematic analysis revealed 14 themes for reasons for important factors. Table 8 presents these in the same way as Table 4. Table 9 presents the results of the chi-squared tests of independence to show which themes and demographics are associated with each other.

Table 4. Reasons for most recent travel mode choice

Themes	Numb		Example quotes	
	particip		-	
	Numb.	%		
Accessibility	17	10.76%	WITH TYON I I I I	
The station is close	11	6.96%	"The HSR station is closer to home"	
The airport is too far from home	6	3.80%	"The nearest airport is too far from home"	
Availability	36	22.78%		
There is no direct HSR	11	6.96%	"No direct HSR service available"	
HSR was not available	5	3.16%	"There is no HSR service"	
No airport at destination	5	3.16%	"The destination has no airport"	
No HSR station at destination	5	3.16%	"There is no HSR station"	
The only available choice apart from PV	5	3.16%	"This is the only alternative, otherwise I could only drive"	
There is no other available choice	4	2.53%	"I don't have a choice"	
No direct flight to destination	1	0.63%	"The airline doesn't provide direct flights"	
Comfort	13	8.23%		
Comfort	9	5.70%	"It is comfortable"	
The seat of HSR is more comfortable	4	2.53%	"The HSR seat is more comfortable"	
Convenience	18	11.39%		
Convenient	18	11.39%	"It is convenient"	
Destination mobility	10	6.33%		
Mobility (at destination)	6	3.80%	"We can drive anywhere at destination"	
Inconvenient without a car when	4		"It is inconvenient if I don't have a car"	
travelling	•	2.53%		
Experience	8	5.06%		
Just to try it	3	1.90%	"Just to have a try"	
New experiences	3	1.90%	"It is a new experience for me"	
To enjoy the view better	2	1.27%	"I can enjoy the scenery better"	
Loyalty programme	5	3.16%		
Frequent flyer programmes	5	3.16%	"I have FFP membership"	
Price	68	43.04%		
Cheaper	29	18.35%	"It is cheaper"	
Lower price	14	8.86%	"The price is lower than others"	
Well-priced	10	6.33%	"The ticket is well-priced"	
Very cheap	8	5.06%	"The ticket is extremely cheap"	
Free road toll	4	2.53%	"The toll is free because of National holiday"	
HSR is cheaper	3	1.90%	"HSR is cheaper"	
Speed	62	39.24%		
Fast	20	12.66%	"It is fast"	
Fast speed	18	11.39%	"The speed is fast"	
Aircraft is faster than HSR	12	7.59%	"Aircraft is faster than HSR"	
The HSR is faster	11	6.96%	"The HSR is faster"	
The intercity bus is too slow	1_	0.63%	"The speed of intercity bus is too slow"	
Technology	7	4.43%		
The availability of the internet	7	4.43%	"There is Internet"	
Time	46	29.11%		
Save much time	13	8.23%	"It can save a lot of time"	
Short travel time	11	6.96%	"The travel time is short"	
The air travel is shorter duration than HSR	9	5.70%	"The air travel is shorter than HSR"	
Short waiting time	8	5.06%	"The waiting time is shorter"	
The earliest departure available	3	1.90%	"It has the earliest service"	
The way to the airport is faster	1	0.63%	"It is faster to drive to the airport"	
It is urgent, and I need to arrive ASAP	1	0.63%	"I have to arrive ASAP because it is urgent"	
Travel distance	40	25.32%		
The destination is too far away from Suzhou	21	13.29%	"The destination city is too distant"	
The destination is close	19	12.03%	"The city is closer"	
Uncategorised	2	1.26%	, <del>-</del>	
I am afraid of Covid-19 because of air travel	1	0.63%	"I am afraid of Covid-19 if I choose air travel"	
We have many presents for our family	1	0.63%	"We have many gifts to bring for our family"	
we have many presents for our family	1	0.0370	we have many girts to bring for our raiffilly	

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Table 5. The associations between demographic variables and reasons for most recent choice of travel mode for intercity travel

Reason	Gender	Age	Occupation	Frequency	Recency	Purpose	Most Recent Mode	Preferred Mode
A agosaibility							HSR***	
Accessibility	-	-	-	-	-	-	(0.286)	-
Availability						Leisure/VFR*	Air travel*	
Tivaliability	-	-	-	-	-	(0.177)	(0.184)	-
Comfort			Unwaged*	Infrequent**	>1 year ago*		HSR***	HSR*
Connort	-	-	(0.138)	(0.159)	(0.177)	-	(0.281)	(0.183)
Convenience						Business + Other*	HSR*	_
	-	-	-	-	-	(0.194)	(0.187)	-
Destination						Business + Other**	PV***	
mobility	-	-	-	-	-	(0.216)	(0.646)	-
Experience	Female*					Leisure/VFR**		
	(0.154)	_	_	-	<u>-</u>	(0.213)	_	_
Loyalty	_	_	_	Frequent*	_	Business**	Air travel***	Air travel***
programme				(0.136)		(0.225)	(0.251)	(0.275)
Price	_	_	_	_	_	Leisure/VFR***	HSR***	_
THEC						(0.250)	(0.432)	
Speed	_	_	_	Frequent*	_	_	Air travel**	_
бреец				(0.136)			(0.239)	
Technology	_	_	_	Infrequent**	_	_	HSR*	_
recimology				(0.159)			(0.202)	
Time	_	_	Waged**	_	_	Business*	Air travel***	_
Time			(0.179)			(0.190)	(0.283)	
					1 month – 1 year		Air travel**	
Travel distance	-	-	-	-	ago**	-	(0.201)	-
					(0.222)		(0.201)	
Uncategorised	-	-	-	-	-	-	-	-

\*, \*\*, \*\*\* denote statistical significance at p < 0.1, 0.05 and 0.01 respectively.

Note: the numbers in parentheses are Cramer's V, where Cohen (1988) defines 0.1 as a small effect, 0.3 as a medium effect, and 0.5 as a large effect.

