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Investigation of Passengers’ Intentions to Use High-Speed Rail and Low-Cost Carriers in China

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INVESTIGATION OF PASSENGERS' INTENTIONS TO USE HIGH-SPEED RAIL AND LOW-COST CARRIERS IN CHINA

by

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ABSTRACT

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With a large population, China is an ideal market for high-speed rail (HSR) and low-cost carrier (LCC) services. While HSR has gained substantial market share in China over the past decade, LCCs have achieved only limited market penetration. The potential growth of LCCs in China, however, is promising given the growing travel demand and government policy support. As LCCs expand their service in the domestic market, they are likely to become a strong competitor of HSR. The potential competition between LCCs and HSR justifies the research of passengers' behavioral intentions to use HSR and LCCs in China.

This research focused on factors that influenced passengers' intentions to use HSR and LCCs in China. Based on the extensive literature review, this study adopted the theory of planned behavior (TPB) as the ground theory and developed the expanded TPB models for HSR and LCCs. In addition to the original TPB components, trust, total travel time, price, service quality, access, and frequency were added to the HSR model. For LCCs, the TPB model was extended with the inclusion of price, service quality, uncertainty avoidance, access, frequency, and technology self-efficacy.

This research used a survey method to collect data from LCC passengers in Shanghai and Shijiazhuang and from HSR passengers in Beijing and Shanghai. The total sample size was 484 for HSR and 596 for LCCs. This study used the structural equation modeling (SEM) method for data analysis. The results indicated that attitudes, subjective norms, price, access, service quality and total travel time were significant determinants of passengers' intentions to use HSR; while frequency, trust and perceived behavioral control (PBC) were not important factors. Service quality had the strongest impact on passengers' intentions to use HSR, followed by total travel time. For LCC passengers, attitudes, subjective norms, price, access, technology self-efficacy, service quality, and uncertainty avoidance significantly affected their motivation in using LCCs, while PBC and frequency were found insignificant. Price was the most important factor in passengers' intentions to use LCCs, followed by service quality. The findings greatly enhance the understanding of passenger motivation in traveling by HSR and LCCs in China.

The model comparison yields valuable insights into potential competition between HSR and LCCs in China. Both HSR and LCC passengers were significantly influenced by attitudes, subjective norms, price, access, and service quality in their decisions to use HSR and LCCs. The finding sheds new light into future competition between the two modes in China.

DEDICATION

I dedicate this dissertation to my family and all the faculty members at Embry-Riddle Aeronautical University who helped me throughout this eduational journey.

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TABLE OF CONTENTS

Page

LIST OF TABLES

Table Page

LIST OF FIGURES

CHAPTER I

INTRODUCTION

High-speed rail (HSR) and low-cost carriers (LCCs) have had a significant impact on the global air transport industry (Alder, Pels, & Nash, 2010; Dobruszkes, 2011; Yang & Zhang, 2012). Over the years, HSR has increased operational speeds and taken market shares away from air transport in high-demand markets (Albalate & Bel, 2012; Fu, Zhang, & Lei, 2012). LCCs, equipped with low fares, have forced full service carriers (FSCs) to change their traditional, high-cost business model (Dennis, 2007; O'Connell & Williams, 2005; Poon & Waring, 2010). HSR and LCCs have attracted increasing numbers of passengers in many countries, including China.

Compared to other countries, China provides a different policy and market environment for its HSR and LCCs to grow. HSR in China has achieved rapid growth because of strong government support (Liu, 2015). LCCs in China, on the other hand, have gained only limited success due to regulatory constraints (Fu, Lei, Wang, & Yan, 2015). The situation is expected to change with the Chinese authority's new policies that will benefit the development of LCCs (the Civil Aviation Administration of China (CAAC), 2016; China Air Transport Association, 2014). As LCCs start to grow in China, they are likely to compete with HSR. The potential competition between HSR and LCCs calls for an in-depth investigation of passengers' motivation in using these modes. This study identified factors that affected passengers' intentions to use HSR and LCCs in China and compared the magnitude of their impact. The research provided empirical evidence of passengers' mode use intentions and LCC-HSR competition in China, which are beneficial to both academia and the industry.

This chapter first introduces the development of HSR and LCCs. Next, it explains the purpose of the study and presents the hypothesis statements. It then discusses the significance and contributions of the research. The chapter concludes by discussing the limitations and delimitations of the research. Definitions of the terms used in this study are provided at the end of the chapter.

Background of the Study

HSR and LCCs have increasingly become a wide spread phenomenon. This section reviews the development of HSR and LCCs and discusses potential competition between the two modes, both globally and in China.

High-speed rail (HSR). HSR is a system consisting of rolling stock and infrastructure that operates at a speed of at least 250 km/h on new tracks, or 200 km/h on existing (conventional) tracks (The International Union of Railways, 2015). Expensive to develop and operate, HSR is an indicator of economic development and technology advancement (Chuang & Johnson, 2011). Japan has been a leader in HSR technology, launching the world's first passenger dedicated service, Shinkansen (SKS), in 1964 on the route between Tokyo and Osaka (Fu et al., 2012). Other countries and regions in Asia, such as Korea, Taiwan, and China, started their HSR development only in the 2000s (Chen, Tang, & Zhang, 2014; Kuo, Hsieh, Feng, & Yeh, 2013; Park & Ha, 2006). In Europe, the first HSR connecting Paris and Lyon in France entered into service in 1981 (Fu et al., 2012). The single, expanding European market has benefited HSR, which saw the demand for HSR service increased by an average of 30% per year between

1990 and 2008 (Dobruszkes, 2011). Outside Asia and Europe, the HSR development has been a slow process, primarily due to the concern over the costs and benefits of building a HSR system (Albalate & Bel, 2012). Recent years have seen a renewed interest in HSR in markets such as the U.S., where the government has recently unveiled a blueprint for a national network of HSR lines, aimed at reducing traffic congestion, cutting national dependence on foreign oil, and improving rural and urban environments (Albalate & Bel, 2012). As more countries plan to expand their HSR systems, HSR will extend its market coverage, providing more passengers with an alternative to air transport for domestic travel. Table 1 shows the HSR systems in selected countries in 2012 and their projected network by 2025.

Table 1

Selected HSR Systems in 2012 and Their Projected Network by 2025

Area	In operation (km)	Under construction (km)	Planned (km)	Total network by 2025 (km)
China	9356	9485	3777	22619
Spain	2276	1547	1702	5525
France	2036	757	2407	5200
Japan	2664	782	180	3626
Turkey	444	603	1758	2805
Germany	1334	428	495	2257
Italy	923	-	395	1318
USA	362	-	777	1139
South Korea	412	186	49	647
Taiwan	345	-	-	345
UK	113	-	204	317

Note. Adapted from “A study of competitiveness between low cost airlines and high-speed-rail: A case study of southern corridor in Thailand,” by Piti Chantruthai, Sirirat Taneerananon, and Pichai Taneerananon, 2014, *Engineering Journal*, *18*(2), p. 141-161. Copyright by Piti Chantruthai, Sirirat Taneerananon, and Pichai Taneerananon.

As indicated in Table 1, China has the world's largest HSR system, accounting for more than half of the world's total HSR lines (Fu et al., 2012). Despite starting only in the 2000s, China's HSR development has shown remarkable achievement. By the end of 2013, a total length of 12,183 km of HSR lines was in service (Ollivier, Bullock, Jin, & Zhou, 2014). More passenger dedicated HSR lines will enter into service by 2025 (National Development and Reform Commission of China, 2016). The long-term HSR network in China will consist of eight north-south and eight east-west links across China's vast geography (National Development and Reform Commission of China, 2016). According to the plan of the Ministry of Railways (MOR), China's HSR network will eventually connect all the provincial capitals and cities with more than 500,000 residents, covering 90% of the population in mainland China (Fu et al., 2012). Figure 1 depicts the HSR system in China as of 2015.

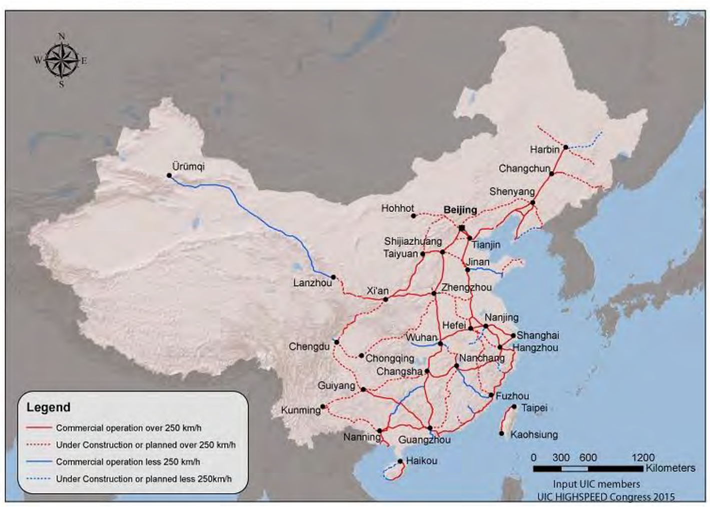

Figure 1. HSR network in China. Adapted from "High-speed railways database and maps" by International Union of Railways (UIC), 2015. Copyright 2015 by International Union of Railways (UIC). Approval granted by UIC for reproducing the map (See Appendix F).

The extensive HSR system has spurred rail travel demand in China. Rail traffic, especially HSR traffic, grew significantly between 2008 and 2013 (Ollivier et al., 2014). Within the same time period, HSR delivered an estimated 1.9 billion trips in the domestic market. The average traffic density has increased from 2.8 million passengers to 22.5 million passengers, which is substantial for a system in its early years of existence (Ollivier et al., 2014).

With a land area of 9.6 million square kilometres and a population of 1.36 billion, China is an ideal market for HSR (Ollivier et al., 2014). China has many well-interspaced large cities of more than 500,000 inhabitants located at distances between 200 and 900 km, making it well suited for HSR services (Ollivier et al., 2014). China has a strong political will to develop HSR (Liu, 2015), making the HSR project a national priority (Liu, 2015) and increasing the total rail investment from 2.2 trillion Renminbi (RMB) (338 billion U.S. dollar (USD)) between 2006 and 2010 to 3.5 trillion RMB (538 billion USD) between 2011 and 2015 (Fu et al., 2012). At the same time, the government invested heavily in the HSR research to master cutting-edge HSR technologies (Liu, 2015). From the perspective of the Chinese government, HSR brings economic and social benefits. HSR is an essential component of China's economic stimulus package (645 billion USD) following the economic downturn in 2008 (Liu, 2015), which is important for generating new economic activities and promoting job creation (Liu, 2015). It also assists China's rapid urbanization and industrialization process by improving inter-city connectivity (National Development and Reform Commission of China, 2016). In addition, HSR is one of the industries that is technologically advanced and environmentally friendly, which is in line with the long-term goal of the Chinese government for its transportation development (CAAC, 2012).

Many attributes of HSR make it an attractive alternative to air transport in short- and medium-haul markets. It is a comfortable way to travel with added on-board services, including mobile phone and internet availability (Valeri, 2014). With train stations usually located in the center of the city, HSR often results in reduced total travel time for passengers (Behrens & Pels, 2009; Cokasova, 2005). Passengers also find HSR's high frequencies (Behrens & Pels, 2012) and relatively low fares (Chantruthai et al., 2014) attractive. In addition, passengers generally have a favorable view of the electric-powered HSR because of its environmental benefits compared to other modes of transportation (Akerman, 2011; Dobruszkes, 2011; Givoni, 2006). Academic research of passengers' perception of HSR in markets such as the U.K., Spain, Korea, Thailand, and Taiwan generally found some or all of these attributes important in passengers' choice of HSR (Chantruthai et al., 2014; Chou & Kim, 2009; Harvey, Thorpe, Caygill, & Namdeo, 2014; Kuo et al., 2013). Surprisingly, such research in the Chinese market is scarce. Some studies examined passengers' selection between HSR and other transportation modes in China (Jing & Juan; 2013; Jing, Juan, & Gao, 2014; Li, Kang, & Liu, 2011; Wang et al., 2014). These studies, however, focused on passengers' mode choice rather than the intention to take HSR. Indeed, despite extensive use of HSR in China, factors motivating passengers to take HSR have remained understudied.

Low-cost carriers (LCCs). The low-cost model was pioneered by Southwest Airlines (SWA) and has been widely emulated by other carriers throughout the world

(Graham & Shaw, 2008). A typical LCC business model configures resources and practices that enable airlines to operate with lower costs than traditional FSCs (Klophaus, Conrady, & Fichert, 2012). Table 2 compares operational and service characteristics of LCCs and FSCs.

Table 2

Operational and Service Characteristics of LCCs and FSCs

Characteristic	Low-Cost Carriers	Full-Service Carriers
Brand	One brand: low price	Extended brand: price/service
Price	Simple pricing structure	Complex pricing structure
Distribution	Internet, direct booking	Internet, direct, and agent
Network	Point-to-point	Hub-and-spoke
Classes	One class	Multiple classes
Cabin service	No frills	Frills (free food and beverages)
Aircraft usage	Very intensive	Average - Intensive
Aircraft types	One type	Multiple types
Turnaround times	Fast (less than 30 minutes)	Slow due to congestion and complexity
Frequent flyer program	No	Yes
Route types	Short haul routes	Short, medium, and long haul routes
Airport	Use of secondary airports	Use of principle airports

Note. Adapted from “Straight and level: Practical airline economics,” by Holloway, 2008, and “Passengers’ perceptions of low cost airlines and full service carriers: A case study involving Ryanair, Aer Lingus, Air Asia and Malaysia Airlines,” by O’Connell & Williams, 2005, Copyright 2005, O’Connell & Williams, and 2008, Holloway.

The LCC model focuses on simplification of business and operational practices, which drives down airline costs (Gillen & Lall, 2004; Lawton & Solomko, 2005; O’Connell & Williams, 2005; Tierney & Kuby, 2008). Low costs translate into low fares (Dennis, 2007), allowing LCCs to effectively compete with FSCs and stimulate new market demand. The average fares of LCCs are generally 40%-60% lower than their full-service competitors (Lawton, 2002). The emergence of LCCs has radically changed the air transport industry. Most noticeably, LCCs have increased competition, forcing FSCs to reduce costs and develop new business strategies (Aguirregabiria & Ho, 2010; Pearson, O'Connell, Pitfield, & Ryley, 2015). At the same time, LCCs have generated considerable consumer benefits. The airline industry has greatly improved operating efficiency as a result of the competition and passed on the gains to consumers in the form of lower fares and more frequent flights (Bauer, 1989; GAO, 2006).

The dramatic growth of LCCs is an important outcome of liberalization of the air transport industry (Fu, Oum, & Zhang, 2010). The success of LCCs is only possible under a deregulated market environment, free of government control on fares, routes, and market entry (Dempsey & Goetz, 1992). The LCC model has proved successful in liberalized markets and driven the growth of air travel (Zhang, Hanaoka, Inamura, & Ishikura, 2008). Figure 2 shows the LCC market shares as of 2013 in the global markets.

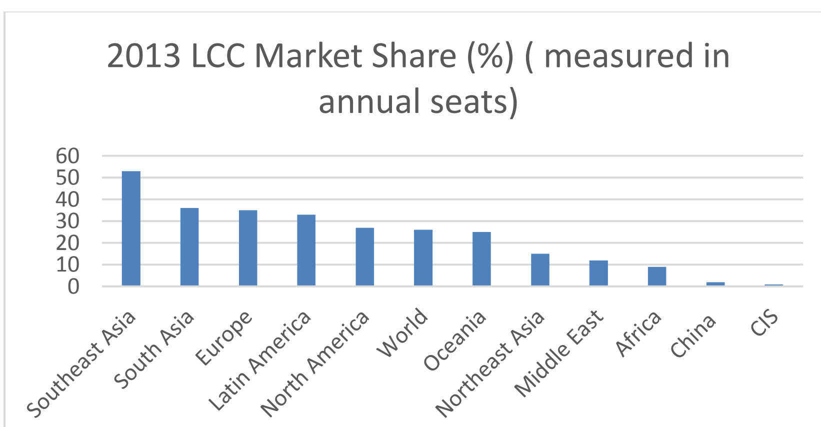

Figure 2. Market shares of LCCs in major global markets. Adapted from "Current market outlook: 2014-2033," by Boeing, 2014, Copyright 2014 Boeing.

China has become the world's second largest aviation market in terms of scheduled capacity, since 2005 (Fu et al., 2015). While FSCs have enjoyed rapid growth, LCCs in China, as indicated in Figure 2, lag behind those in other aviation markets. In 2013, The LCC sector accounted for less than 3% of the Chinese domestic market (Fu et al., 2015). The slow growth of LCCs in China relates closely to regulatory constraints. The industry's regulator, the Civil Aviation Administration of China (CAAC), plays an important role in regulating the airline market (Zhang et al., 2008). A direct consequence of government interference is over-concentration of the aviation market, with the three state-owned airlines taking over 80% of the market share (Zhang et al., 2008). At the same time, the top ten airports account for nearly half of the domestic market in terms of scheduled capacity, making it difficult for LCCs to obtain desired slots at these airports (Fu et al., 2015). China's aviation policies also negatively affect LCCs in aircraft purchase and fleet buildup, pilot recruitment, fuel purchase, airport charges, route entry, and pricing (Fu et al., 2015; Zhang et al., 2008).

The unfavorable situation, however, has started to change over the past three years, with LCCs demonstrating a positive growing trend in China. Spring Airlines, established in 2005, is by far the largest LCC in China (Fu et al., 2015). The number of passengers carried by Spring Airlines increased steadily between 2006 and 2013 (Fu et al., 2015), but the annual growth was particularly strong between 2013 and 2015, 8% and 13% respectively, making the total passenger number close to 13 million in 2015 (Spring Airlines, 2014, 2015). While Spring Airlines continue to grow, four domestic LCCs have entered the market since 2013 (Chengdu Airlines website, 2016; China United Airlines website, 2016; Fu et al., 2015; Jiu Yuan Airlines website, 2016). At the same time, a number of international LCCs have tapped into the Chinese market and gained success (Chen, 2012). All these changes have promoted the market image and consumer awareness of LCCs in China. Similar to HSR, LCCs focus on short- and medium-haul markets and use high frequencies to attract passengers. As LCCs continue to expand, they are likely to become a competitor of HSR. The potential HSR-LCC competition in China is discussed in more detail in the next section.

A large number of studies examined passengers' choice between LCCs and FSCs (Forgas, Moliner, Sánchez, & Palau, 2010; Mikulić & Prebežac, 2011; Ong & Tan, 2010) and passengers' perception of LCCs (Alam, 2012; Chang & Hung, 2013; Yang, Hsieh, Li, & Yang, 2012). As expected, many studies showed a predominant effect of ticket prices on passengers' willingness to choose LCCs, followed by some service attributes, such as flight frequency. In addition, the literature indicated that demographic characteristics, such as age and educational level, may affect passengers' use of LCCs in different ways (Alam, 2012; Sai, Ekiz, & Kamarulzaman, 2012; O'Connell & Williams, 2005; Ong & Tan, 2010).

Although a number of studies examined the LCC industry in China (Fu et al., 2015; Liang & James, 2011), they primarily focused on airline pricing, market share analysis, and the development of LCCs in general. There is limited research of LCCs in China from the consumers' perspective, particularly passengers' motivation in choosing LCCs. Understanding passengers' intentions to use LCCs is meaningful in China, given the country's large population base, economic development, and huge market potential for low-cost travel. Only one study investigated passengers' choice of LCCs in China (Chiou & Chen, 2010). However, the study primarily focused on the effect of service-related factors (Chiou & Chen, 2010), which could limit the understanding of passengers' mode use intentions toward LCCs. Clearly, there is a need to examine the effect of a wider range of impact factors in China's specific context, which can provide deeper insights into underlying forces that drive passengers to choose LCCs.

Potential competition between HSR and LCC. Although there is limited research on competition between HSR and LCCs, a number of studies suggested that LCCs could become a competitor of HSR in domestic markets (Chantruthai et al., 2014; Clewlow, Sussman, & Balakrishnan, 2014; Dobruszkes, 2011; Finger, Bert, & Kupfer, 2014). For example, Albalate and Bel (2012) suggested that the airline industry in Japan, facing the competition from HSR, has effectively only been able to grow with the emergence of LCCs following the liberalization of air transport.

In China, limited competition exists between LCCs and HSR in the current market due to the small market share of LCCs. However, there are signs that LCCs are poised for fast development and could become a serious competitor for HSR. Due to the extensive HSR system in China, the intermodal competition between HSR and FSCs is strong (Chen et al., 2014). The competition has forced FSCs to reduce or cease operations on many short- and medium-distance routes where they compete with HSR (Fu et al., 2012). The HSR impact on air transport will get stronger in the future, with more HSR trains starting operation. Specifically, air traffic in major cities will face serious HSR competition in the future (Fu et al., 2012). To avoid head-on competition with HSR, FSCs in China have redirected their attention to international markets (Fu et al., 2012). Such market change will provide LCCs the opportunity to grow in the domestic market.

LCCs in China could also benefit from an improved air transport infrastructure, particularly airport development. The number of civil airports will reach 244 by 2020, up 69 from 2010 (Fu et al., 2012). The new airports will provide extra capacities for LCCs to enter important markets. Spring Airlines, for example, has had difficulty entering the Beijing market over the years due to capacity constraints at Beijing Capital International Airport (Jia & Wang, 2011). With Beijing's second airport soon becoming available, LCCs will have the opportunity to gain market share in Beijing.

New travel demand provides another opportunity for LCCs to grow. The overall Chinese markets have been growing at more than 15% a year, and such increase is mostly driven by a growing percentage of affluent citizens who are newly introduced to the aviation market (Fu et al., 2012). These passengers are usually sensitive to price and are likely to be attracted by low fares of LCCs (Fu et al., 2012).

The most important driver of the growth of LCCs would come from a more liberalized market in China. Two recent policies are essential to the development of domestic LCCs. First, after freezing issuing licenses to new airlines from 2007 to 2013 (Fu et al., 2015), CAAC has reopened the market to new airlines (China Air Transport Association, 2014). Since 2013, four domestic LCCs, namely Jiu Yuan Airlines, China West Air, Chengdu Airlines, and China United Airlines have started operation (Chengdu Airlines website, 2016; China United Airlines website, 2016; Fu et al., 2015; Jiu Yuan Airlines website, 2016). China United Airlines, a low-cost subsidiary of China Eastern Airlines, will establish its operational base at the second airport in Beijing, aiming to expand its fleet from 31 to 80 aircraft when the airport starts service (China United Airlines, 2016). As such, Beijing could become another important market for LCCs after Shanghai, where Spring

Airlines' hubs are located (Spring Airlines Annual Report, 2015). Because Beijing and Shanghai are the most important markets for HSR, the fast growth of LCCs in these markets can soon face the competition of HSR.

Second, the reform on airline prices is beneficial to LCCs. Over the years, CAAC has played an important role in regulating airline prices (Zhang et al., 2008). It sets a base price (USD 0.11/km), requiring airlines to determine ticket prices within the range of 25% above and 45% below the base price (Zhang et al., 2008). The reform gives the domestic airlines more freedom to determine their prices. Specifically, for all domestic routes under 800 kilometers and for routes over 800 kilometers on which airlines compete with HSR, CAAC has given the domestic airlines full control of their prices (CAAC, 2016). The reform is significant because it allows LCCs to set prices based on their costs. Free of price control, LCCs are in a better position than FSCs to compete with HSR. Due to high costs, FSCs in China have little room to lower their prices, which explains their avoidance of HSR on many domestic routes and pursuit of growth in international markets (Fu et al., 2012). From this perspective, passengers' intentions to use HSR and FSCs may be a less meaningful research topic, compared to HSR and LCCs, given the competition pattern in the future Chinese market.

In summary, the changing market competition, increasing demand for low-cost travel, improved air transport infrastructure, and regulatory support mean LCCs are likely to rapidly expand in China and become a competitor of HSR. As LCCs and HSR continue to grow, it is likely that Chinese passengers will increasingly choose from LCCs and HSR for domestic travel. While this study focused on passengers' intentions to use LCCs and HSR, it is important to note the potential competition between the two modes in China. From both academic and practical perspectives, it is meaningful to understand driving forces underlying passengers' use of LCCs and HSR.

Statement of the Problem

More countries in the world will utilize HSR to solve capacity restrictions, lightening congestion in certain corridors and facilitating industrial connections (Albalate & Bel, 2012). At the same time, LCCs will grow in more markets to deliver services at minimal possible cost and lowest price (Graham & Shaw, 2008; Lawton & Solomko, 2005). The growing trend of HSR and LCCs and their potential competition highlight the need to understand the factors that drive passengers to use HSR and LCCs.

Although many studies examined passengers' choice of HSR (Chou & Kim, 2009; Harvey et al., 2014; Kuo et al., 2013), such research is limited in China, where the world largest HSR system is in operation. Passengers' choice of LCCs has been an academic interest for decades (Chiou & Chen, 2010; Forgas et al., 2010; O'Connell & Williams, 2005). However, few studies focused on China, one of the most rapidly growing air transport markets in the world (Chiou & Chen, 2010). Indeed, passengers' motivation in choosing HSR and LCCs in China has been an understudied area of research.

In addition, although some studies examined passengers' behaviors in the HSR and LCC context in China, they failed to consider the unique patterns of development of LCCs and HSR. In China, HSR grows more extensively than in other countries due to government support, while the LCC sector has demonstrated a positive growing trend only in recent years. The cultural, economic, and market environment of China means Chinese passengers could be affected by factors other than those identified in the literature in their intentions to use HSR and LCCs. Such factors, however, have remained unclear due to limited research in this regard.

Purpose Statement

The present study has two purposes. First, it aimed to find out factors influencing passengers' intentions to use HSR and LCCs in the Chinese market. To that end, this study used the theory of planned behavior (TPB) in the transport context and performed a quantitative analysis using structural equation modeling (SEM). It adopted a survey method to collect data from LCC passengers in Shanghai and Shijiazhuang and HSR passengers in Beijing and Shanghai.

Second, as separate models for the use of HSR and LCCs were developed, the results of the two models were compared for providing insights into future competition between LCCs and HSR. Although HSR and LCCs are different transportation modes, the models were comparable because of their designs in the current study. Both models focused on the Chinese market and targeted passengers with the same cultural background. Both models adopted the TPB as the ground theory and selected similar factors as predictors of passengers' mode use intentions. Both models employed SEM for data analysis and utilized empirical data to test the models. The comparison allowed for identification of areas in which competition between LCCs and HSR may occur, which can provide empirical evidence to both academic research and the industry.

Research Questions

The present study investigated the following research questions:

- What factors influence passengers' intentions to use HSR in the Chinese market?
- How do these factors affect passengers' intentions to use HSR in the Chinese market?
- What factors influence passengers' intentions to use LCCs in the Chinese market?
- How do these factors affect passengers' intentions to use LCCs in the Chinese market?

Hypotheses

This research makes the following hypothesis statements for the HSR model:

- H1: Passengers' attitudes are positively related to passengers' intentions to use HSR in China.
- H2: Subjective norms are positively related to passengers' intentions to use HSR in China.
- H3: Perceived behavioral control is positively related to passengers' intentions to use HSR in China.
- H4: Service quality has a positive influence on HSR passengers' attitudes in China.
- H5: Service quality has a positive influence on passengers' intentions to use HSR in China.
- H6: Trust is positively related to passengers' intentions to use HSR in China.
- H7: Price has a positive influence on passengers' intentions to use HSR in China.

- H8: Total travel time has a positive influence on passengers' intentions to use HSR in China.
- H9: Frequency has a positive influence on passengers' intentions to use HSR in China.
- H10: Access has a positive influence on passengers' intentions to use HSR in China.

For the LCC model:

- H1: Passengers' attitudes are positively related to passengers' intentions to use LCCs in China.
- H2: Subjective norms are positively related to passengers' intentions to use LCCs in China.
- H3: Perceived behavior control is positively related to passengers' intentions to use LCCs in China.
- H4: Service quality has a positive influence on LCC passengers' attitudes in China.
- H5: Service quality has a positive influence on passengers' intentions to use LCCs in China.
- H6: Price has a positive influence on passengers' intentions to use LCCs in China.
- H7: Frequency has a positive influence on passengers' intentions to use LCCs in China.
- H8: Access has a positive influence on passengers' intentions to use LCCs in China.

- H9: Uncertainty avoidance (cultural influence) is negatively related to passengers' intentions to use LCCs in China.
- H10: Technology self-efficacy has a positive influence on passengers' intentions to use LCCs in China.

Significance of the Study

The present study made three contributions to the body of knowledge about HSR and LCC travelers' behavioral intentions. First, it focused on passengers' intentions to use LCCs and HSR in China, which is understudied in the literature. A review of the existing literature indicated lack of research of passengers' motivation in taking HSR in China, despite extensive use of HSR in China. The research of LCC passengers is also limited, although there has been significant growth in the LCC sector. The finding of this study can enhance the understanding of passengers' mode use intentions in China.

Second, while previous studies generally found factors such as price and service important in passengers' choice of LCCs and HSR, this study extended the understanding of passengers' intentions to use LCCs and HSR by exploring a wider range of impact factors, such as cultural influence and operational characteristics that are specific to the Chinese market. The development of LCCs and HSR in China has followed a different path compared to that in other countries. In Europe, LCCs have developed extensively following the airline market deregulation (Zhang et al., 2008) while HSR has been competitive only on limited routes (Dobruszkes, 2011). In China, LCCs have grown slowly (Fu et al., 2015) while HSR has achieved a rapid development in many domestic markets (Fu et al., 2012). There has been limited research on the impact of context-specific factors on passengers' motivation in using LCCs and HSR, particularly in China. The results of this study can fill the knowledge gap.

Third, by comparing the HSR and LCC models, this study can contribute to the literature of competition between HSR and LCCs. Academically, the model comparison can provide empirical evidence of possible competition between the two modes in China, adding value to the research of HSR-LCC competition, which has remained an understudied area. From an industry's perspective, the results can help HSR and LCCs better understand their passengers and competitors and assist them in creating effective business strategies.

Delimitations

The first delimitation of this study was the choice of research problem. The problem selected addressed a specific and practical need in China's air transport market. As explained in previous sections, LCCs and HSR are likely to compete with each other in the future. Knowing factors that could affect passengers' decisions to use LCCs and HSR has both academic and practical significance. The selection of the research problem related closely to the intended accomplishment of this study, which was to fill a gap in the literature and provide useful information to the industry and government.

The second delimitation was the choice of timeframe for conducting the research. This research took place in the current transport market in China, which is undergoing many changes. As discussed in the previous sections, HSR serves a large number of cities while LCCs have just started to grow in the domestic market. As a result, there is little competition between the two modes in the current market. However, with LCCs enlarging their market shares, it is likely that the competition will take place in the near future. It is important to note the changing dynamics between HSR and LCCs in the current and future Chinese market, which justify the need of examining passengers' mode use intentions.

The third delimitation was the choice of research perspective. Many studies investigated HSR and LCCs from an economic perspective, such as cost, price, market, policy, and intermodal competition (Fu et al., 2012; Fu et al., 2015; Lawton & Solomko, 2005; Liu, 2015; Zhang, Luan, & Zhao, 2012). This study examined HSR and LCCs from a perspective of consumer behaviors. Specifically, this study investigated, through the lens of behavior and attitude, how passengers in the HSR and LCC segments made their decisions to use HSR and LCCs. Since this decision process is not the same for the two modes, this study developed two models for LCCs and HSR. At the end, this researcher compared the results in order to determine which factors were significant to each mode. The comparison can shed light on future competition between LCCs and HSR in China.