**Table 6.** Important factors for choosing travel mode for intercity travel

Themes	Number of par	rticipants	Example quotes
	Number	0/0	• • •
Accessibility	40	25.32%	
Access time	24	15.19%	"I need to consider the how long it takes to the station or airport"
Access distance	14	8.86%	"How far it is from my home to the station is critical"
The traffic	2	1.27%	"The traffic will affect whether I can arrive at the terminal on time"
Availability	11	6.96%	
HSR Availability	9	5.7%	"Whether the HSR is available"
The availability of air travel	2	1.27%	"The flight to the destination"
Comfort	46	29.11%	
Comfort	46	29.11%	"The comfort when travelling"
Price	78	49.37%	
Price	75	47.47%	"The price counts"
Toll	3	1.90%	"The toll"
Purpose	11	6.96%	
Travel purpose	11	6.96%	"My travel purpose"
Safety	3	1.90%	
Safety	3	1.90%	"The safety problems"
Speed	43	27.22%	•
Speed	26	16.46%	"The speed"
Speed of mode	13	8.23%	"The speed of transportation"
Travel speed	4	2.53%	"The travel speed is critical"
Time	120	75.95%	•
Travel time	56	35.44%	"How long it takes to arrive"
Departure time	15	9.49%	"The time of the departure"
Urgency	15	9.49%	"The urgency of this trip"
Arrival time	10	6.33%	"When can I arrive"
Departure time options	9	5.7%	"A variety of departure time to choose"
The total travel time	9	5.7%	"The total time of the whole trip"
Waiting time	6	3.8%	"Time spent on waiting"
Travel distance	39	24.68%	-
Travel distance	39	24.68%	"The distance between two cities"
Weather	9	5.7%	
Weather conditions	9	5.7%	"The weather"

Table 7. The associations between demographic variables and important factors for choosing travel mode

Factor	Gender	Age	Occupation	Frequency	Recency	Purpose	Most Recent Mode	Preferred Mode
Accessibility	-	-	-	-	-	-	-	-
Availability	-	-	-	-	1 month – 1 year ago* (0.174)	-	HSR** (0.208)	-
Comfort	-	Over 60** (0.251)	-	-	Within last month* (0.174)	-	-	-
Price	-	-	Unwaged** (0.158)	-	-	Leisure/VFR + Other*** (0.296)	-	HSR*** (0.267)
Purpose	-	-	Waged** (0.189)	Frequent* (0.154)	-	Business*** (0.259)	-	-
Safety	-	-	-	-	-	-	PV** (0.229)	PV*** (0.311)
Speed	-	-	Unwaged*** (0.217)	-	-	Leisure/VFR + Other** (0.204)	-	-
Time	-	Below 60* (0.180)	-	-	-	Business*** (0.260)	Air travel + PV* (0.176)	Air travel** (0.208)
Travel distance	-	-	-	-	-	-	Air travel** (0.198)	-
Weather	Female** (0.191)		-	Infrequent** (0.157)	-	-	Air travel + PV* (0.182)	-

<sup>\*, \*\*, \*\*\*</sup> denote statistical significance at p < 0.1, 0.05 and 0.01 respectively.

Note: the numbers in parentheses are Cramer's V, where Cohen (1988) defines 0.1 as a small effect, 0.3 as a medium effect, and 0.5 as a large effect.

Table 8. Reasons for important factors for travel mode choice

Themes	Number of pa	articipants	Example quotes	
	Number	0/0		
Accessibility	4	2.53%		
Access distance determines which mode to choose	4	2.53%	"If the station is closer, I will choose HSR"	
Availability	18	11.39%		
To have alternative options about the departure time	10	6.33%	"I can choose whenever I want to depart"	
The departure had better be not that early	4	2.53%	"The departure had better be at midday"	
The availability of HSR	2	1.27%	"I would choose HSR if available"	
Unable to catch early flights/HSR services	2	1.27%	"I can't catch the early services"	
Price	72	45.57%	•	
The price determines how much money to spend	21	13.29%	"It determines the money spent on tickets"	
Travel budget determines which mode to choose	14	8.86%	"How much available for transportation"	
The price is based on my financial well-being	13	8.23%	"My affordability determines the mode"	
To have the cheapest mode available	7	4.43%	"I would go for the cheapest mode"	
To have the fastest mode available [for a good price]	6	3.80%	"The fastest mode within an acceptable price range"	
HSR is cheaper because the destination is closer	4	2.53%	"HSR is cheaper if the destination is closer"	
The toll determines which station or terminal to choose	4	2.53%	"To decide the terminal for the cheaper toll"	
To travel with lowest price	3	1.9%	"The lowest price possible"	
Comfort	21	13.29%	1 1	
To have a comfortable travel	21	13.29%	"A comfortable travel is better"	
Convenience	1	0.63%		
The convenience of HSR	1	0.63%	"HSR is convenient"	
Distance	9	5.7%		
Travel distance	9	5.7%	"Travel distance determines which mode to choose"	
Experience	9	5.7%		
Weather conditions affect travel experience	7	4.43%	"The weather would affect the trip"	
There are fewer people on the aircraft than HSR	2	1.27%	"There are too many HSR passengers"	
Maximising time at destination	32	20.25%	, 1	
Travel time determines how much time to spend at destination	18	11.39%	"Travel time determines how long I can spend at destination"	
Early arrival to have more time at the destination	7	4.43%	"To arrive ASAP for more time at destination"	
The in-vehicle time determines how much time available at the	7	4.43%	"The travel time determines my available time at	
destination	1	7.73/0	destination"	
Minimising travel time	73	46.2%	destination	
Spend shortest en-route time possible	73 14	8.86%	"The travel had better be as shortest as possible"	
spena snortest en-toute une possible	14	0.0070	The traver had better be as shortest as possible	