The fourth delimitation related to the choice of market. The geographical region in this study covered Shanghai, Beijing, and Shijiazhuang in China. Data of LCC passengers came from Shanghai and Shijiazhuang. Shanghai is the most important commercial center and a key market for LCCs in China (Fu et al., 2015). With four domestic LCCs and eight international LCCs flying to Shanghai (Shanghai Airport Authority, 2016), Shanghai is by far the most important LCC market in China. Shijiazhuang has become a popular city for LCCs in recent years due to its efforts of promoting low-cost travel (Hebei Airport Authority, 2016; Wang, 2015). Specifically, Shijiazhuang Zhengding International Airport has positioned itself as a hub for LCCs. In 2015, the LCC operation accounted for nearly 40% of the airport's total operations (Wang, 2015). This author surveyed LCC passengers at Shanghai Pudong International Airport and Shijiazhuang Zhengding International Airport for their intentions to use LCCs. Data of HSR passengers came from Beijing and Shanghai. Both cities are key markets for HSR and important hubs for a number of HSR lines, including the Jing-Hu (Beijing-Shanghai) HSR line which carried over 100 million passengers in 2014 (Ollivier et al., 2014). This author surveyed HSR passengers at Shanghai Hongqiao Railway Station and Beijing South Railway Station for their opinions of taking HSR. More explanation is provided in Chapter III regarding why these survey locations were representative of the population.

The last delimitation was the choice of ground theory and research method. The method selected for this study was SEM and the ground theory was the theory of planed behavior (TPB). Both the methodology and theory have been extensively used in studies of social psychology and human behaviors (Liu et al., 2013), including studies of airline and railway passengers (Buaphiban, 2015; Hsiao & Yang, 2010; Kuo & Tang, 2013; Mikulić & Prebežac, 2011).

Limitations and Assumptions

There were four limitations to this research. First, the present study developed two separate SEM models for LCCs and HSR to find out what factors drive passengers to use each mode. The two models contained different predicting factors and were tested using different samples. As such, the results of this study primarily focused on how LCC passengers made decisions to choose LCCs and how HSR passengers made decisions to choose HSR, with little implication of how passengers selected between the two modes. Although unable to link the two models statistically, the SEM method allows for examination of the relationship between latent variables of interest (Nachtigall, Kroehne, Funke, & Steyer, 2003), which can provide a deeper understanding of the topic under investigation.

Second, the cross-sectional nature of the research presented a limitation (Babbie, 2013). Because the data collection was conducted within a few days, the research was a snapshot dependent on conditions occurring during a short period of time (Babbie, 2013). Although this research can compare different population groups at a certain interval of time, it cannot provide information beyond that time (Babbie, 2013). This limitation can be addressed by repeating the research at different times and locations to assess the consistency of the results.

Third, there was a methodological limitation. Because this research used a survey questionnaire for data collection at the airport and railway station, it relied on self-reported data for testing the model (Babbie, 2013). Self-reported data obtained through the questionnaire can be difficult to independently verify (Vogt, Gardner, & Haeffele, 2012). It may also introduce potential bias, such as memory bias, that could affect the accuracy of information provided by the survey participant (Vogt et al., 2012). This researcher took measures to ensure that the questionnaire was relevant to the research topic and easy to understand in order for the participant to provide accurate information.

The fourth limitation related to market accessibility. China is a large country with many cities being important transportation hubs for rail and air services. Ideally, surveys on passengers' intentions to use HSR and LCCs in China should cover more markets and people in order to achieve desired generalized effects. Due to time and budget restrictions, it was difficult for this researcher to access a large number of markets and survey participants. Hence, the result of this study was based on data collected from a small percentage of the population in limited markets. To address this problem, this researcher selected the most important markets for HSR and LCCs in China and used relatively large samples in order to obtain generalizable results.

This study was built upon three assumptions. The first underlying assumption was that LCCs in China will quickly enter the market, achieve a fast growth, and compete with HSR. This was a reasonable assumption because of growing demand for air travel (CAAC, 2012) and the new policies that will benefit LCCs (CAAC, 2016) in China. It is important to note that, although HSR carries a large number of passengers, there is room for air transport to grow. Air travel in China is less common compared to that in countries such as the U.S. and Japan (Fu et al., 2012). The small number of flights per capita suggests a strong potential for air travel in China (Fu et al., 2012) which would allow LCCs to enter and grow the market quickly. As LCCs continue to grow, they will inevitably compete with HSR that covers many aviation markets in China (Fu et al., 2012).

Second, the present research assumed that most passengers departing from Shanghai and Shijiazhuang by LCCs and from Beijing and Shanghai by HSR were short- and medium- haul passengers. This was a reasonable assumption given the operational characteristics of LCCs and HSR. LCCs, due to their point-to-point, high frequency operations, typically develop their route structures around short- and medium-haul routes

(Fu et al., 2015; Zhang et al., 2008). HSR in China provides long-haul services, noticeably Jing-Hu HSR and Jing-Guang HSR, in addition to many short- and medium-haul services. Both Jing-Hu HSR and Jing-Guang HSR lines start from Beijing with a route length over 1,200 kilometers (746 miles) (China National Railway Authority, 2016). However, few of the passengers travel end-to-end on these trains, and the average trip length in both corridors is actually about 500 kilometers (Ollivier et al., 2014). The assumption allowed for investigation of passengers' choice of HSR and LCCs in shared market segments, making the subsequent model comparison more meaningful.

The third assumption was that passengers would answer the survey questions honestly. As participation in this survey was voluntary and participants may withdraw from the study at any time during the data collection process (Vogt et al., 2012), it was reasonable to assume that participants would answer the questions based on their true opinions.

Definition of Terms

Attitudes:	Attitudes reflect feelings of favorableness or unfavorableness toward performing a behavior (Ajzen, 1985).
Average traffic density:	The passenger-kilometers divided by the average length of HSR lines in operation for the year (Ollivier et al., 2014).

Culture:	Culture is the collective programming of the mind which distinguishes the members of one group or society from those of another (Hofstede, 1984).
High-speed rail:	A system consisting of rolling stock and infrastructure which operates at a speed of at least 250 km/h on new tracks or 200 km/h on existing (conventional) tracks (The International Union of Railway, 2015).
Perceived behavior control:	Perceived behavioral control (PBC) refers to the perceived ease or difficulty of performing the behavior of interest (Ajzen, 2002).
Service quality:	Service quality is the result of the comparison between customer perceptions of service delivery and expectations (Parasuraman, Zeithaml, & Berry, 1994).
Self-efficacy:	Self-efficacy refers to confidence in an individual's own ability to accomplish a behavior (Armitage & Conner, 2001; Bandura, 1991).
Subjective norms:	Subjective norms refer to the perceived social pressure that significant others (parents, spouse, friends, etc.) desire the individual to perform or not perform a behavior (Ajzen, 1991).

List of Acronyms

AMOS	Analysis of a Moment Structures
ANOVA	Analysis of Variance
AVE	Average Variance Extracted
CAAC	Civil Aviation Administration of China
CAMIC	Civil Aviation Management Institute of China
CNNIC	China Internet Network Information Center
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CR	Construct Reliability
EMU	Electric Multiple Unit
FFP	Frequent Flyer Program
FSC	Full Service Carrier
GFI	Goodness of Fit Index
HSR	High-speed Rail
IRB	Institutional Review Board
KTX	Korea Train Express
LCC	Low-cost Carrier
MLE	Maximum Likelihood Estimation
MIMIC	Multiple Indicators and Multiple Causes
MOR	Ministry of Railways
NFI	Normed Fit Index
PBC	Perceived Behavioral Control

RMB	Renminbi, Chinese Currency
RMSEA	Root Mean Square Error of Approximation
SEM	Structural equation modeling
SERVQUAL	Service Quality, an Instrument Measuring Service Based on Five Dimensions – Reliability, Assurance, Tangibles, Empathy, and Responsiveness (Ariffin et al., 2010)
SKS	The Japanese Shinkansen (SKS)
SPSS	Statistical Package for the Social Sciences
SWA	Southwest Airlines
TRA	Theory of Reasoned Action
TPB	Theory of Planned Behavior
UAE	United Arab Emirates
UIC	International Union of Railways
USD	United States Dollar
WOM	Word of Mouth

CHAPTER II

REVIEW OF THE RELEVANT LITERATURE

Chapter II contains four sections. First, it reviews previous studies related to passengers' use of LCCs and HSR, both globally and in China. Next, a ground theory is selected based on the literature review of the TPB. It then develops the expanded TPB models for passengers' intentions to use HSR and LCCs in China and justifies the inclusion of the factors to the models. Finally, this chapter presents hypothesis statements and theoretical frameworks for use in this research.

Studies of Passengers' Use of HSR

Having emerged in Japan in the 1960s, HSR has led to a worldwide revolution in transportation (Li et al., 2011). Largely due to geographical features and political support, HSR has been mostly used in Europe and Asia as an alternative to air transport, especially in short- and medium-haul passenger markets (Fu et al., 2012; Ollivier et al., 2014; Pagliara, Vassallo, & Román, 2012). HSR is costly, and it is generally difficult to gauge actual profits (Ryder, 2012). As such, HSR relies heavily on government investments (Gehrt, Rajan, O'Brien, Sakano, & Onzo, 2007; Yang & Zhang, 2012), and it is usually part of a broader economic project, with industrial, regional economic, environmental, employment, export, and development implications (Ryder, 2012). Other benefits such as traffic congestion relief and time saving (Marincioni & Appiotti, 2009) are also important considerations for developing HSR. Among all the countries that operate HSR, China stands out with the world's largest HSR system. With nearly 700 million passengers annually (Ollivier et al., 2014), HSR has become a popular option for domestic travel, and it has fundamentally changed the pattern of transportation in China.

Because HSR competes strongly with air transport in short- and medium-haul markets, many studies examined passengers' choice between HSR and FSCs (Behrens & Pels, 2009, 2012; Cokasova, 2005; Jing & Juan, 2013; Jing et al., 2014; Jung & Yoo, 2014; Li et al., 2011; Pagliara et al., 2012; Park & Ha, 2006; Wang et al., 2014). Researchers also investigated passengers' decisions when choosing between HSR and LCCs (Chantruthai et al., 2014), and between HSR and private cars (Kuo et al., 2013). In addition, a number of studies examined passengers' perception of HSR and their decisions to choose HSR (Hsiao & Yang, 2010). Table 3 summarizes studies of passengers' choice toward HSR and factors that influenced their choices.

Table 3

Selected Studies of Passengers' Choice of HSR and the Impact Factors

Context	Market	Major Impact Factor	Methodology	Reference
HSR & Air	Europe	Price, travel time, access to airport or station, schedule & frequency, punctuality & reliability, on-board comfort, luggage handling	Simulations	Cokasova (2005)
HSR & Air	Korea	Price, access and egress time to airport and station, operational frequency	Stated preference technique, logit analysis	Park & Ha (2006)
HSR	USA	Safety, connections, on-board amenities, information, efficiency of HSR	CFA & SEM	Gehrt et al. (2007)
HSR & Air	Europe	Travel time, frequency, fare	Logit models	Behrens & Pels (2009)
HSR & Other choice	China	Price, speed, train time, environment, safety, overall satisfaction	Support vector machine	Li et al. (2011)
HSR & Air	Europe	Travel time and frequency	Logit analysis	Behrens & Pels (2012)

Table 3 *(continued)*

Context	Market	Major Impact Factor	Methodology	Reference
HSR & Air	Spain	Price, service frequency, check-in, and security controls at the airport,	Discrete choice model	Pagliara et al. (2012)
HSR & private car	Taiwan	Service qualities, socio-economic characteristics, price promotions	Factor analysis, logit analysis	Kuo et al. (2013)
Traditional train, electric multiple unit, HSR, coach	China	Attitude, subjective norms, descriptive norms, habit	Hierarchical regression analyses	Jing & Juan (2013)
HSR, FSCs, & LCCs	South Korea	Fare, access time, journey time	Discrete choice model	Jung & Yoo (2014)
Traditional train, HSR, & coach	China	Descriptive norms and habit, Demographic factors, TPB components	Multiple indicators and multiple causes (MIMIC)	Jing et al. (2014)
HSR, auto modes, expressway-based bus	China	Income levels, travel time, trip costs, trip distance	Logit analysis	Wang et al. (2014)
HSR & LCCs	Thailand	Travel time, price, users' occupation, household income, educational level, trip purposes	Logistic regression	Chantruthai et al. (2014)
HSR & Air	Italy	Total travel time, cost, on-board services, especially mobile phone use, ticket flexibility	Discrete choice model	Valeri (2014)
HSR	Taiwan	Attitudes, PBC, subjective norms, novelty seeking, trust	SEM	Hsiao & Yang, (2010)

Four studies were particularly relevant to this research. The first study investigated factors affecting passengers’ choice between HSR and other transportation modes in China (Li et al., 2011). The study conducted a survey of HSR passengers (N=1,232) about their choice between HSR and other transport modes including train, airplane, and bus. The method of support vector machine was employed for building a predicting model. The results indicated that six factors - price, speed, train time, environment, safety, and overall satisfaction - strongly affected passengers’ choice. The study concluded that support vector machine was a good fit for the topic, with a 91.44% accuracy rate (Li et al., 2011). Clearly, the main purpose of the study was testing a new analytical methodology in the context of transportation. There was limited analysis of how the identified factors affected passengers' mode choice.

The second study examined mode choice behaviors of business and leisure passengers between HSR, bus, and car in China (Wang et al., 2014). The study developed multinomial logit and nested logit models using passenger survey data (N=2,821). The results indicated that income levels, trip distance, travel time, and trip costs significantly influenced modal shifts. The study also concluded that the nested logit model appeared to be more appropriate for analyzing intermodal choice in the shorter corridor (Wang et al., 2014). Again, the study placed substantial emphasis on the model building. Passengers' intention to use HSR was not the focus of the study.

The third study developed an expanded TPB model for predicting passengers' intermodal choice involving HSR, conventional train, electric multiple unit (EMU), and coach in China (Jing & Juan, 2013). It considered two external factors - descriptive norms and habit - in addition to attitudes, subjective norms, and perceived behavioral control (PBC). The study collected passenger survey data (N=320) in Zhenjiang and used the hierarchical regression method for identifying determinants of passengers' choice for the four transportation modes. The main findings indicated that attitudes and subjective norms were important factors. The addition of descriptive norms and habit increased the predictive power of the TPB model (Jing & Juan, 2013).

Jing et al. (2014) conducted a follow-up study using the same expanded TPB model, which was the fourth relevant study reviewed here. The study employed a

Multiple Indicators and Multiple Causes (MIMIC) technique for analyzing passengers' choice among HSR, conventional train, and coach in China. Using the passenger survey data from the same market (N=3,248), the study determined that the original predictors of the TPB, descriptive norms, and habit can predict passengers' intentions and behaviors. However, habit was insignificant in the intention to use HSR, although it was important in the choice of other modes. The study also indicated close relationships between demographic characteristics and the constructs under investigation, suggesting the importance of passenger demographics in the intermodal choice in China (Jing et al., 2014).

Although the findings of the third and fourth studies shed light on passengers' choice behaviors in China, there were several shortcomings of these studies in examining passengers' intentions to use HSR. The focus of the two studies was not on passengers' intentions to use HSR. Instead, the studies considered several travel options including HSR, focusing on intermodal selection and comparison. Although the studies discussed passengers' choice and intentions toward HSR, detailed analysis and explanation in this regard were lacking. For example, although both studies emphasized the predictive power of habit on different transportation modes, it is not clear how habit affected the intention to use HSR. With respect to factor selection, the two studies focused primarily on the predictive power of two factors - descriptive norms and habit. For HSR passengers, these two factors may have only partially explained their motivation in using HSR. This is especially the case in China, where HSR offers a wide range of attributes, such as affordability, convenience, and service that passengers may find important in their choice of HSR. There is clearly a need to examine passengers' intentions to use HSR in greater depth, taking into account more relevant impact factors.

The literature review in this section further supported the gaps identified in Chapter I, highlighting the academic contribution of the current research. As shown in Table 3, there are a large number of studies of passengers' choice of HSR, both globally and in China. Review of these studies indicated substantial gaps in the research of passengers' behavioral intentions to use HSR in China. Despite the extensive HSR system in China, there is limited research concerning passengers' intentions to use HSR. There is also a need to consider factors specific to the Chinese market that may affect passengers' choice of HSR. The current study focused on passengers' intentions to use HSR and examined a wide range of influencing factors, providing deeper insights into the topic under investigation.

Studies of Passengers' Use of LCCs

Originating in the U.S., LCCs have made significant impacts in the world's domestic passenger markets (O'Connell & Williams, 2005). LCCs have pursued simplicity, efficiency, productivity, and high utilization of assets to offer low fares (O'Connell & Williams, 2005). As a result, network carriers have lost market share to LCCs on all continents (Castillo-Manzano & Marchena-Gómez, 2010). With lower fares and a simpler way to travel, LCCs have made air travel available and affordable to more people. The benefits brought by LCCs are concrete, dramatic, and lasting, and they form a significant part of the gains from air transport liberalization (Fu et al., 2010). The benefit of low-cost travel, however, has been limited in China due to the partially regulated aviation market (Zhang et al., 2008). With the growing economy and new policies to support LCCs, LCCs in China are likely to experience fast-track growth in the years to come.

There is a wealth of literature illustrating LCCs' development in a liberalized market. One topic relevant to this study is passengers' choice of LCCs. Many studies compared passengers' perceptions of LCCs and FSCs in different geographical markets (Campbell & Vigar-Ellis, 2012; Chang & Sun, 2012; Chiou & Chen, 2010; Forgas et al., 2010; Mikulić & Prebežac, 2011; Ong & Tan, 2010). These studies highlighted the importance of fares in passengers' mode selection (Chiou & Chen, 2010; Forgas et al., 2010; Mikulić & Prebežac, 2011; Ong & Tan, 2010), but also recognized the impact of other factors, such as service (Campbell & Vigar-Ellis, 2012; Chang & Sun, 2012; Thanasupsin, Chaichana, & Pliankarom, 2010). A number of studies examined passengers' perception and choice toward LCCs (Alam, 2012; Buaphiban, 2015; Chang & Hung, 2013; Charoensettasilp & Wu, 2013; Yang et al., 2012).

In addition to airline characteristics, researchers often examined the impact of passengers' socio-demographic attributes in studies of LCCs. Different views exist in relationships between passenger characteristics and their choice toward LCCs (Castillo-Manzano & Marchena- Gómez, 2010; O'Connell & Williams, 2005; Ong & Tan, 2010). Some studies found passenger demographics such as age and income important in the use of LCCs (Alam, 2012; Chang & Hung, 2013; O'Connell & Williams, 2005) while others found passenger demographics insignificant in their choice of LCCs (Castillo-Manzano & Marchena-Gómez, 2010; Charoensettasilp & Wu, 2013; Ong & Tan, 2010). Table 4 summarizes studies investigating factors that influenced passengers' choice of LCCs.

Table 4

Selected Studies of Passengers' Choice of LCCs and the Impact Factors

Context	Market	Major Impact Factor	Methodology	Reference
LCCs & FSCs	Europe & Asia	LCCs: price, brand reputation, age FSCs: reliability, quality, flight schedule, connections, Frequent Flyer Program (FFP), comfort	Survey	O'Connell & Williams (2005)
LCCs & FSCs business class passengers	South Africa	Service attributes such as FFP, schedule/frequency of flights, in-flight service, business lounge, price	Mann-Whitney U-test	Fourie & Lubbe (2006)
LCCs, FSCs, & HSR	South Korea	Fare, access time, journey time	Discrete choice model	Jung & Yoo (2014)
LCCs & FSCs	Malaysia	Fare, schedule, booking method, educational level, ethnicity, routes, purpose of journey	Logit analysis	Ong & Tan (2010)
LCCs & FSCs	China	LCCs: service value, price FSCs: service perception	SEM	Chiou & Chen (2010)
LCCs & FSCs	Spain	LCCs: trust, service quality, price, brand, and image FSCs: professionalism of airline employees, brand	SEM	Forgas et al. (2010)
LCCs & FSCs	Europe	LCCs: price, safety, image FSCs: discounting/rewarding within loyalty programs, weekly flight frequency, flight experience, image	Partial least squares (PLS) model	Mikulić & Prebežac (2011)
LCCs	UAE	Price, age, gender, stay in UAE	ANOVA	Alam (2012)
LCCs	Taiwan	Service quality in terms of reliability, tangibles, responsiveness, and assurance. Airline image only limited impact	SEM	Yang et al. (2012)
Domestic airlines	South Africa	Safety, punctual/reliable flights, price (only willing to sacrifice voyager miles and legroom and onboard space for low prices)	Exploratory study	Campbell & Vigar-Ellis (2012)
LCCs & FSCs	Taiwan	Fares, luggage restrictions, destination airports	Multinomial choice model	Chang & Sun (2012)
LCCs & FSCs	Malaysia	LCCs: price, safety FSCs: service, safety	Multiple regression analysis	Sai et al. (2012)

Table 4 *(continued)*

Context	Market	Major Impact Factor	Methodology	Reference
LCCs & FSCs	Thailand	Group size, fare deviation to income ratio, waiting time deviation multiplied by income, punctuality, safety	Logit analysis	Thanasupsin et al. (2010)
LCCs	Taiwan	Trip purpose, fare, image, booking channel, safety, awareness of the existence of LCCs, passenger socio-economic characteristics	Survival model	Chang & Hung (2013)
LCCs	Thailand	Price, place, product, people, process, physical evidence, promotion	T-test, one way analysis of variance, Turkey's multiple comparison	Charoensettasilp & Wu, (2013)
LCCs & FSCs	Worldwide	FSCs: FFP and range of destinations LCCs: price, schedule, airport location	Internet survey, segmentation analysis	Chacon & Mason, (2011)
LCCs	Thailand	Price, service, airline reputation subjective norms.	SEM	Buaphiban (2015)
LCCs	Spain	Socioeconomic variables were insignificant in choosing LCCs Some trip attributes related to choice of LCCs	Logit specification	Castillo-Manzano &Marchena-Gómez (2010)

One study relevant to this study investigated factors affecting passengers' intentions to use FSCs and LCCs in China (Chiou & Chen, 2010). The study examined relationships among service expectation, service perception, service value, passenger satisfaction, airline image, and behavioral intention. A self-administered questionnaire was used to collect data from passengers traveling by Spring Airlines (N=968), China's largest LCC (Fu et al., 2015). The study performed a SEM analysis, which indicated differences in perceptions between FSC and LCC passengers. While service perception was most important for FSC passengers, service value had the greatest effect on intentions in LCC passengers. The study also concluded that LCC passengers were more sensitive to price than service. Therefore, the cost-leadership strategy, such as low fares, remained top priority for LCCs (Chiou & Chen, 2010).

The literature review in this section, as shown in Table 4, confirmed the gaps in the knowledge outlined in Chapter I. First, although passengers' choice of LCCs has been a long-time research interest in many markets, it has been understudied in China. Only one study examined passengers' selection toward Spring Airlines, China's largest LCC (Chiou & Chen, 2010). The study, however, focused on relationships among service-related variables, image, and intentions. It used data from 2007, two years after the establishment of Spring Airlines, which may only reflect passengers' initial market impression toward LCCs in China. Clearly, there is a need to use current data and consider a wider range of factors, including psychological factors, social factors, and airline service and operational characteristics for gaining better understanding of the use of LCCs. Second, the effect of demographic attributes on the use of LCCs is under-examined in China. Such influence merits a close examination given the large market for low-cost travel in China. Third, the TPB, despite its wide use in predicting intentions and behaviors, has rarely been used in the research of airline passengers, particularly LCC passengers in China. The current study developed an expanded TPB model for the use of LCCs, providing new insights into the travel behavior of LCC passengers.

Ground Theories for the Study

The literature review in the previous sections indicated relationships between a number of factors and passengers' perception of LCCs and HSR. Price and, arguably, service attributes were important in passengers' choice toward LCCs. For HSR passengers, service related attributes often influenced their perception of HSR. It is necessary to draw upon well-established theories to gain deeper insights into the antecedents of passengers' intentions to use LCCs and HSR. With a solid theoretical basis, this research can provide broader understanding of the decision process that informs passengers' travel behavior. This study emphasized the context under which the travel behavior took place. Therefore, the ground theory selected should be able to address the need related to the specific context of China.

To fulfill the research purpose, this study employed the TPB as the ground theory and developed the expanded TPB models for investigating passengers' intentions to use LCCs and HSR in China. It selected the TPB based on three considerations. First, the current study assumed that significant factors influence passengers' decisions toward HSR and LCCs. The underlying concepts of the TPB support this assumption. According to the TPB, behavioral decisions are not made spontaneously, but result from a reasoned process in which behavioral intentions are influenced by some key factors (Liu et al., 2013). Second, this study considered factors other than cognitive factors that may affect passengers' use of HSR and LCCs, and the TPB can address this need. For example, the TPB model considers subjective norms as an important variable, which brings attention to social pressures that make a person behave in a certain way (Conner & Armitage, 1998). Third, this study examined passengers' use of HSR and LCCs in China, which can be very different from other countries. It is thus important to consider factors specific to the Chinese market. The TPB model allows for inclusion of additional factors depending on specific contexts (Ajzen, 1991), which makes the theory particularly suitable for this research. The following two sections review the TPB and expanded TPB in detail.

Theory of planned behavior (TPB). The TPB is a well-established and compelling model of social psychology (Lee & Choi, 2009). It specifies salient beliefs that influence given behavioral perceptions and subsequent actual behavior (Ajzen, 1991). The theory incorporates some of the central concepts in the social and behavior sciences, and it defines these concepts in a way that permits prediction and understanding of particular behaviors in specified contexts (Ajzen, 1991). According to the theory, attitude toward the behavior, subjective norms, and PBC lead to the formation of a behavioral intention, which has a direct effect on behavior (Ajzen, 1991; Lee & Choi, 2009). The TPB has emerged as one of the most influential and popular conceptual frameworks for the study of human action (Ajzen, 2002).

Components of the TPB. The TPB is an extension of the theory of reasoned action (TRA), which had its origins in Fishbein's work on the psychological processes by which attitudes cause behavior (Conner & Armitage, 1998). The TRA allows the researcher to predict human behaviors in specific situations. The theory suggests that broad attitudes and personality traits have an impact on specific behaviors only indirectly by influencing some of the factors that are more closely linked to the behavior in question (Ajzen, 1991). As such, the TRA introduces the factor of behavioral intention. According to the TRA, behavioral intention to perform a certain behavior precedes the actual behavior, and this intention is determined by attitudes to behaviors and subjective norms (Conner & Armitage, 1998). The theory specifies subjective norms as the social pressure an individual feels to perform or not perform a behavior (Ajzen, 1991). However, in suggesting that behavior is solely under the control of intention, the TRA restricts itself to volitional behaviors (Conner & Armitage, 1998).

The TPB shares important similarities with the TRA. In a TPB model, the individual's intention to perform a given behavior is still the central factor (Ajzen, 1991; Conner & Armitage, 1998). As a general rule, the stronger the intention to engage in a behavior, the more likely an individual should perform the behavior (Conner & Armitage, 1998). In addition, the TPB also considers subjective norms as an important factor that affects the intention to perform a specific behavior (Ajzen, 1991). The major difference between the TPB and TRA lies in the recognition of behavioral control as a determinant of the intention (Ajzen, 1991). Behaviors requiring skills, resources, or opportunities not freely available are not considered to be within the domain of applicability of the TRA, or are likely to be poorly predicted by the TRA (Conner & Armitage, 1998; Fishbein, 1993). Yet, it is recognized that the resources and opportunities available to a person must to some extent dictate the likelihood of behavioral achievement (Ajzen, 1991). The TPB attempts to predict nonvolitional behaviors by incorporating PBC as an additional predictor (Ajzen, 1991).

Hence, in a TPB model, behavioral intention is a function of three direct determinants: attitudes, subjective norms, and PBC (Ajzen, 1991; Conner & Armitage, 1998). The attitude component is a function of a person's salient behavioral beliefs, which represents perceived outcomes or attributes of the behavior. Subjective norms are a function of normative beliefs, which represent perceptions of specific significant others' preferences about whether one should or should not engage in the behavior. Judgements of PBC are influenced by beliefs concerning whether one has access to the necessary resources and opportunities to perform the behavior successfully, weighted by the perceived power of each factor to facilitate or inhibit behavior (Ajzen, 1988, 1991; Conner & Armitage, 1998; Conner, Warren, Close, & Sparks, 1999). The PBC plays an important role in the TPB. Studies have suggested that PBC and intentions would interact in their predictions of behaviors such that intentions would become stronger predictors of behaviors as PBC increased (Ajzen, 1985, 1991; Conner & Armitage, 1998).

While PBC affects behavior indirectly through behavioral intentions, in some circumstances it can be used to directly predict behavioral achievement (Ajzen, 1991). A reason for expecting a direct relationship between PBC and behavioral performance is that PBC may be used as a substitute for a measure of actual control (Ajzen, 1991). However, some pre-conditions must exist for a direct link between PBC and performance to take place. When a person has only limited information about the behavior or there is a change in the resource and opportunity, PBC alone may not accurately predict the happening of a specific behavior (Ajzen, 1991). Figure 3 depicts the components of the TPB and their relationships in a TPB model.

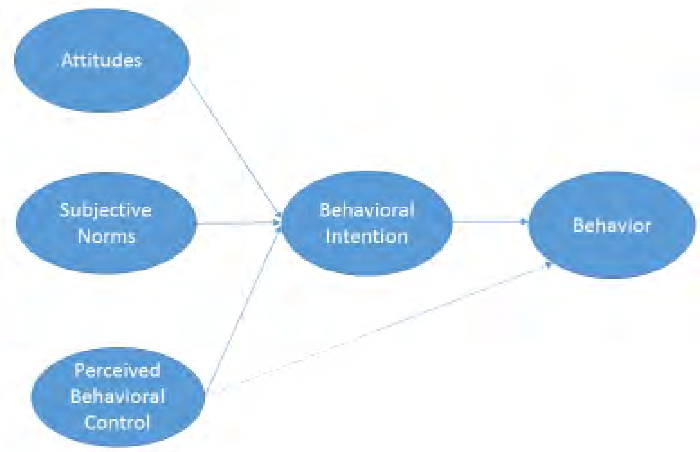

Figure 3. Components and relationships of the TPB. Adapted from “The theory of planned behavior” by Ajzen (1991). Copyright 1991 by Icek Ajzen.

Studies of the TPB. The TPB has been used in predicting a wide range of human behaviors, including health-related activities (Vermeir & Verbeke, 2008), human-environment interactions (Chan & Bishop, 2013), and consumer behaviors (Ma, Littrell, & Niehm, 2012), to name just a few. Some studies used the TPB for predicting consumers’ behaviors in the travel industry. This section reviews three such studies. They were relevant to this study because they involved travel-related decision making.

One study compared the effects of the TPB and TRA in predicting college students’ travel intentions and behaviors (Kim & Noh, 2004). Attitudes, subjective norms, and PBC were found significant in predicting the intention to travel abroad, while intentions and PBC were important predictors of the actual behavior. The results suggested that, compared to the TRA, the TPB provided a better understanding of consumers’ travel motivation (Kim & Noh, 2004).

Another study employed the TPB for investigating the impact of electronic WOM (word-of-mouth) on tourism destination choices in Iran (Jalilvand & Samiei, 2012). It performed a SEM analysis for examining the relationships between the constructs in the TPB model. Data was collected from inbound tourists (N=296) who had experience within online communities. The findings indicated that online WOM communications strongly influenced attitudes, subjective norms, PBC and the intention to visit Iran. In addition, the study found attitudes, subjective norms, and PBC significant in predicting the intention to visit Iran (Jalilvand & Samiei, 2012).