Themes	Number of p	articipants	Example quotes	
	Number	%	-	
Arrive as soon as possible	11	6.96%	"For the fastest arrival"	
Arrive ASAP because of urgency	9	5.7%	"To arrive ASAP"	
The en route time will affect total travel time	8	5.06%	"The in-vehicle time affects total travel time"	
To have shortest travel time	7	4.43%	"To have the shortest travel time"	
Less time spent on travelling, the better	6	3.8%	"The travel time had better be short"	
To have the fastest mode available for a good price	6	3.8%	"I prefer the fastest mode for a well-priced ticket"	
How much time to access determines when to leave home	5	3.16%	"The access time determines when I should leave for the terminal"	
Less time spent before departure	4	2.53%	"Less time spent on waiting before departure"	
To save en route time	3	1.9%	"To save the time spent on my way"	
Punctuality	4	2.53%	1 , ,	
Arrive on time	4	2.53%	"On-time arrival is important"	
Reducing fatigue	36	22.78%	•	
To prevent exhaustion	21	13.29%	"To avoid exhaustion"	
Tiring to spend too much travel time	10	6.33%	"It can be tiring if too much travel time spent"	
In the right mindset for business activities upon arrival	5	3.16%	"Ready for the business activities upon arrival"	
Safety	3	1.9%	•	
Safety concerns matter	3	1.9%	"I'm worried about the safety problems"	
Travel plan	29	18.35%	, 1	
To determine when to leave for the station/ terminal	16	10.13%	"I need to consider when to depart from my home"	
The travel time affects the travel plan	13	8.23%	"The total travel time affects the whole trip"	
Urgency	24	15.19%		
The level of urgency determines the travel time	10	6.33%	"To spend the shortest travel time possible if it is urgent"	
The urgency determines when to depart	7	4.43%	"The urgency determines when should I depart"	
The total travel time can affect the in-vehicle time options	4	2.53%	"The total time of my trip determines how long I can spend on the transportation"	
To depart ASAP	3	1.9%	"The earliest departure possible"	

Table 9. The associations between demographic variables and reasons for important factors

Reason	Gender	Age	Occupation	Frequency	Recency	Purpose	Most Recent Mode	Preferred Mode
Accessibility	-	-	-	-	-	-	-	-
Availability	-	-	-	Frequent** (0.186)	-	-	-	Aircraft* (0.191)
Price	-	-	-	Infrequent* (0.155)	-	Leisure/VFR + Other** (0.200)	-	HSR + PV*** (0.263)
Comfort	Male*** (0.205)	-	-	Frequent* (0.139)	-	-	-	-
Convenience	-	-	-	-	-	-	-	-
Distance	_	-	-	-	-	-	-	-
Experience	-	Under 30** (0.216)	-	-	-	-	-	-
Maximising time at destination	Female** (0.191)	-	-	-	-	-	Air travel + $PV^*$ (0.182)	-
Minimising travel time	-	-	-	-	-	-	-	-
Punctuality	-	-	-	-	-	-	-	-
Reducing fatigue	-	_	-	-	-	-	-	-
Safety	-	-	Unwaged* (0.133)	-	-	-	-	-
Travel plan	-	-	-	-	>1 year ago** (0.204)	-	-	PV*** (0.311)
Urgency	-	-	-	Infrequent*** (0.223)	>1 year ago*** (0.244)	-	-	-

<sup>\*, \*\*, \*\*\*</sup> denote statistical significance at p < 0.1, 0.05 and 0.01 respectively.

Note: the numbers in parentheses are Cramer's V, where Cohen (1988) defines 0.1 as a small effect, 0.3 as a medium effect, and 0.5 as a large effect.

## 4.6 Predicting most recent travel mode choice

Binary logistic regressions were performed to ascertain the effects of the reasons for most recent travel mode choice (Model 1) and the important factors for travel mode choice (Model 2) upon the likelihood that a participant travelled by HSR. Participants who travelled by PV (n = 20) were excluded from these regressions, meaning that destination mobility had to also be excluded because this was only used as a reason by those that chose to travel by PV. Model 1 showed a statistically significant result,  $\chi^2(11) = 78.774$ , p < 0.001, explaining 59.0% (Nagelkerke R²) of the variance in travel mode choice and correctly classifying 82.6% of cases. Model 2 also showed a statistically significant result,  $\chi^2(10) = 18.057$ , p = 0.054, explaining 16.6% (Nagelkerke R²) of the variance in travel mode choice and correctly classifying 66.7% of cases. The full results of the two models of binary logistic regressions are shown in Table 10. Positive betas can be interpreted as increasing the likelihood of having chosen to travel via HSR, and negative betas as decreasing the likelihood (or alternatively, increasing the likelihood of having chosen to travel via air).

**Table 10.** Results of binary logistic regressions to predict most recent travel mode choice

Dependent variable = Likelihood of having chosen HSR in most recent trip					
Explanatory Variables	Model 1 (Reasons for mos choice)	t recent	Model 2 (Important factors for choosing travel mode)		
	β	$\chi^2$	β	$\chi^2$	
(Intercept)	-1.259	2.447	1.157	2.006	
Accessibility	2.950**	5.977	0.075	0.018	
Availability	0.581	0.773	1.919*	3.037	
Comfort	21.229	0.000	-0.243	0.269	
Convenience	3.134***	10.977	-	-	
Experience	20.377	0.000	-	-	
Loyalty programme	-21.465	0.000	-	-	
Price	2.575***	19.564	-0.094	0.040	
Purpose	-	_	-0.377	0.227	
Safety	-	_	19.962	0.000	
Speed	-0.592	0.913	0.084	0.027	
Technology	20.617	0.000	-	-	
Time	0.241	0.186	-0.546	2.185	
Travel distance	-0.276	0.236	-1.041**	4.176	
Weather			-1.119	1.400	

<sup>\*, \*\*, \*\*\*</sup> denote statistical significance at p < 0.1, 0.05 and 0.01 respectively.

# 4.7 Predicting travel mode preference

Binary logistic regressions were performed to ascertain the effects of the reasons for most recent travel mode choice (Model 3) and the important factors for travel mode choice (Model 4) upon the likelihood that a participant preferred to travel by HSR. Model 3 showed a statistically significant result,  $\chi^2(12) = 21.680$ , p = 0.041, explaining 21.6% (Nagelkerke  $R^2$ ) of the variance in travel mode preference and correctly classifying 80.6% of cases. Model 4 also yielded a statistically significant result,  $\chi^2(10) = 19.734$ , p = 0.032, explaining 19.8% (Nagelkerke  $R^2$ ) of the variance in travel mode preference and correctly classifying 79.2% of cases. The full results of the two models of binary logistic regressions are shown in Table 11. Positive betas can be interpreted as increasing the

likelihood of having a preference to travel via HSR, and negative betas as decreasing the likelihood (or alternatively, increasing the likelihood of having a preference to travel via air).