In a more recent study, Al Ziadat (2015) tested the sufficiency and application of the TPB on the tourist industry in Jordan. The study examined the antecedents of revisit intentions and actual visit behaviors. Specifically, the study tested the mediating effect of revisit intentions in the relationships between subjective norms, PBC and actual visit behaviors. The results indicated no mediating effect of revisit intentions between subjective norms and actual visit behaviors, and between PBC and actual visit behaviors. Instead, they showed that both subjective norms and PBC directly affected actual visit behaviors. The study also suggested that other determining factors should be added to the TPB model in order to provide a broader view on Jordan's potential in attracting international tourists (Al Ziadat, 2015).

Effectiveness of the TPB. The TPB has been applied successfully to a wide range of human behaviors (Liu et al., 2013). In broader terms, the theory has been well-supported by empirical evidence (Ajzen, 1991). Attitudes, subjective norms, and PBC can predict intentions to perform various behaviors with relatively high accuracy. These intentions, together with PBC, accounted for considerable variance in actual behaviors (Ajzen, 1991). Mega-analytical reviews of the TPB provided strong support for the predictive validity of the TPB in terms of the percentage of variance explained in the intention and behavior by the components of the TPB (Conner & Armitage, 1998). On average, attitudes, subjective norms, and PBC accounted for 27% and 39% of the variance in behavior and intention, respectively (Armitage & Conner, 2001).

Despite the success of the TPB, the model still leaves out a considerable proportion of unexplained variance in intentions and behaviors (Armitage & Conner, 2001; Conner & Armitage, 1998). It is important to note that TPB only distinguishes between three types of beliefs - behavioral, normative, and control - and between the related constructs of attitudes, subjective norms, and PBC (Ajzen, 1991). However, human behaviors are complex and context-embedded. For different contexts, constructs other than the three primary components in the TPB model may also affect intentions and behaviors. Luckily, a researcher can expand the TPB model to address this need. The TPB model opens to the inclusion of additional predictors if it can be shown that these predictors capture a significant proportion of the variance in intentions or behaviors after the theory's current variables have been taken into account (Ajzen, 1991). The expanded TPB model is particularly suitable to this study because the market and cultural environment in China requires additional factors be considered to better explain passengers' intentions to use LCCs and HSR.

The expanded TPB. The sufficiency of the TPB has received considerable attention, with suggestions of adding new constructs to the model for improving its predictive ability (Conner & Armitage, 1998). Researchers discussed the possibility of making further distinctions among additional kinds of beliefs and related dispositions in a TPB model (Conner & Armitage, 1998). They suggested that additional constructs in the TPB, such as belief salience, past behavior/habit, self-efficacy, moral norms, self-identity, and affective beliefs could be useful in furthering the understanding of human behaviors (Ajzen, 1991; Conner & Armitage, 1998). The addition of the construct, however, should rely on the theoretical description of the role of additional variables within the TPB (Conner & Armitage, 1998). Specifically, the theoretical description should specify the process by which the new variable influences intentions and behaviors, its relationship to existing components of the TPB, and the range of conditions over which such a variable might be expected to have an impact (Conner & Armitage, 1998).

Applications of the expanded TPB. A wide range of studies developed expanded TPB models for better understanding human behaviors. Because human behaviors are heavily dependent on situational contexts, researchers added context-related factors to a TPB model for increasing the proportion of the explained variance in behaviors conducted in specific contexts (Ajzen, 2005; Conner & Armitage, 1998). This section reviews seven studies. The first three studies used the expanded TPB for analyzing consumers' buying behaviors, which were relevant to the current study because both involved passengers' decisions of choosing a product or service. The rest of the studies applied the expanded TPB to the transportation context, including the HSR context.

Dowd and Burke (2013) examined a three-step adaptation of the TPB through investigating consumers' intentions to purchase sustainably sourced food in Australia.

The study used hierarchical multiple regression for examining the predictive utility of the original TPB (Step 1) and the expanded model adding the constructs of moral attitudes and ethical self-identity (Step 2). The third step further added retail channels and nine food choice motivations to the expanded model developed in Step 2. While the original TPB variables (attitudes, subjective norms, and PBC) explained 61.6% of the variance in the intention to purchase sustainably sourced food, the expanded models in Step 2 and 3 explained 73% and 76% of the variance, respectively. The results suggested that measures of ethical concern made a useful addition to the TPB framework when considering domains that involved moral/ethical judgements (Dowd & Burke, 2013).

Another study employed an expanded TPB model for investigating how attitudes, subjective norms, PBC, self-identity, and past behavior influenced Chinese consumers' intentions to purchase foreign products (Liu et al., 2013). The results indicated that all the factors affected the purchase intention. While past experience was a relatively weak predictor, self-identity significantly improved the predictive power of the model. The study suggested that respondents (N= 3,171) who had a self-identity as a consumer of imported products were more likely to purchase foreign products in the future than those who did not have such a self-identity. Overall, the model explained 40% of the variance in the purchase intention (Liu et al., 2013).

The third study extended the TPB with service and product characteristics and found these factors important in consumers' purchase intentions. Ma et al. (2012) investigated fare trade consumption behaviors of young female consumers. The study examined interrelationships among beliefs, attitudes, PBC, and shopping intentions regarding non-food fair trade products. Findings revealed that the consumers' attitudes, PBC, and beliefs about the fair trade concept and product attributes were important in determining their willingness to purchase a non-food fair trade product. The study indicated that the consumers' beliefs of both the fair trade concept and product attributes played a critical role in driving purchase intentions. Specifically, product attributes such as ethnic appearance or handcrafted nature of the products played a major role in shaping attitudes toward fair trade purchases and PBC, which in turn influenced the purchase decision (Ma et al., 2012).

In the transportation domain, researchers often expanded the TPB model for better understanding passengers' choice decisions. One study examined relationships between perceived barriers of public transport users in making transfer and their resulting willingness to use routes with transfer in New Zealand (Chowdhury & Ceder, 2013). The study focused on the effects of two types of control - PBC and self-efficacy - on the use of transfer. Based on the SEM analysis, the study made two conclusions. First, the TPB was suitable for investigating influencing factors in travelers' intentions to use public transfer routes. Second, public transport users needed to feel capable (self-efficacy) of making the transfer. The study showed that self-efficacy was more closely associated with the intention and behavior than perceived controllability. It also found that socio-demographics and trip characteristics directly affected the intention of public transport users (Chowdhury & Ceder, 2013).

Researchers also developed expanded TPB models for investigating passengers' choice behaviors in the HSR context. Jing and Juan (2013) extended the TPB model with descriptive norms and habit for investigating passengers' choice among four travel modes - the traditional train, the Electric Multiple Unit (EMU), HSR, and coach - in China. The regression analysis indicated that attitudes, subjective norms, and PBC explained between 33% and 45% of the variance in intentions to use different travel modes. While adding descriptive norms to the original TPB model increased the explained variance in intentions by between 4% and 8%, the addition of habit led to a larger increase, between 9% and 12% (Jing & Juan, 2013). Jing et al. (2014) tested the same expanded TPB model in a follow-up study. The results indicated that descriptive norms and habit influenced travel intentions and behaviors. In line with the previous study, Jing et al. (2014) indicated that descriptive norms and habit increased the predictive power of the TPB for passengers' mode choice intentions in China.

Another study developed an expanded TPB for examining students' intentions to take HSR in Taiwan (Hsiao & Yang, 2010). Because tourism is a major industry in Taiwan and safety plays a pivotal role in travel activities, the study added two constructs - novelty seeking and trust - to the TPB model. The results indicated that attitudes and PBC strongly affected the intention to use HSR among the students. The study found subjective norms less significant than other factors in the model, indicating that opinions of families and friends did not exert a strong influence on college students' decisions on leisure activities in Taiwan. The study revealed indirect, significant influence of both novelty seeking and trust on students' intentions to take HSR via attitudes, subjective norms, and PBC. It appeared that the low intention to take HSR may be attributed to a lack of positive attitude toward HSR, which was strongly influenced by students' tendency for novelty seeking and trust toward HSR. Overall, the expanded TPB model accounted for 50% of the variance explained in intentions (Hsiao & Yang, 2010).

Applying the expanded TPB to this study. The literature review of the TPB and expanded TPB had important implications for the current research. On the one hand, although the TPB has gained considerable success in predicting human behaviors, there remained substantial variances in intentions and behaviors that were unexplained by attitudes, subjective norms, and PBC. The TPB provides a theoretical explanation for human behaviors in general. As such, the three components in the model may not fully reflect the context under which a specific behavior takes place. To increase the explanatory power of the TPB, it is necessary to add factors to the TPB model. The inclusion of the new factor, as shown in this section, significantly improved the predictive power of the TPB model, leading to a better understanding of human behaviors. On the other hand, the studies reviewed in this section demonstrated the importance of context in factor selection. Individual behaviors may vary from one situational context to another. To achieve a better result, the TPB model was often extended with external factors in order to take into account these external differences in context, which can change the way consumers respond to specific situations (Ajzen, 2005; Buaphiban, 2015). The literature review in this section provided support for using an expanded TPB in explaining passengers' choice behaviors in China.

This study extended the model with context-specific factors. The factor selection followed three principles. First, studies in the transportation context, as shown in the preceding sections, provided useful guidance for factors that may influence passengers' decisions to use HSR and LCCs. Second, because of the unique cultural and social environment in China, some context-specific factors may affect Chinese passengers' motivation in using HSR and LCCs. Third, rail and air transport is fundamentally a service industry, which involves providing service for transporting passengers from one point to another for an agreed price. Service-related attributes, such as price and travel time, are important for passengers to consider rail or air services and therefore should be included in this study. In addition, as many studies found socio-demographic characteristics important in passengers' perception toward HSR and LCCs, as shown in Table 3 and Table 4, this study considered passenger characteristics in the use of HSR and LCCs in China.

The next two sections discuss the factor selection for the expanded TPB models. As HSR and LCCs are two different transportation modes, passengers may choose each mode for different reasons. This study developed separate expanded TPB models for HSR and LCCs, each including factors relevant to the transportation mode under examination.

Constructs Influencing Passengers Intentions to Use HSR

The expanded TPB model contained both the original components of the TPB and external factors. This section justifies the addition of external factors to the TPB model. It considers factors influencing passengers' choice of HSR as revealed in the literature review. In addition, it fills the knowledge gap by incorporating factors particularly relevant to the HSR context in China. The expanded TPB model included six external factors - trust, price, total travel time, service quality, frequency, and access. This section also provides operational definitions of both the original TPB components and external factors in the context of HSR.

Trust. Consumer trust refers to the expectations held by the consumer in which the service provider is dependable and can be relied upon to deliver its promises (Hsiao & Yang, 2010; Sirdeshmukh, Singh, & Sabol, 2002). In the service industry, trust plays a critical role in helping consumers overcome the perceptions of risk and insecurity (Mcknight, Choudhury, & Kacmar, 2002), increasing their intentions to choose a product and service. Prior studies investigated the relationship between trust and behavioral intentions in many contexts, including the cruise context (Forgas-Coll, Palau-Saumell, Sánchez-García, & Garrigos-Simon, 2015), the online merchant context (Hong & Cha, 2013; Shankar, Urban, & Sultan, 2002), the airline context (Han & Hwang, 2014), and the HSR context (Hsiao & Yang, 2010). These studies generally revealed positive relationships between trust and behavioral intentions, indicating that when customers' trust level is high, they are more likely to engage in purchase behaviors.

A study conducted in South Korea examined the mediating role of consumer trust in the relationships between perceived risks and purchase intentions in the e-commerce industry (Hong & Cha, 2013). The study developed two models for testing the effects with and without the mediation of trust. It used the SEM method for analysing the survey data collected from local university students. The findings suggested that perceived risks had significant negative influence on purchase intentions under the unmediated model, while under the mediated model trust can mediate perceived risks, ultimately increasing consumers' intentions to buy online (Hong & Cha, 2013).

In the transport industry, researchers examined the role of trust in the use of various transportation modes. Forgas-Coll et al. (2015) performed a cross-national analysis for investigating the effect of nationality on the relationships between perceived value, satisfaction, trust, and behavioral intentions among cruise line passengers from the U.S. and Spain. Using a SEM technique, the study analyzed the survey data (N=968). The results of the study indicated that Spaniards showed stronger relationships between trust and behavioral intentions and between emotional value and satisfaction. Americans presented stronger relationships between service quality and satisfaction and between service quality and behavioral intentions (Forgas-Coll et al., 2015).

In the LCC industry, one study investigated passenger perception of service quality among different age groups and the drivers of their repurchase intentions (Han & Hwang, 2014). The study used Analysis of Variance (ANOVA) and multi-regression techniques for analyzing the data collected from a sample of passengers on international flights (N = 402). The results indicated significant differences in perceptions of service quality across age groups. The findings also revealed that trust in the airline, among other factors, was decisive in LCC passengers' decision formation, which in turn affected their intentions for using LCCs (Han & Hwang, 2014).

Some studies also found trust important in the HSR industry. Hsiao and Yang (2010) extended the TPB with two additional constructs - novelty seeking and trust - in order to understand college students' willingness to take HSR in Taiwan. The study collected survey data from a local university and developed the SEM model based on the data. The results showed that trust had indirect significant influences on students' intentions to use HSR via attitudes. Noticeably, trust was more important compared to novelty seeking in influencing attitudes. The study attributed this result to the relationship between safety and trust in the travel industry. Because personal safety was the primary goal for tourists in traveling, trust was likely to play a more significant role in students' attitudes and intentions toward HSR (Hsiao & Yang, 2010).

Customer behavior involves risk in the sense that any action of a consumer will produce consequences that one cannot anticipate and of which at least some are likely to be unpleasant (Bauer, 1960; Hong & Cha, 2013). As such, trust can be an important part of the decision process for choosing a service. In China, trust can be a relevant factor for passengers to choose HSR because of the characteristics of HSR. The satisfactory on-time performance and safety record of HSR (Liu & Deng, 2004; Pagliara et al., 2012) may create trust in passengers. In addition, the Chinese government's strong support of HSR could affect the perceived trust of passengers toward HSR. It is therefore necessary to add trust to the TPB model.

Price. The second factor considered was price, which referred to HSR fares in this study. Although mentioned less than service quality, price is important in attracting passengers for HSR (González-Savignat, 2004; Park & Ha, 2006). Jung & Yoo (2014) developed logit models for investigating how fares, access time, frequency, and journey time affected passengers' choice decision for FSCs, LCCs, and Korea Train Express (KTX) in Korea. Based on the passengers' survey data (N=3,834), the study indicated that fares, access time, and journey time were significant in passengers' mode decision. The results further revealed that non-business passengers were more affected by price than business passengers in choosing HSR (Jung & Yoo, 2014).

Some studies found price important in competition between HSR and LCCs. Finger et al. (2014) indicated that, due to significant travel time reductions and better pricing systems, rail operators were able to outcompete low-cost carriers on many routes in the European market. Another study examined passengers' selection between HSR and LCCs in Thailand (Chantruthai et al., 2014). Based on the logit regression analysis, the study indicated the importance of price in the intermodal choice. The average fares of LCCs and HSR were estimated to be USD 0.09/km and USD 0.06/km in Thailand, respectively. The study indicated that the fare differential of USD 0.03/km could be significant in making passengers change from LCCs to HSR, giving HSR competitive advantage over LCCs (Chantruthai et al., 2014).

Some studies indicated the effect of pricing strategy on HSR passengers' behaviors. Kuo et al. (2013) examined the effects of price promotion of HSR on passengers' choice behavior in Taiwan. The study suggested that pricing strategies, such as a discount on the second ticket and less restrictive round trip tickets could help HSR attract more passengers from other transportation modes, including private cars (Kuo et al., 2013). Similarly, Yao, Yang, Zhang, and Sun (2013) analyzed the pricing strategy of HSR in the Wuhan-Guangzhou market in China and found relationships between HSR market share and HSR fares. The study suggested that HSR should develop a pricing strategy with floating fares. Specifically, the ticket fare should be set to a lower level on weekdays and higher level on holidays to attract passengers (Yao et al., 2013).

Price plays a special role in the HSR operation in China. The affordable price is likely to be an important reason that HSR gains popularity in China. The low-cost structure of HSR and government policy make the low price possible. Based on the summary of Fu et al. (2012), both total cost and operational cost of HSR in China are lower than that reported for Japan and most European routes (Campos & de Rus, 2009;

Fu et al., 2012; Ida & Suda, 2004). As such, China is able to charge low HSR fares. The government policy in China also supports low HSR fares due to the consideration of social welfare (Yang & Zhang, 2012). As a combined result, second-class fares for 200 to 250 km/h HSR services in China are about U.S. $ 0.045 per km, similar to intercity bus fares, and second-class fares for 300 to 350 km/h HSR services are U.S. $0.077 per km, lower or comparable to discounted airfares (Ollivier et al., 2014). These fares are about one quarter of the fares charged in other HSR countries (Ollivier et al., 2014).

The relatively low price of HSR is likely to influence passengers' willingness to travel by train. Such influence, however, has not been fully understood in China. Although price has been found important in passengers' intermodal choice in China (Wang et al., 2014), its effect on passengers' intentions to use HSR has remained unclear. It is thus important to add price to the TPB model.

Total travel time. The third factor considered was total travel time. From a passenger's perspective, the most obvious benefit of HSR is that it saves time (Zhao, Zhao, & Li, 2015). This study emphasized total travel time of HSR. It assumed that passengers considered the time spent on the entire trip when choosing a transportation mode. The concept of total travel time comes from Belobaba's definition of a typical air trip, which contains ground access portion of the trip, the enplanement processing, the aircraft portion, the deplanement processing, and the ground egress portion (Belobaba, Odoni, & Barnhart, 2015). Passengers traveling by HSR follow a similar procedure. Compared to station-to-station travel time, total travel time considers the time spent on different components of a passenger's entire trip, and thus better reflects the timesaving benefit of HSR.

Some studies emphasized the importance of total travel time of HSR. Fu et al. (2012) pointed to the advantage of HSR in "generalized traveling time" in short- and medium- markets. The authors argued that, although it takes less time to fly over a same station-to-station distance, air passengers may spend more time traveling because they need to arrive at the airports much earlier for boarding and security check. In addition, rail stations are normally closer to downtowns and have better land transportation networks compared to airports, resulting in reduced total travel time for HSR passengers (Fu et al., 2012). Goldman Sachs (2010) provided empirical evidence for total travel time of HSR and air transport. They reviewed twenty major HSR routes in the world and found that HSR travelers spent 92% of the journey time on trains, compared to 62% for air travelers on planes. The study indicated the benefit of using total travel time in comparing the travel time of HSR and air transport (Goldman Sachs, 2010).

A number of studies showed that passengers valued total travel time when selecting between HSR and air transport. Behrens and Pels (2012) investigated the behavior of travelers in the London-Paris market and the conditions under which HSR became a viable alternative for passengers. Using the survey data over the period 2003-2009, the study found total travel time, frequency, and distance to the U.K. port important in travelers' choice behavior. Total travel time was more important to business passengers than leisure passengers. It also suggested that a 1% decrease in total travel time of Eurostar would lead to an increase in market share of 1.09% and 0.44% in the business and leisure market, respectively (Behrens & Pels, 2012). In the Italian market, Valeri (2014) examined the effects of total travel time, total travel cost, delay, ticket flexibility, and on-board services on passengers' choice of HSR on the Rome-Milan route. It found that total travel time, which contained access time, station-to-station/airport-to-airport, waiting time, and egress time was significant in passengers' decision to use HSR (Valeri, 2014). Another study examined the effect of total travel time and costs on passengers' selection between HSR and air transport in China (Chen et al., 2014). On the Wuhan-Guangzhou route, the time required for airport procedures significantly increased the total travel time of air transport, resulting in minor total time savings for the air travel. On the cost side, the total fare of air travel cost nearly twice the price of HSR travel in this market, making HSR a preferred choice for passengers (Chen et al., 2014).

Total travel time can be highly relevant to this study because of the operational speeds of HSR and market characteristics in China. On the one hand, HSR in China can operate at higher average speeds than most of its international counterparts due to its high technical standards (Zhao et al., 2015), which can further reduce total travel time. On the other hand, although HSR is generally competitive for trips within 3-4 hours (Goldman Sachs, 2010), it can be competitive for longer trips in China due to the relatively low per capita income and thus low value of time (Fu et al., 2012). The higher speeds and greater market coverage of HSR in China mean passengers can obtain more timesaving benefits in more markets, which could drive the use of HSR. Total travel time has not been adequately researched in the use of HSR in China. It is therefore necessary to add total travel time to the TPB model.

Service quality. The fourth factor considered was service quality. Service quality is a measure of how well the service level that is delivered matches customer expectations (Lai & Chen, 2011; Parasuraman et al., 1994; Sumaedi, Bakti, & Yarmen, 2012). Service quality relates to both customer satisfaction and subsequent purchase intentions and behaviors (Boyer & Hult, 2006; Lai & Chen, 2011; Park, Robertson, & Wu, 2006; Sumaedi et al., 2012). It is among the most significant factors influencing passengers' choice of HSR (Kuo et al., 2013; Ortúzar & Simonetti, 2008; Valeri, 2014). Airline managers often consider HSR service as a significant barrier to enter into the market (Kappes & Merkert, 2013).

Previous studies revealed both direct and indirect relationships between service quality and passengers' behavioral intention in the HSR context. Many of these studies evaluated service quality based on the SERVQUAL model, which measures service quality by Tangibles, Reliability, Responsiveness, Assurance, and Empathy (Saha & Theingi, 2009). Chou and Kim (2009) examined effects and interrelationships among service quality, corporate image, satisfaction, complaint, and loyalty for both Korean and Taiwan HSR systems. The results indicated that service quality influenced passenger satisfaction both directly and indirectly. Corporate image was a strong mediator in this relationship. The study also showed that HSR in Taiwan can better handle passenger complaints compared to HSR in Korea, leading to higher customer loyalty toward HSR in Taiwan (Chou & Kim, 2009).

Another study investigated relationships among service quality, corporate image, customer satisfaction, and behavioral intentions for elderly passengers who used HSR service in Taiwan (Kuo & Tang, 2013). The results showed that customer satisfaction directly affected behavioral intentions, while service quality and corporate image only played indirect roles. The study evaluated service quality from three aspects - accessibility environment, hardware qualities, and staff attitude and adaptability. Among them, accessibility of environment had the most significant influence on passengers' satisfaction, reflecting the special needs of elderly passengers in using HSR (Kuo & Tang, 2013).

Some studies supported direct relationships between service quality and behavioral intentions in the use of HSR. Kuo et al. (2013) examined the effects of price promotions and service attributes on passengers' choice of HSR in Taiwan. The study collected data from private car drivers and employed logit models for data analysis. The results indicated that both monetary costs and service quality strongly influenced the use of HSR. The study assessed service quality from four aspects - efficiency, accessibility, comfort, and reliability. It revealed that the major barriers preventing car drivers from shifting to HSR service were accessibility and high costs (Kuo et al., 2013).

As the literature demonstrated, service quality influenced passengers' intentions toward HSR directly or indirectly via satisfaction. As such, service quality is an important factor in the use of HSR. The literature also indicated the importance of measuring service quality from different aspects depending on situational contexts. This study measured onboard service quality of HSR. Onboard service was relevant to this study because of the many medium- and long-distance HSR routes in China, which would make this service aspect particularly important to HSR passengers.

Frequency. The fifth external factor considered in the HSR model was frequency, which referred to how often HSR trains operated within a certain time period. Frequency is important in competition between HSR and other transportation modes (Behrens & Pels, 2009, 2012; Givoni, 2006; Park & Ha, 2006). Dobruszkes (2011) empirically examined five city-pair markets in Western Europe that were serviced by both air and rail transport. The results indicated that, in addition to travel time, other factors such as frequency also played an important role in the intermodal competition (Dobruszkes, 2011).

In the London-Paris market, Behrens & Pels (2012) studied the behavior of travelers and found frequency and total travel time significant in passengers' selection toward HSR. However, frequency appeared to be less important for leisure passengers than business passengers (Behrens & Pels, 2012). Another study in Spain investigated factors affecting mode choice between HSR and air transport on the Madrid-Barcelona route (Pagliara et al., 2012). The study concluded that travel time, frequency, and price were the most important determinants in passengers' decision. The study emphasized the significance of frequency in both airline and HSR services. It showed that by maintaining high frequencies with smaller planes, the airlines on the Madrid-Barcelona route can effectively compete with HSR (Pagliara et al., 2012).

Service frequency was relevant to this study given the HSR capacity and system in China. HSR offers high service frequencies, especially in densely populated markets such as on the Beijing-Shanghai route (Zhao et al., 2015) which carries over 100 million passengers annually (Ollivier, 2014). The high frequency of HSR makes rail transport convenient to passengers, which is likely to influence their decisions to choose HSR. It is therefore necessary to include service frequency to the expanded TPB model.

Access. The sixth factor considered was station accessibility. Accessibility to HSR facilities can be a major factor of success for HSR links (Cascetta, Papola, Francesca, & Marzano, 2011; Clever & Hansen, 2008; Pagliara et al., 2012). Chang and Lee (2008) performed an accessibility analysis for HSR in Korea. It was determined that poor station accessibility was one of the main reasons for not using HSR services in Korea (Chang & Lee, 2008). Another study focusing on the Korean market indicated the importance of station/airport access time in passengers' mode choice (Jung & Yoo, 2014). Specifically, the study showed that reducing access time was more important than reducing journey time for short-haul domestic travelers (Jung & Yoo, 2014).

In the European market, Cokasova (2005) ranked factors according to their importance in passengers' choice between HSR and air transport. Based on the survey result, the study concluded that ticket price, travel time, and access to the airport or rail station were the most important factors influencing passengers' choice behavior. It also appeared that frequent travelers, compared to infrequent travelers, assigned more importance to time, access to station/airport, and comfort on-board (Cokasova, 2005). In Spain, HSR is competitive partially because HSR stations are on average more accessible than airports for users, particularly for those who get to or leave the station or airport by public transportation (Pagliara et al., 2012).

Station accessibility was relevant to this study given the location of HSR stations in China. HSR stations are generally located closer to downtowns (Fu et al., 2012). In many cities in China, more than one station on the network is available due to very high passenger volume (Fu, Nie, Meng, Sperry, & He, 2015). Improved road transportation, such as the subway system, can further enhance accessibility to HSR facilities. The convenient location of HSR stations is likely to influence passengers' decisions to use HSR. It is therefore important to add station accessibility to the TPB model.

Table 5 shows the operational definitions of the factors in the HSR model. Table 6 summarizes the reviewed studies for the HSR's external factor selection.

Table 5

Operational Definitions of Study Constructs (HSR Model)

Factor	Operational Definition
Attitudes	A passengers' feeling of favorableness or unfavourableness toward HSR
Subjective Norms	The social pressure a passenger feels from his/her significant others who desire the individual to use or not use HSR
Perceived Behavioral Control	A passenger's perceived control of making the decision to select HSR
Trust	A passenger's belief that HSR is reliable and can provide services with minimal risks
Price	The perception of a passenger about how well the HSR price meets his/her needs
Service Quality	A measure of how well the service level that is provided by HSR matches a passenger's expectations
Frequency	The perception of a passenger about how well the HSR frequency meets his/her needs
Access	The perception of a passenger about the efficiency of accessing an HSR station
Total Travel Time	Time spent on a passenger's entire HSR trip including ground access, boarding processing, train portion, un-boarding processing, and ground egress portion

Table 6

Major Studies Reviewed for the Additional Factor Selection (HSR)

Factor	Market	Findings related to the factor	Reference
Trust	South Korea	Trust can mediate the effect of perceived risks, increasing consumers' intentions to buy online.	Hong & Cha (2013)
	South Korea	Trust in the airline was found to be decisive in LCC passengers' decision formation.	Han & Hwang (2014)
	Spain & U.S.	Compared to Americans, Spaniards showed stronger relationships between trust and behavioral intentions.	Forgas-Coll et al. (2015)
	Taiwan	Trust was more important than novelty seeking in influencing attitudes, which had a decisive influence on the behavioral intention to use HSR.	Hsiao & Yang (2010)
Price			
	South Korea	Fares, among other factors, were significant in passengers' choice toward HSR.	Jung & Yoo (2014)
	Europe	Cost is an important factor for passengers to choose HSR.	Finger et al. (2014)
	Taiwan	Pricing strategies such as discount on the second tickets and less restrictive round trip tickets could help HSR attract passengers from other transportation modes.	Kuo et al. (2013)
	China	A floating HSR fare system can improve occupancy rates for HSR.	Yao et al. (2013)
	Thailand	Fares were significant in passengers' choice between HSR and LCCs.	Chantruthai et al. (2014)
Total Travel Time			
	Italy	Total travel time (access time, station-to-station/airport-to-airport, waiting time, egress time) and total travel cost were among the most important factors in passengers' choice of HSR.	Valeri (2014)
	Europe	Total travel time, among other factors, significantly influenced travelers' choice behavior. It is more important to business passengers than leisure passengers.	Behrens & Pels (2012)
	China	Because of longer airport procedures (minor total time saving) and high costs of air transportation, HSR can be a preferred choice in some domestic markets.	Chen et al. (2014)

Table 6 *(continued)*

Factor	Market	Findings related to the factor	Reference
Service Quality			
	South Korea & Taiwan	Service quality influenced passengers' satisfaction toward HSR both directly and indirectly.	Chou & Kim (2009)
	Taiwan	Customer satisfaction directly affected HSR passengers' intention, while service quality and corporate image only played an indirect role.	Kuo & Tang (2013)
	Taiwan	Both costs and service quality significantly impacted on passengers' decision toward HSR.	Kuo et al. (2013)
Frequency			
	Western Europe	In addition to travel time, other factors such as frequency was also significant in competition between HSR and air transport.	Dobruszkes (2011)
	Europe	Frequency and total travel time were important factors in passengers' choice of HSR. Frequency was more important for business passengers.	Behrens & Pels (2012)
	Spain	Travel time, frequency, and price were the most important determinants in passengers' choice of HSR.	Pagliara et al. (2012)
Station Accessibility			
	South Korea	Poor station accessibility was among the main reasons preventing passengers from using HSR.	Chang & Lee (2008)
	South Korea	Access time was important in passengers' mode choice. It was more important than reducing journey time for short-haul domestic passengers.	Jung & Yoo (2014)
	Italy	Improved accessibility is among the main factors of success of HSR.	Cascetta et al. (2011)
	Europe	Ticket price, travel time, and access to the airport or rail station were the most important factors influencing passengers' choice behavior.	Cokasova (2005)
	Spain	HSR station is more accessible than airport.	Pagliara et al. (2012)

Summary of external factor selection. Passengers choose HSR because they seek a fast, safe, comfortable, and affordable way to travel. Not surprisingly, the literature consistently points to relevant factors such as price, service, travel time, safety, and frequency that influence passengers' choice of HSR. Taking into account the literature and the context of China, this study extended the TPB model with six additional factors, namely trust, price, total travel time, service quality, frequency, and access. The next section presents a theoretical framework and hypothesis statements with respect to the intention to use HSR.

Theoretical Framework and Hypotheses (HSR)

Following the literature review, this study proposed a theoretical framework for passengers' intentions to use HSR, as shown in Figure 4. The predictor variables in the framework included attitudes, subjective norms, PBC, trust, price, total travel time, service quality, frequency, and access. The outcome variable was passengers' behavioral intentions to use HSR in China. Noticeably, this framework focused on the relationships between the predictors and intentions instead of actual behaviors as shown in a typical TPB model. In Figure 4, service quality affected both the behavioral intention and attitudes. It is important to note that more interrelationships between the factors could exist in this model. Moreover, other factors not included in the model could predict passengers' intention to use HSR. Due to the limited scope of this study, the factor and path selections in the model were realistically restricted to include only the relevant factors and mostly direct relationships between the predictors and behavioral intentions.