Table 11. Results of binary logistic regressions to predict preferred travel mode

Dependent variable = Likelihood of having HSR as the participant's preferred travel mode					
Explanatory Variables	Model (Reasons for most r	3	Model 4 (Important factors for choosing travel mode)		
	β	$\chi^2$	β	$\chi^2$	
(Intercept)	0.525	0.581	0.908	0.969	
Accessibility	-0.283	0.154	-0.046	0.005	
Availability	0.588	1.079	-0.274	0.111	
Comfort	19.648	0.000	0.170	0.094	
Convenience	-0.330	0.264	-	-	
Destination mobility	0.518	0.329	-	-	
Experience	19.426	0.000	-	-	
Loyalty programme	-2.802**	5.476	-	-	
Price	0.424	0.755	1.322**	5.136	
Purpose	-	-	0.584	0.045	
Safety	-	-	0.548	0.704	
Speed	0.277	0.264	-	-	
Technology	19.169	0.000	-	-	
Time	0.550	1.095	-0.357	0.809	
Travel distance	0.573	1.055	-0.144	0.068	
Weather	-	-	20.068	0.000	

<sup>\*, \*\*, \*\*\*</sup> denote statistical significance at p < 0.1, 0.05 and 0.01 respectively.

#### 4.8 Additional comments

While not directly related to the research question, participants were asked at the end of each interview whether they had any additional comments about intercity travel within Mainland China. Only 30 participants (18.99%) chose to make additional comments. Thematic analysis of the additional comments revealed 7 themes for additional comments, along with those that could not be categorised. These are shown in Table 12.

**Table 12.** Themes for additional comments

Theme	Number of participants		Example quotes
	Number	0/0	•
Advantages of air travel	7	4.43%	"I love aircraft"
Disadvantages of air travel	6	3.80%	"Economy class is so uncomfortable"
Comparisons between	6	3.80%	"I would prefer air travel if [it was] as
travel modes			comfortable as HSR"
Advantages of HSR	5	3.16%	"The non-seat ticket is so cheap"
Disadvantages of HSR	9	5.70%	"Some places are not accessible by HSR"
Advantages of PVs	1	0.63%	"It is wonderful to travel to fringe places by car"
Disadvantages of PVs	2	1.27%	"There is too much traffic"
Uncategorised	1	0.63%	"I seldom return to my hometown"

#### 5. Discussion

## 5.1 High-level comparison against past research

The results show that price as a reason was the strongest predictor of having used HSR in the most recent trip (see Model 1 in Table 10), and as an important factor the strongest predictor of HSR being the preferred mode choice (see Model 4 in Table 11). Price as a reason was also associated with having travelled on HSR in the most recent trip (see Table 5), and as both an important factor and reason for important factors was associated with HSR being the preferred mode choice (see Tables 7 and 9). These results suggest that price is the most important attitudinal and behavioural factor when travellers are choosing which mode to use for intercity travel. This finding is broadly consistent with extant literature (e.g., Xia & Zhang, 2016; Yang & Zhang, 2012; R. Zhang et al., 2019), and also consistent with the theory of price elasticity, where increases in prices relative to competition will usually result in lower demand ceteris paribus (Fibich et al., 2005; Tellis, 1988). Lower HSR prices compared with air travel are the key deciding factor. The policy implication of this finding is clear – if there is not a clear difference between the price of travelling via HSR and travelling via air travel, then many travellers will not see an advantage in travelling via HSR. If governments would like to reduce emissions from transport by increasing HSR uptake, then reducing HSR fares through subsidies will be an effective way of doing so, noting that there are differing views on whether to subsidise HSR, how to subsidise HSR, and for how long (e.g., Jiang, 2021; Tang et al., 2015; Zembri & Libourel, 2017).

Convenience and accessibility were significant predictors of the participant having chosen HSR on their previous trip (see Model 1 in Table 10). However, these are not significant important factors (attitudinal), nor predictors of preferred travel mode (attitudinal). Convenience and accessibility have been identified as important factors for determining travel mode choice (Danapour et al., 2018; Sun et al., 2021), however, our research identifies that this is only true from a behavioural point of view. In other words, both convenience and accessibility represent behavioural constraints. Attitudinally, a passenger may want to travel via air travel, however, in Suzhou that involves travelling to one of the three airports in neighbouring cities. Thus, it is inconvenient due to the relative inaccessibility of the airports compared to the four HSR stations in Suzhou. This also helps explain the discrepancies between preferred mode choice, and actual mode choice (see Table 3). In other parts of China, airports may be more easily accessible, or in some cases, the only choice (see Sun et al., 2021, for visual depictions of accessibility to HSR stations and airports throughout China), hence we would expect the opposite directionality would be found compared to the regressions in our study (i.e., increasing the likelihood of air travel instead of HSR). This again highlights an important policy implication: governments that want to encourage the use of HSR in lieu of air travel will need to ensure that HSR stations are sufficiently accessible to be convenient for travellers. Our findings suggest that even if travellers prefer air travel (attitude), they will still choose to travel via HSR if this is more convenient (behaviour).

Conversely, availability and travel distance are important attitudinal predictors (important factors) of actual mode choice behaviours. Mentioning availability as an important factor increased the likelihood of having chosen HSR on their most recent trip, while travel distance increased the likelihood of having chosen air travel. While important factors were asked generally and thus are attitudinal (not related to a specific behaviour), they suggest that from a pre-consumption point of view travellers make important assumptions about HSR and air travel (i.e., HSR is more available, air travel is better for longer distances), which then influences their actual decisions. Similar findings regarding pre-consumption attitudinal factors have been found when studying airline brand choice (Henderson et al., 2019). Given the greater availability of HSR services from Suzhou and the fact that air travel is much faster for longer trips, the directionality of both these factors makes sense for the case study

city. The findings are also analogous to a concept called double jeopardy from marketing, where smaller brands get hit twice because they have a smaller customer base, who are also less loyal because the brand's products are less available due to it being a smaller brand (Ehrenberg et al., 1990; Sharp, 2010). In this case, rather than specific brands, one can think of transport modalities as being analogues of those brands. HSR travel is more available and easier to purchase in Suzhou, therefore, it has greater behavioural loyalty regardless of preferences. However, for longer range travel, air travel is more readily available and thus travel distance may also override an underlying preference for HSR.