The remainder of this section presents hypothesis statements based on the proposed framework.

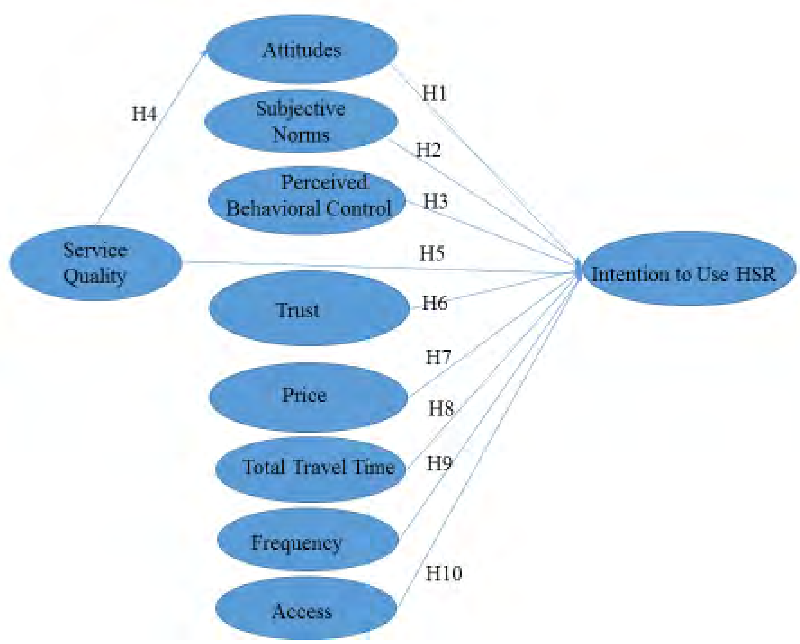

Figure 4. Research theoretical framework and hypotheses (HSR).

The TPB is widely used in explaining and predicting human behavioral intentions across a variety of disciplines (Liu et al., 2013). A typical TPB model postulates three conceptually independent determinants of the intention, namely attitudes, subjective norms, and PBC (Ajzen, 1985, 1991). As shown in Figure 4, the expanded TPB model retained these components given their impact on the behavioral intention.

Attitudes are developed reasonably through consideration of the potential consequences of performing the behavior (Ajzen & Fishbein, 1980; Lee & Choi, 2009). Attitudes reflect feelings of favorableness or un-favorableness toward performing a behavior (Ajzen, 1985, 1991). If the behavior is projected to provide valuable outcomes or avoid negative outcomes, the individual's attitude toward the behavior should be positive or favorable (Lee & Choi, 2009). Attitudes are a significant predictor of behavioral intentions in multiple domains (Fen & Sabaruddin, 2008; Hagger, Anderson, Kyriakaki, & Darkings, 2007). Some studies suggested that a favorable attitude toward HSR had a decisive influence on the behavioral intention of passengers (Hsiao & Yang, 2010). It is necessary to examine the relationship between attitudes and HSR use in China. Based on this consideration, H1 was proposed:

H1: Passengers' attitudes are positively related to passengers' intentions to use HSR in China.

Subjective norms refer to the perceived social pressure that significant others (parents, spouse, friends, etc.) desire the individual to perform or not perform a behavior (Ajzen, 1991; Hsiao & Yang, 2010). If an individual perceives that significant others endorse (or disapprove of) the behavior, he or she is more (or less) likely to intend to perform it (Armitage & Conner, 2001). Studies using the TPB model often produced mix results regarding the ability of subjective norms in explaining behavioral intentions. Some studies revealed low correlations between subjective norms and intentions (Armitage & Conner, 2001) while others found strong associations between the two (Dowd & Burke, 2013). In the domain of transportation, a number of studies indicated significant impact of reference groups on travel behaviors (Hsu, Kang, & Lam, 2006; Lam & Hsu, 2006). However, studies examining mode choice behaviors involving HSR in China suggested that subjective norms were not always a significant predictor of passengers' decisions (Jing et al., 2014; Jing & Juan, 2013). The divergent views in the literature highlighted the need to further examine the relationship between subjective norms and behavioral intentions, especially in the HSR context in China. H2 was thus proposed:

H2: Subjective norms are positively related to passengers' intentions to use HSR in China.

Perceived behavioral control refers to the perceived ease or difficulty of performing the behavior of interest (Ajzen, 1991). Factors such as opportunities, dependence on others, and barriers are likely to facilitate or inhibit the performance of behaviors (Conner & Armitage, 1998). Generally, people who perceive that they have access to the necessary resources and that there are opportunities to perform the behavior are likely to have a high degree of PBC (Ajzen, 1991). Although PBC varies across situations and actions (Ajzen, 1991), it has been found significant in predicting intentions in many domains (Boudreau & Godin, 2014; Cavazos, 2013). Several studies examined the effect of PBC on passengers' intentions in the HSR context. The PBC was a strong predictor of college students' intentions to travel by HSR in Taiwan (Hsiao & Yang, 2010). However, it was insignificant in predicting passengers' choice of HSR in mainland China (Jing & Juan, 2013). To further evaluate the importance of PBC in the use of HSR in China, H3 was proposed:

H3: Perceived behavioral control is positively related to passengers' intentions to use HSR in China.

The TPB predicts behavioral intentions based on attitude toward the behavior, a social factor termed subjective norm, and the degree of perceived behavioral control (Ajzen, 1991). Using the TPB as a conceptual guide, researchers made modifications to the theory for analyzing behaviors in different situational contexts. Previous studies in the HSR context added passenger-related attributes such as trust and habit to the TPB model (Hsiao & Yang, 2010; Jing & Juan, 2013; Jing et al., 2014). In this study, more context-related factors were considered. The expanded TPB model included six external factors - trust, price, total travel time, service quality, frequency, and access.

The first external factor was service quality. Current literature indicates that service quality influences HSR passengers in two possible ways. Service quality influences HSR passengers' choice decisions (Kuo et al., 2013). It also affects HSR passengers' satisfaction (Chou & Kim, 2009; Chou & Yeh, 2013; Kuo & Tang, 2013). As such, the proposed model examined two relationships involving service quality of HSR, which were represented by H4 and H5:

H4: Service quality has a positive influence on HSR passengers' attitudes in China.

H5: Service quality has a positive influence on passengers' intentions to use HSR in China.

Consumer behavior could be viewed as an instance of risk taking (Bauer, 1960; Hong & Cha, 2013). As such, trust is important in helping consumers overcome the perceptions of risk and insecurity in the decision process of choosing a product or service (Maadi, Maadi, & Javidnia, 2016). Trust has been examined in various contexts including buyer-seller relationships (Hong & Cha, 2013) and transport industry (Forgas-Coll et al., 2015; Han & Hwang, 2014; Hsiao & Yang, 2010). The findings generally supported the positive relationship between trust and consumers' intention to choose a service or product. In the HSR context, there could be some risk perceived by a passenger in making a decision about using HSR. To what extent trust toward HSR can reduce the risk effect and increase the intention to choose HSR has remained unclear in China. H6 was thus proposed as the following:

H6: Trust has a positive influence on passengers' intentions to use HSR in China.

The third external factor was price. Many studies confirmed the importance of price in passengers' mode choice between FSCs and HSR (González-Savignat, 2004; Jung & Yoo, 2014; Park & Ha, 2006). In some markets, price was a determining factor for passengers to shift from LCCs to HSR (Chantruthai et al., 2014). China charges lower HSR fares compared to other countries due to the low-cost structure of HSR construction and government support (Fu et al., 2012; Yang & Zhang, 2012), although the investment in HSR is very high (Fu et al., 2012; Yang & Zhang, 2012). Given the price advantage, passengers in China are likely to perceive HSR positively. Thus, H7 was stated:

H7: Price has a positive influence on passengers' intentions to use HSR in China.

The fourth external factor was total travel time. Total travel time better reflects the time benefit of HSR because it accounts for different components of a passenger's trip, such as access to station and station procedures of HSR, which are usually more efficient than that of air travel (Fu et al., 2012; Goldman Sachs, 2010). Studies showed that passengers, especially business passengers, considered total travel time when selecting between air transport and HSR (Behrens & Pels, 2012). Due to the heavy investment in HSR technologies, HSR in China operates at higher average speeds and covers larger market areas compared to that of other countries (Fu et al., 2012; Zhao et al., 2015). As such, HSR operators can reduce total travel time of HSR in China, which could have a positive impact on passengers' intention to use HSR. H8 was thus stated:

H8: Total travel time has a positive influence on passengers' intentions to use HSR in China.

The fifth external factor was frequency. Service frequency is a determining factor for passengers to choose HSR (Behrens & Pels, 2012; Dobruszkes, 2011; Pagliara et al., 2012; Park & Ha, 2006). It is likely to be an important factor affecting passengers' intentions to use HSR in China given the high service frequency of HSR, especially in major domestic markets. H9 was thus proposed:

H9: Frequency has a positive influence on passengers' intentions to use HSR in China.

The sixth factor was access. A number of studies found station accessibility significant in passengers' choice of HSR (Cascetta et al., 2011; Chang & Lee, 2008; Jung & Yoo, 2014; Pagliara et al., 2012). In China, passengers generally have quick access to HSR facilities due to the convenient location of HSR stations, which could increase the use of HSR. H10 was therefore proposed:

H10: Access has a positive influence on passengers' intentions to use HSR in China.

This section extends the TPB model with six external factors in order to examine passengers' intentions to use HSR in China. The next section develops an expanded TPB model for the intention to use LCCs in China. Although focusing on different transportation modes, the two models shared important similarities, such as in the use of ground theory and factor selection, making it possible for model comparison during the process of data analysis.

Constructs Influencing Passengers Intentions to Use LCCs

The expanded TPB model contained both the original components of the TPB and external factors. This section justifies the addition of external factors to the TPB model. A wide range of factors, such as price, airline reputation, and service quality affected passengers' choice toward LCCs (Buaphiban, 2015). As the literature review showed, a knowledge gap exists in understanding the factors that influence passengers' decisions to use LCCs in China. The factor selection aimed to fill the gap, considering both prior research and factors specific to the LCC context in China. Six external factors - price, service quality, uncertainty avoidance (cultural influence), frequency, access, and technology self-efficacy were included in the TPB model. This section provides the operational definitions of both the original components of the TPB and external factors in the LCC context.

Price. The first external factor considered was price, which referred to ticket price in this model. The price of LCCs associates closely with the cost leadership strategy. LCCs provide only the basic air transport service, which significantly lowers their costs. As such, LCCs are able to offer low fares, which are 40-60% lower than typical FSC fares (Lawton, 2002; O'Connell & Williams, 2005). The low-cost, low-fare strategy allows LCCs to compete with FSCs, gaining increasing market share globally (Oliveira, 2008).

Price is often the most important factor for passengers to choose LCCs over FSCs (Chang & Sun, 2012; Chen & Wu, 2009; Forgas et al., 2010; Jung & Yoo, 2014; O'Connell & Williams, 2005; Ong & Tan, 2010). The dominant effect of price on LCC passengers is evident in all markets. Ong and Tan (2010) investigated determining factors in the choice between incumbent Malaysia Airlines and low-cost AirAsia. The study found fares significant in airline choice. It revealed that respondents (N=316) who valued airfares had about 44% greater tendency to travel by AirAsia (Ong & Tan, 2010). In a similar study, Sai, Ekiz, and Kamarulzaman (2012) determined factors that influenced the choice of FSCs and LCCs in Malaysia. Using a survey methodology (N=376), the study indicated that LCC passengers in Malaysia placed emphasis on low price, which reconfirmed the popular perception that passengers choose LCCs only because of price. In addition, over 70% of the LCC respondents were below the age of 30, suggesting that among the younger age group, the price was a main determinant in the choice of LCCs (Sai et al., 2012).

Some studies examined the effect of price on LCC passengers' behaviors. Davison and Ryley (2010) examined European destination preferences and price sensitivity in LCC passengers in the United Kingdom. It was found that the majority of the respondents (N=392) were sensitive to price increase. Specifically, the study showed that a EU50 rise in total airfare would make most respondents (63%) fly less frequently (Davison & Ryley, 2010). In another study, Chen and Wu (2009) investigated how service and price of low-cost travel would affect passengers in Taiwan. The result of the survey (N=315) suggested that price was important for non-business passengers, and these passengers were more willing to trade-off service attributes with airfares compared to business travelers (Chen & Wu, 2009).

Different views exist on whether price has remained the dominant factor for passengers to choose LCCs, given the changing market conditions (Kim & Lee, 2011).

Assaf (2009) indicated that, due to the increasing competition in the airline market, airlines have lowered prices to match competitors' fares in order to attract passengers. Therefore, price may not be a prominent factor in choosing an airline, even for LCCs (Kim & Lee, 2011). A study of airline choice in South Africa suggested that price alone was unlikely to be an effective basis for airline competition in South Africa where three LCCs were in operation (Campbell & Vigar-Ellis, 2012). According to the study, passengers were not prepared to sacrifice either safety or punctuality for price, indicating a reduced influence of price on LCC passengers. Instead, LCC passengers looked for value, which is a mix of multiple attributes including product, price, accessibility, promotion, process, and people (Campbell & Vigar-Ellis, 2012).

There appears to be a new trend of LCCs combining low-fares with other market strategies such as service improvement to attract new passengers, especially business passengers. While business travelers often differ from leisure travelers in the way they are influenced by price and service factors (Fourie & Lubbe, 2006; Milioti, Karlaftis, & Akkogiounoglou, 2015), a number of studies showed that LCCs have become a viable option for business travelers (Evangelho, Huse, & Linhares, 2005; Mason, 2000, 2001), especially in domestic, short-haul markets (Fourie & Lubbe, 2006; Mason, 2001).

Successful LCCs have built up their business rigidly on the low-cost, low-fare principles (Lawton & Solomko, 2005; Liang & James, 2011). A wealth of literature shows that low price has remained the major factor for passengers to choose LCCs in all geographical markets. Price is highly relevant to this study due to the market condition in China. According to the Civil Aviation Management Institute of China (CAMIC) (2010), leisure passengers account for about half of the Chinese aviation market. These travelers are likely to be price sensitive, and as such are an ideal market segment for LCCs (Fu et al., 2015). The effect of price on LCC use has remained understudied in China. It is therefore important to add price to the TPB model.

Uncertainty avoidance (cultural influence). Culture is the collective programming of the mind that distinguishes the members of one group or society from those of another (Hofstede, 1984). A number of studies investigated culture influence on consumer behaviors (Smith et al., 2013; Yoon, 2009). One related study examined the role of culture in influencing online shopping use, comparing differences across three counties: Norway, Germany, and the United States (Smith et al., 2013). The study tested the Technology Acceptance model in the three contexts, using a SEM methodology. Major findings revealed that, while the relationship between perceived ease of use and behavioral intentions was strong in the U.S., this relationship appeared to be weak in the Norwegian and German samples, indicating the cultural influence on online users' behaviors across the three countries (Smith et al., 2013).

Only limited studies examined cultural impact on consumer behaviors in the transport context. Lee, Jin, Ji, and Yun (2009) compared HSR passengers' ridership experience in Korea and France. The results suggested that, although high-speed trains in Korea and France shared many similarities such as engineering designs, compartment spaces, and average operative speed, passengers in the two countries experienced different levels of ride comfort due to different cultural influence (Lee et al., 2009). In the air transport context, Liu (2012) profiled the international passengers taking the C airline into four ethnic groups - Chinese, Caucasian, Japanese, and Korean - and assessed their cabin service satisfaction. An analysis on the survey data (N=439) indicated varying satisfactions among different ethnic groups. Due to cultural influence, the Caucasian group expressed the highest satisfaction, followed by Koreans and Chinese. The Japanese showed the lowest satisfaction (Liu, 2012).