The only other significant variable from the regressions was loyalty programmes as a reason for the most recent mode choice used to predict preferred travel mode (Model 3 in Table 11). This increased the likelihood of participants preferring air travel. This finding supports past research that highlights loyalty programmes may help create favourable attitudes and preferences towards airlines, but don't appear to drive actual behaviours (Henderson et al., 2019; Lynn, 2008; O'Malley, 1998). The practical implication of this finding is that airlines are better off targeting more customers through market penetration rather than trying to make their own customers more loyal (Henderson et al., 2019; Lynn, 2008). Past research on HSR vs. air travel competition suggests HSR's advantage is for short to medium range trips, which depending on researchers' interpretations could be anywhere from <800km to <1,200km (Chen et al., 2019; Fu et al., 2012; Wan et al., 2016). While only assessed qualitatively, our results also show favourability towards air travel when the travel distance is larger. Thus, market penetration could be done by targeting routes without HSR competition (regardless of length), or where the HSR competition would be slower or less convenient (longer distances).

#### 5.2 Attitudes vs. behaviours

Consistent with extant literature (e.g., Chandon et al., 2005; Juvan & Dolnicar, 2014), this study finds that preferences were not very effective at predicting actual behaviours. The participants interviewed only travelled on their preferred mode of transport in 55.7% of the cases (see Table 3). While this is still statistically significant and should not be ignored, it highlights that for the other 44.3% of cases, intent to travel on a particular mode did not actually result in that person travelling via that mode. We also see from the regression models that Model 1, using reasons for most recent mode choice to predict most recent mode choice was the strongest regression model. These findings highlight the importance of using behavioural measures for studying intermodal competition as ultimately it is actual behaviours that help transport companies make money or governments to reduce carbon emissions, rather than the intent to do so. However, simply observing behaviours is also not enough. Without understanding why travellers are behaving the way they are then one only sees part of the picture. This is why the qualitative themes are equally important, they help provide a full picture of how passengers choose between travel modes, even when their behaviours are different to their preferences. Methodologically speaking, this study calls for further studies using open-ended qualitative interviews to understand travel behaviours.

#### 5.3 Demographic differences

The findings from the chi-squared tests of independence highlight that there are associations between demographic variables, themes, and actual and preferred travel mode choices. Many of the significant associations are analogous to results published in extant literature, however, some are also new or different. The chi-squared tests of independence do show that price is more likely to be a reason, important factor, and a reason for important factors for those who are travelling for leisure or visit friends and family. This is consistent with past literature highlighting that these are the most price-sensitive traveller types (Garrow et al., 2007; Morlotti et al., 2017; Zhou et al., 2020).

Comfort was associated with having used HSR in the most recent trip, and as an important factor was also associated with the participant being over 60 years of age. Considerable research has gone into improving the cabin comfort within HSR (e.g., Chen et al., 2020; Sharma & Kumar, 2017; Yang et al., 2019), whose cabins are not as restricted in their design as for aircraft, nor subjected to the same meteorological and aerodynamic forces. It is also unsurprising that comfort is more important for older participants considering similar findings in other travel modes (e.g., Hwangbo et al., 2015).

While PVs were not the focus of the study, we also find that destination mobility as a reason is strongly associated with having used a PV in the most recent trip. The ability to go to the destination and then travel around the destination with your own vehicle means that PVs offer a level of flexibility that cannot be achieved with scheduled transportation services (Bilotkach et al., 2010). A preference towards travelling via PV was also found for those who identified travel plans as being a reason for their important factors, again implying that the flexibility of PVs is what attracts them towards this travel mode. While having safety as an important factor is associated with having travelled via PV and a preference towards travel via PV, it is hard to draw any meaningful conclusion due to only have 3 participants in this theme. However, it does align with research that suggests safety is an important factor when choosing a personal vehicle (Daziano, 2012). On the other hand, time and weather as important factors are associated with having travelled via PV. Potentially, the flexibility of a PV allows for more time-efficient travel to areas that do not have HSR stations nearby (noting that air travel was also linked with time sensitivity). Weather has been shown to influence travel behaviours in several studies (Abenoza et al., 2019; St-Louis et al., 2014) and adverse weather has also been linked with greater risks when driving (Zhang et al., 2018). Thus, it may be one or a combination of these factors that result in this finding.

#### 6. Conclusion

This study has provided an examination of the factors affecting passengers' travel mode choice behaviours and preferences for intercity travel within Mainland China from Suzhou, focussing primarily on competition between HSR and air travel. Different to extant literature, this study examines travel mode choice behaviours in a single city, and uses a research approach carefully designed to avoid self-generated validity and construct creation while providing a rich account of traveller perceptions. It also avoids the assumption that intentions and preferences will translate into actual behaviours and instead gathers data about traveller's most recent mode choices as examples of actual behaviours. The study finds that accessibility, convenience, and price as reasons for the most recent mode choice all increase the likelihood of having chosen HSR in their most recent trip.

This was the strongest regression model, however, availability and travel distance as important factors were also significant for predicting most recent mode choice, with availability increasing the likelihood of having chosen HSR, and travel distance for choosing air travel. Both regression models aimed at predicting preferred travel mode yielded weaker results, where loyalty programmes as a reason increased the likelihood of preferring air travel, and price as an important factor for preferring HSR. The implications of these findings are that HSR fare subsidies would be the most effective policy for governments to increase the uptake of HSR, with convenience and accessibility of HSR stations also being paramount. Conversely, airlines may wish to focus their efforts on routes without HSR competition or longer routes where they are able to provide more timely and readily available services to increase their market penetration. From an attitudinal point of view, loyalty programmes are also a distinct advantage for airlines over HSR.

This study contributes to the academic literature in several ways. Firstly, it provides a methodology for studying travel mode choice behaviours that avoids self-generated validity and construct creation. Secondly, it highlights the value of qualitative research in providing rich themes that allow for traveller

behaviours to be better understood. Finally, it provides implications for policy makers and practitioners with regard to influencing traveller mode choice behaviours for intercity travel within Mainland China. These implications centre around the subsidisation of HSR travel, the importance of convenient HSR station locations, ensuring that HSR and airline availability are targeted at their relative advantages (i.e., HSR for shorter distance trips, and air travel for longer distance trips), and airlines being the only to use loyalty programmes (providing HSR providers an opportunity to better compete with airlines).

#### 7. Limitations and Future Research

Because this is a case study, its findings may not be generalisable to other cities where competition between HSR and air travel is present. Specifically, Suzhou lacks its own airport and instead its residents must travel to a neighbouring city to access air travel, whereas it has four HSR stations within its city limits. Replication of this case study in other parts of China and indeed other cities around the world may help to elucidate which findings are specific only to Suzhou and which are present in other cities. This study was conducted while the COVID-19 pandemic was ongoing around the world. While China was not subjected to any restrictions on intercity travel during the study period, there may have still been lingering perceptions about the safety of travel (notably, only one participant mentioned the ongoing pandemic). It is unclear whether this may have influenced the results of this study and hence follow-up studies post-pandemic will help to see if there was any impact.

While the data gathered in this study is useful and provides a detailed picture of traveller mode choice behaviours, it is based upon a convenience sample. It is difficult to obtain purposive samples while using street intercepts, however, a purposive sample that is linked back to census data for a city may allow for better generalisability and comparisons between different demographic groups. This study has provided basis to apply an integrated conceptual model to predict the effects of attributes like price, convenience, and loyalty programmes upon travel mode choice. Future research could test such a model using empirical data gathering from cities in similar situations to Suzhou (easy access to HSR, but where driving to another city's airport is necessary).

#### References

- Abenoza, R. F., Liu, C., Cats, O., & Susilo, Y. O. (2019). What is the role of weather, built-environment and accessibility geographical characteristics in influencing travelers' experience? Transportation Research Part A: Policy and Practice, 122, 34-50.
- Albalate, D., Bel, G., & Fageda, X. (2015). Competition and cooperation between high-speed rail and air transportation services in Europe. *Journal of Transport Geography*, 42, 166-174.
- Basit, T. (2003). Manual or electronic? The role of coding in qualitative data analysis. *Educational Research*, 45(2), 143-154.
- Behrens, C., & Pels, E. (2012). Intermodal competition in the London–Paris passenger market: High-Speed Rail and air transport. *Journal of Urban Economics*, 71(3), 278-288.
- Bel, G. (1997). Changes in travel time across modes and its impact on the demand for inter-urban rail travel. *Transportation Research Part E: Logistics and Transportation Review*, 33(1), 43-52.
- Bilotkach, V., Fageda, X., & Flores-Fillol, R. (2010). Scheduled service versus personal transportation: The role of distance. *Regional Science and Urban Economics*, 40(1), 60-72.

- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101.
- Chandon, P., Morwitz, V. G., & Reinartz, W. J. (2005). Do intentions really predict behaviour? Self-generated validity effects in survey research. *Journal of Marketing*, 69(2), 1-14.
- Chen, Z. (2017). Impacts of high-speed rail on domestic air transportation in China. *Journal of Transport Geography*, 62, 184-196.
- Chen, Z., Wang, Z., & Jiang, H. (2019). Analyzing the heterogeneous impacts of high-speed rail entry on air travel in China: A hierarchical panel regression approach. *Transportation Research Part A: Policy and Practice*, 127, 86-98.
- Chen, Z.-S., Liu, X.-L., Rodríguez, R. M., Wang, X.-J., Chin, K.-S., Tsui, K.-L., & Martínez, L. (2020). Identifying and prioritizing factors affecting in-cabin passenger comfort on high-speed rail in China: A fuzzy-based linguistic approach. *Applied Soft Computing*, 95, 106558.
- Chung, H., Yang, Y., Chen, C.-L., & Vickerman, R. (2020). Exploring the association of the built environment, accessibility and commuting frequency with the travel times of high-speed rail commuters: Evidence from China. *Built Environment*, 46(3), 342-361.
- Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). Lawrence Erlbaum Associates.
- Danapour, M., Nickkar, A., Jeihani, M., & Khaksar, H. (2018). Competition between high-speed rail and air transport in Iran: The case of Tehran–Isfahan. *Case Studies on Transport Policy*, 6(4), 456-461.
- Daziano, R. A. (2012). Taking account of the role of safety on vehicle choice using a new generation of discrete choice models. *Safety Science*, 50(1), 103-112.
- Dennett, D. (1991). Consciousness explained. Little Brown.
- Dobruszkes, F. (2011). High-speed rail and air transport competition in Western Europe: A supply-oriented perspective. *Transport Policy*, 18(6), 870-879.
- Ehrenberg, A. S. C., Goodhardt, G. J., & Barwise, T. P. (1990). Double jeopardy revisited. *Journal of Marketing*, 54(3), 82-91.
- Feldman, J. M., & Lynch, J. G. (1988). Self-generated validity and other effects of measurement on belief, attitude, intention, and behavior. *Journal of Applied Psychology*, 73(3), 421-435.
- Fibich, G., Gavious, A., & Lowengart, O. (2005). The dynamics of price elasticity of demand in the presence of reference price effects. *Journal of the Academy of Marketing Science*, 33(1), 66-78.
- Forbes, S., & Avis, M. (2020). Construct creation from research questions. *European Journal of Marketing*, 54(8), 1817-1838.
- Fu, X., Zhang, A., & Lei, Z. (2012). Will China's airline industry survive the entry of high-speed rail? Research in Transportation Economics, 35(1), 13-25.
- Garrow, L. A., Jones, S. P., & Parker, R. A. (2007). How much airline customers are willing to pay: An analysis of price sensitivity in online distribution channels. *Journal of Revenue and Pricing Management*, 5(4), 271-290.
- Gundelfinger-Casar, J., & Coto-Millán, P. (2017). Intermodal competition between high-speed rail and air transport in Spain. *Utilities Policy*, 47, 12-17.
- Henderson, I. L., Tsui, K. W. H., Ngo, T., Gilbey, A., & Avis, M. (2019). Airline brand choice in a duopolistic market: The case of New Zealand. *Transportation Research Part A: Policy and Practice*, 121, 147-163.

- Higham, J., Reis, A., & Cohen, S. A. (2016). Australian climate concern and the 'attitude-behaviour gap'. *Current Issues in Tourism*, 19(4), 338-354.
- Hwangbo, H., Kim, J., Kim, S., & Ji, Y. G. (2015). Toward universal design in public transportation systems: An analysis of low-floor bus passenger behavior with video observations. *Human Factors and Ergonomics in Manufacturing & Service Industries*, 25(2), 183-197.
- Jiang, C. (2021). Aviation tax and railway subsidy: An integrated policy. *Transportation Research Part B: Methodological*, 146, 1-13.
- Jiang, C., & Zhang, A. (2016). Airline network choice and market coverage under high-speed rail competition. *Transportation Research Part A: Policy and Practice, 92*, 248-260.
- Jung, S.-Y., & Yoo, K.-E. (2014). Passenger airline choice behavior for domestic short-haul travel in South Korea. *Journal of Air Transport Management*, 38, 43-47.
- Juvan, E., & Dolnicar, S. (2014). The attitude–behaviour gap in sustainable tourism. *Annals of Tourism Research*, 48, 76-95.
- Lee, J.-K., Yoo, K.-E., & Song, K.-H. (2016). A study on travelers' transport mode choice behavior using the mixed logit model: A case study of the Seoul-Jeju route. *Journal of Air Transport Management*, 56, 131-137.
- Li, X., Ma, R., Guo, Y., Wang, W., Yan, B., & Chen, J. (2021). Investigation of factors and their dynamic effects on intercity travel modes competition. *Travel Behaviour and Society*, 23, 166-176.
- Li, Z.-C., & Sheng, D. (2016). Forecasting passenger travel demand for air and high-speed rail integration service: A case study of Beijing-Guangzhou corridor, China. *Transportation Research Part A: Policy and Practice, 94*, 397-410.
- Lin, W., Hong, C., & Zhou, Y. (2020). Multi-scale evaluation of Suzhou city's sustainable development level based on the sustainable development goals framework. *Sustainability*, 12(3).
- Looker, E. D., Denton, M. A., & Davis, C. K. (1989). Bridging the gap: Incorporating qualitative data into quantitative analyses. *Social Science Research*, 18(4), 313-330.
- Lynn, M. (2008). Frequency strategies and double jeopardy in marketing: The pitfall of relying on loyalty programs. *Cornell Hospitality Report*, 8(12), 6-12.
- Ma, W., Wang, Q., Yang, H., Zhang, A., & Zhang, Y. (2019). Effects of Beijing-Shanghai high-speed rail on air travel: Passenger types, airline groups and tacit collusion. *Research in Transportation Economics*, 74, 64-76.
- Martínez Sánchez-Mateos, H. S., & Givoni, M. (2012). The accessibility impact of a new High-Speed Rail line in the UK a preliminary analysis of winners and losers. *Journal of Transport Geography*, 25, 105-114.
- Morlotti, C., Cattaneo, M., Malighetti, P., & Redondi, R. (2017). Multi-dimensional price elasticity for leisure and business destinations in the low-cost air transport market: Evidence from easyJet. *Tourism Management*, *61*, 23-34.
- O'Malley, L. (1998). Can loyalty schemes really build loyalty? *Marketing Intelligence & Planning, 16*(1), 47-55
- Oakes, M., & Bor, R. (2010). The psychology of fear of flying (part I): A critical evaluation of current perspectives on the nature, prevalence and etiology of fear of flying. *Travel Medicine and Infectious Disease*, 8(6), 327-338.
- Oster, C. V., Strong, J. S., & Zorn, C. K. (2013). Analyzing aviation safety: Problems, challenges, opportunities. *Research in Transportation Economics*, 43(1), 148-164.

- Pan, J. Y., & Truong, D. (2020). Low-cost carriers versus high-speed rail: Understanding key drivers of passengers' choice in china. *Transportation Journal*, 59(1), 1-27.
- Park, Y., & Ha, H.-K. (2006). Analysis of the impact of high-speed railroad service on air transport demand. *Transportation Research Part E: Logistics and Transportation Review*, 42(2), 95-104.
- Ren, X., Chen, Z., Wang, F., Dan, T., Wang, W., Guo, X., & Liu, C. (2020). Impact of high-speed rail on social equity in China: Evidence from a mode choice survey. *Transportation Research Part A: Policy and Practice, 138*, 422-441.
- Ren, X., Wang, F., Wang, C., Du, Z., Chen, Z., Wang, J., & Dan, T. (2019). Impact of high-speed rail on intercity travel behavior change: The evidence from the Chengdu-Chongqing Passenger Dedicated Line. *Journal of Transport and Land Use, 12*(1), 265-285.
- Sharma, S. K., & Kumar, A. (2017). Ride performance of a high-speed rail vehicle using controlled semi active suspension system. *Smart Materials and Structures*, 26(5), 055026.
- Sharp, B. (2010). How brands grow: What marketers don't know. Oxford University Press.
- Shaw, S.-L., Fang, Z., Lu, S., & Tao, R. (2014). Impacts of high-speed rail on railroad network accessibility in China. *Journal of Transport Geography*, 40, 112-122.
- Srnka, K. J., & Koeszegi, S. T. (2007). From words to numbers: How to transform qualitative data into meaningful quantitative results. *Schmalenbach Business Review*, 59, 29-57.
- St-Louis, E., Manaugh, K., van Lierop, D., & El-Geneidy, A. (2014). The happy commuter: A comparison of commuter satisfaction across modes. *Transportation Research Part F: Traffic Psychology and Behaviour*, 26, 160-170.
- Stoop, J. A., & Kahan, J. P. (2005). Flying is the safest way to travel: How aviation was a pioneer in independent accident investigation. *European Journal of Transport and Infrastructure Research*, 5(2), 115-128.
- Sun, X., Wandelt, S., & Zhang, A. (2021). Comparative accessibility of Chinese airports and high-speed railway stations: A high-resolution, yet scalable framework based on open data. *Journal of Air Transport Management, 92*, 102014.
- Takebayashi, M. (2014). The future relations between air and rail transport in an island country. Transportation Research Part A: Policy and Practice, 62, 20-29.
- Tang, S., Boyles, S. D., & Jiang, N. (2015). High-speed rail cost recovery time based on an integer optimization model. *Journal of Advanced Transportation*, 49, 634-647.
- Tellis, G. J. (1988). The price elasticity of selective demand: A meta-analysis of econometric models of sales. *Journal of Marketing Research*, 25(4), 331-341.
- Wan, Y., Ha, H.-K., Yoshida, Y., & Zhang, A. (2016). Airlines' reaction to high-speed rail entries: Empirical study of the Northeast Asian market. *Transportation Research Part A: Policy and Practice*, 94, 532-557.
- Wang, K., Xia, W., & Zhang, A. (2017). Should China further expand its high-speed rail network? Consider the low-cost carrier factor. *Transportation Research Part A: Policy and Practice, 100*, 105-120.
- Wang, K., Zhang, A., & Zhang, Y. (2018). Key determinants of airline pricing and air travel demand in China and India: Policy, ownership, and LCC competition. *Transport Policy*, 63, 80-89.
- Wang, L., Zhang, S., Sun, W., & Chen, C.-L. (2020). Exploring the physical and mental health of high-speed rail commuters: Suzhou-Shanghai inter-city commuting. *Journal of Transport & Health*, 18, 100902.

- Wen, C.-H., Wang, W.-C., & Fu, C. (2012). Latent class nested logit model for analyzing high-speed rail access mode choice. *Transportation Research Part E: Logistics and Transportation Review*, 48(2), 545-554.
- Xia, W., & Zhang, A. (2016). High-speed rail and air transport competition and cooperation: A vertical differentiation approach. *Transportation Research Part B: Methodological, 94*, 456-481.
- Yang, H., & Zhang, A. (2012). Effects of high-speed rail and air transport competition on prices, profits and welfare. *Transportation Research Part B: Methodological*, 46(10), 1322-1333.
- Yang, L., Li, X., & Tu, J. (2019). Thermal comfort analysis of a high-speed train cabin considering the solar radiation effects. *Indoor and Built Environment*, 29(8), 1101-1117.
- Zembri, P., & Libourel, E. (2017). Towards oversized high-speed rail systems? Some lessons from France and Spain. *Transportation Research Procedia*, 25, 368-385.
- Zhang, A., Wan, Y., & Yang, H. (2019). Impacts of high-speed rail on airlines, airports and regional economies: A survey of recent research. *Transport Policy, 81*, A1-A19.
- Zhang, Q., Yang, H., & Wang, Q. (2017). Impact of high-speed rail on China's Big Three airlines. Transportation Research Part A: Policy and Practice, 98, 77-85.
- Zhang, R., Johnson, D., Zhao, W., & Nash, C. (2019). Competition of airline and high-speed rail in terms of price and frequency: Empirical study from China. *Transport Policy*, 78, 8-18.
- Zhang, W., Hu, Z., Feng, Z., Ma, C., Wang, K., & Zhang, X. (2018). Investigating factors influencing drivers' speed selection behavior under reduced visibility conditions. *Traffic Injury Prevention*, 19(5), 488-494.
- Zhang, Y., & Zhang, A. (2016). Determinants of air passenger flows in China and gravity model: Deregulation, LCCs, and high-speed rail. *Journal of Transport Economics and Policy*, 50(3), 287-303.
- Zhou, H., Norman, R., Xia, J., Hughes, B., Kelobonye, K., Nikolova, G., & Falkmer, T. (2020). Analysing travel mode and airline choice using latent class modelling: A case study in Western Australia. *Transportation Research Part A: Policy and Practice*, 137, 187-205.
- Zhou, Z., & Zhang, A. (2021). High-speed rail and industrial developments: Evidence from house prices and city-level GDP in China. *Transportation Research Part A: Policy and Practice, 149*, 98-113.

## **Appendices**

Semi-structured interview questions (Mandarin)

- 1. 请说明您的:
  - a、 性别
  - b、 年龄
  - c、国籍
  - d、职业
- 2. **您住在**苏州的哪个区?
- 3. 您平时(即新冠肺炎以前)多长时间到苏州以外的地方旅游?
- 4. 想想你最近一次从苏州到中国大陆的另一个城市。
  - a、 那是多久以前的事了?
  - b、 你去哪儿旅行了?
  - c、 旅行的目的是什么?
  - d、 你选择了哪种交通方式到达那里?
  - e、 你使用过哪个机场/火车站/公共汽车站等?
  - f、 **你**为什么选择这种交通方式旅行?
- 5. **更一般地**说,在选择中国内地城际旅行的交通方式时,**你会考**虑哪些方面的因素
- 6. 为什么这些东西对你很重要?
- 7. 一般来说,在中国大陆的城际旅行中,您是否更喜欢一种交通方式?
- 8. 你对中国内地的城际旅行有什么补充意见吗?

Semi-structured interview questions (English)

- 1. Could you please state your:
  - a. Gender
  - b. Age
  - c. Nationality
  - d. Occupation
- 2. Which district of Suzhou do reside in?
- 3. How often do you travel outside of Suzhou in normal times (i.e., pre-COVID)?
- 4. Think about the most recent time you travelled from Suzhou to another city within Mainland China.
  - a. How long ago was that?
  - b. Where were you travelling to?
  - c. What was the purpose of the travel?
  - d. Which mode of transport did you choose to get there?
  - e. Which airport/train station/bus terminal, etc. did you use?
  - f. Why did you choose to travel on that mode of transport?
- 5. Thinking more generally, what sorts of things are important to you when choosing which mode of transport to use for intercity travel within Mainland China?
- 6. Why are those things important to you?
- 7. Generally speaking, do you prefer one transport mode over others for intercity travel within Mainland China?
- 8. Do you have any additional comments to make about intercity travel within Mainland China?