Because culture can influence a wide range of basic psychological processes (Weber & Hsee, 1999), it is likely to play a role in passengers' intentions to use LCCs. It is especially the case in China, where culture strongly influences individual behaviors (Ambler & Witzel, 2000). It is likely that cultural factors help establish the image of LCCs and passengers' satisfaction in China, consequently determining the passengers' decision for choosing LCCs. Culture is a complex construct containing multiple dimensions. Due to the limited scope of this study, it is impossible to examine the effect of all cultural aspects on passengers' use of LCCs. This study drew upon Hofstede's theory of cultural dimensions, one of the most widely used approaches to the study of culture (Taras, Steel, & Kirkman, 2012), in order to identify the most relevant cultural factor to be included in the expanded TPB model.

Hofstede developed the theory of cultural dimensions in the 1980s for explaining and measuring observed cultural differences between two cultures (Hofstede, 1984; Triandis, 2004). The theory contains five distinct cultural dimensions - the dimension of power distance, the dimension of individualism-collectivism, the dimension of masculinity-femininity, the dimension of uncertainty avoidance, and the dimension of long-term orientation and short-term orientation (Hofstede, 1984, Hofstede & Hofstede, 2005). Among them, the dimension of uncertainty avoidance is most relevant to this study. In its technical term, uncertainty avoidance refers to the extent to which people in a society feel threatened by ambiguity and therefore try to avoid ambiguous situations by providing greater certainty and predictability (Al-Weqaiyan, 1998; Hofstede, 1980, 1984, 1985; Thi, 2015). According to Hofstede (1984; 1985), people in high uncertainty avoidance cultures seek stability and predictability, and they are usually uncomfortable with unknown futures. On the contrary, low uncertainty avoidance cultures embrace innovation and new ideas, and they are usually at ease with the unknown and more tolerant of change.

Although different views exist, many studies suggested that Chinese culture is more conservative in risk decisions than Western culture (Cheng, 2010; Weber & Hsee, 1999). The cautious attitude toward risk and uncertainty in China may be associated with the Doctrine of the Mean of Confucianism, which emphasizes maintaining balance and harmony (Ambler & Witzel, 2000). A number of studies involving China used Hofstede's theory of cultural dimensions for cross-cultural analysis (Quintal, Lee, & Soutar, 2010; Zheng, Plaisent, Pecquet, & Bernard, 2015). In a study that compared tourists' information searching behaviors in Australia, Japan, and China, Chinese respondents reported the highest score in uncertainty avoidance, followed by Japan and Australia, indicating a high uncertainty avoidance tendency in Chinese tourists (Quintal et al., 2010). In another study comparing consumers' online shopping behaviors in China and France, Chinese consumers received higher scores in uncertainty avoidance than French consumers (Zheng et al., 2015). The study concluded that the different attitudes toward uncertainty can be explained by the cultural difference between the two countries (Zheng et al., 2015).

From a passengers' perspective, choosing a transportation mode, like choosing any other service, brings a certain degree of uncertainty. Such uncertainty, when associated with LCCs in China, may include the perceived uncertainty of the low-cost concept, the future of LCCs, and even the possible relationship between a low-cost model and flight safety. It is likely that such perceived uncertainty could influence passengers' intentions to use LCCs, especially in a high uncertainty avoidance culture. Chinese consumers, as shown in previous studies, may be more likely to demonstrate such an uncertainty avoidance tendency due to cultural influence. As shown in the literature review, existing research has not examined passengers' intentions to use LCCs in China from a cultural perspective. Therefore, it is meaningful to add the cultural factor of uncertainty avoidance to the model.

Service quality. The third factor considered was service quality. While service-related attributes have often been used to predict passenger choice in FSCs (Ariffin, Salleh, Aziz, & Asbudin, 2010; O'Connell & Williams, 2005), they are rarely used in the LCC context. Indeed, LCCs are often associated with low service quality. Many studies showed that LCC passengers often sacrificed service for low fares (Chen & Wu, 2009). This is especially the case in some European markets where LCC passengers still found service elements such as in-flight service and on-time performance insignificant in their choice between LCCs and FSCs (Mikulić & Prebežac, 2011).

Some studies, however, argued for the importance of service quality in low cost travel (Kim & Lee, 2011). In some markets, service quality could replace price as the most significant factor in choosing an LCC (Lerrthaitrakul & Panjakajornsak, 2014).

Forgas et al. (2010) considered both quality of service and monetary price as key elements for passenger satisfaction toward LCCs. Service quality is particularly important in Asian markets, where there appears to be market space for LCCs that offer low prices and a modicum of above average service (Kim & Lee, 2011; Lawton & Solomko, 2005). While these LCCs still emphasize low cost and low fares, they achieved cost reduction through improving efficiency in their operations rather than reducing services (Saha & Theingi, 2009). In South Korea, LCCs provide a level of service quality comparable to that of FSCs, such as using primary airports, providing complementary in-flight service, and offering seat assignments, while offering lower fares as a strategy tool (Kim & Lee, 2011). Another study indicated that service quality had a significant impact on behavioral intentions of LCC passengers in Taiwan (Yang et al., 2012). The study concluded that LCC passengers cared not only about low price but also about service quality issues (Yang et al., 2012).

Service quality has multiple aspects which may affect LCC passengers in different ways. The SERVQUAL model measures five dimensions of service quality, including Tangible, Responsiveness, Reliability, Assurance, and Empathy (Saha & Theingi, 2009). Many studies used the concept of SERVQUAL for assessing service quality of airlines (Chou, Liu, Huang, Yih, & Han, 2011; Pakdil & Aydin, 2007), including LCCs (Ariffin et al., 2010; Kim & Lee, 2011; Lerrthaitrakul & Panjakajornsak, 2014). In these studies, service quality influenced passengers' intentions both directly or indirectly via satisfaction.

One study investigated relationships between service quality, customer satisfaction, and behavioral intentions in LCC passengers in South Korea (Kim & Lee, 2011). It measured service quality by the five service aspects in the SERVQUAL model. The study indicated that Responsiveness and Tangible were most important in passenger satisfaction, which in turn affected behavioral intentions of LCC passengers. The results revealed the importance of direct and touchable service appeal, which reflected the preferences of LCC passengers in South Korea (Kim & Lee, 2011). Ariffin et al. (2010) identified five service aspects based on the SERVQUAL model, including Caring and Tangible, Reliability, Responsiveness, Affordability, and Visual Attractiveness, and determined the relationships between these service aspects and LCC passengers' satisfaction in Malaysia. The survey results (N=100) revealed that Caring and Tangible were important in explaining passengers' satisfaction with LCCs (Ariffin et al., 2010). In another study, Lerrthaitrakul and Panjakajornsak (2014) employed the SERVQUAL model for examining relationships between LCC service quality and passengers' post-purchase intentions. Passengers flying with LCCs in Thailand were sampled (N=425) by completing an online questionnaire. The results indicated that Assurance, Reliability, and Empathy significantly influenced post-purchase intentions. The study further suggested that LCCs should pay greater attention to on-time performance, customer care, and safety in order to satisfy the needs of their passengers (Lerrthaitrakul & Panjakajornsak, 2014).

Park et al. (2006), however, argued that many airline service studies ignored the effects of individual dimensions of airline service quality, as they only focused on the effect of the five service dimensions of the SERVQUAL. The authors conducted a study investigating relationships among airline service quality, passenger satisfaction, airline image, value, and passengers' future behavioral intentions in Australia. The study measured airline service quality by six dimensions - in-flight service, reservation and ticketing, airport service, reliability, flight availability, and employee service. The results suggested that in-flight service and employee service were the significant drivers of passenger satisfaction, which directly related to pricing, airline image, and passengers' behavioral intentions (Park et al., 2006).

Service quality of LCCs has received growing attention, especially in the Asian markets (Kim & Lee, 2011). Therefore, it is important to add service quality to the TPB model. As shown in the studies reviewed, different aspects of service quality influenced passengers in different ways. The five service dimensions developed by Park et al. (2006) provided useful tools for assessing service quality in the airline industry. Of the five dimensions, this study examined inflight service quality of LCCs in China.

Frequency. The fourth factor considered was flight frequency. Competitive advantage of LCCs derives partially from greater aircraft productivity, which is achieved by using uncongested secondary airports and offering high frequency flights (Gillen & Lall, 2004; Tierney & Kuby, 2008). Southwest Airlines (SWA) maximizes its airplane utilization by minimizing the amount of time their airplanes spend on the ground (Gillen & Lall, 2004; Tierney & Kuby, 2008). During the three-year period between 2000 and 2002, SWA airplanes averaged 2,600 flights per plane per year, nearly twice the industry average (Gillen & Lall, 2004). High frequency has become an effective business strategy for LCCs to compete with FSCs.

On the passenger side, flight frequency appears to have a different impact on passengers' choice between FSCs and LCCs (Evangelho et al., 2005; Fourie & Lubbe, 2006; Mason, 2000, 2001). Flight frequency appears to be an important consideration for business passengers to choose LCCs (Fourie & Lubbe, 2006; Mason, 2001). Mason (2001) examined two groups of business passengers who used LCCs and FSCs in the U.K., respectively. Among other findings, frequency was assigned the highest importance by both groups of travelers. In a similar study in South Africa (Fourie & Lubbe, 2006), two groups of business travelers (those who preferred LCCs and those who preferred FSCs) viewed service attributes such as frequency of flights in different ways.

Another study examined determinants of passenger loyalty in users of FSCs and LCCs (Mikulić & Prebežac, 2011). It found that weekly flight frequencies were significant for FSC users but insignificant for LCC passengers. The study further explained that, because LCC passengers often plan their trips some time in advance to obtain low fares, a large number of flights to a particular destination during the week might not be useful for them (Mikulić & Prebežac, 2011).

Given the market characteristics in China, flight frequency could be an important factor affecting passengers' intentions to use LCCs. LCCs such as Spring Airlines use primary airports (Spring Airlines Annual Report, 2015) due to the lack of secondary airports in China (Liang & James, 2011). The capacity restriction and congestion in these airports means that LCCs cannot achieve desired turnaround times (frequency) which are essential to the success of most European and American LCCs (Liang & James, 2011). To what extent flight frequency of LCCs affects passengers' choice has remained unexamined in China. It is therefore necessary to add flight frequency to the TPB model.

Access. The fifth factor considered was airport accessibility. For LCC passengers, airport access is often considered inconvenient because LCCs typically operate from secondary airports far away from the city center in order to save costs and minimize aircraft turnaround times (Gillen & Lall, 2004; Tierney & Kuby, 2008). While in North America and Europe LCCs typically use secondary airports (Fourie & Lubbe, 2006; Tierney & Kuby, 2008), LCCs in emerging markets have started to move away from this strategy. In Brazil and South Africa, LCCs fly to all the major airports (Fourie & Lubbe, 2006). In South Korea, LCCs arrive at and depart from primary airports instead of secondary or regional airports (Kim & Lee, 2011). In South-East Asia, many LCCs find it difficult to use secondary airports in the pattern of European and North American LCCs, due to the different operating environment (Damuri & Anas, 2005).

One study investigated the motivation of SWA passengers in choosing a less convenient, secondary airport (Tierney & Kuby, 2008). The study showed that the respondents were willing to fly through a less convenient airport in exchange for not only lower airfares but also other benefits such as fewer delays and easier ground transport. It also concluded that leisure travel, traveling with family, and frequent flyer membership significantly affected the choice of a less convenient airport (Tierney & Kuby, 2008). Another study found airport access important in passengers' choice of LCCs in Asia (Jung & Yoo, 2014). The study investigated determinants of passengers' intermodal selection among FSCs, LCCs, and HSR in South Korea. It concluded that fares, access time, and journey time significantly influenced passengers' choice behaviors. Specifically, the study showed that business passengers, compared to non-business passengers, perceived higher value of access time and were willing to pay more to shorten access time (Jung & Yoo, 2014).

Airport accessibility was relevant to this study because of the air transport context in China. Due to the lack of secondary airports in China, LCCs, especially Spring Airlines, base their operations in primary airports (Spring Airlines Annual Report, 2015). By doing so, LCCs provide their passengers with efficient access to the airport. The overall effect of airport accessibility on LCC passengers has remained under-examined in China. It is thus important to add airport accessibility to the expanded TPB model.

Technology self-efficacy. The sixth factor considered was technology self-efficacy. Self-efficacy refers to the confidence in an individual's own ability (internal resources) to accomplish a behavior (Armitage & Conner, 1999; Bandura, 1986; Conner & Armitage, 1998). Although Ajzen (1991, 2005) argued that self-efficacy and PBC were synonymous, many researchers view the two as different constructs, with PBC referring to access to necessary resources and opportunities (external resources) to successfully perform a behavior (Armitage & Conner, 1999; Chan, Prendergast, & Ng, 2016; Conner & Armitage, 1998). Within TPB research, a number of studies provided evidence for distinctions between self-efficacy and PBC (Chan et al., 2016; Fen & Sabaruddin, 2008). These studies also revealed relationships between self-efficacy and behavioral intentions, indicating that people intend to engage in behaviors of which they feel they are capable (Conner & Armitage, 1998).

In this study, self-efficacy referred to technology self-efficacy. It was a relevant factor because of the operational characteristics of LCCs. LCCs sell tickets directly to consumers via their websites in order to bypass travel agents and their commissions (Escobar-Rodríguez & Carvajal-Trujillo, 2014). The principle European LCCs such as

Ryanair and EasyJet typically sell more than 90% of their tickets directly through their websites (Koo, Mantin, & O'Connor, 2011). On the contrary, incumbent airlines still rely heavily on travel agents for ticket selling in order to attract business and corporate passengers. As such, LCC passengers need sufficient IT knowledge and skills in order to search for ticket information and purchase tickets online. This raises the question of whether passengers wanting to use LCCs possess the ability to complete technology-related tasks.

Previous studies indicated a strong correlation between learning to use technologies and self-efficacy (Karavidas, Lim, & Katsikas, 2005). For people with a low level of self-efficacy, the probability of using technology was generally reduced (Czaja et al, 2006). One study investigated how self-efficacy influenced the E-ticket buying behavior in Austria (Schreder, Siebenhandl, & Mayr, 2009). It found that low self-efficacy could lead to an active avoidance of using E-ticket machines. It is especially the case with older and middle-aged passengers who avoided ticket machines because of bad experiences, doubt in their own abilities, and distrust with respect to the technology (Schreder et al., 2009). Another study examined online ticketing acceptance levels among airline passengers in Iran (Vakilalroaia & Fatorehchi, 2015). It showed that perceived ease of use in E-ticket purchases had a significant effect on attitudes toward buying tickets online (Vakilalroaia & Fatorehchi, 2015). Self-efficacy positively influenced PBC, which in turn affected the intention to buy tickets online (Vakilalroaia & Fatorehchi, 2015).

In the context of LCCs, several studies showed that a passenger's intention to use LCCs can be affected by the person's technology self-efficacy. Chang and Hung (2013) examined factors affecting the duration of airline passengers to adopt a LCC and their loyalty toward LCCs in Taiwan. Among other findings, booking channels were significant in both adoption duration and customer loyalty. The study suggested that LCCs can increase their probability of adoption and create stronger loyalty in their customers by continuing to upgrade the functions of their booking channels, their ease of use, and the advantages they will confer to passengers using internet booking (Chang & Hung, 2013). Another study investigated the determinants of passenger loyalty toward LCCs and FSCs in Europe (Mikulić & Prebežac, 2011). Among all service components examined in the study, the ticket purchase experience had the strongest impact on service quality perceptions, indicating the importance of convenience and simplicity in collecting information about flights and making reservation (Mikulić & Prebežac, 2011).

The factor of technology self-efficacy became relevant to this study due to the development of e-commerce in China. Internet users in China have grown rapidly, from 111 million in 2005 to 420 million in 2010 (Jun & Jaafar, 2011). In 2009, 85.7% of internet users in China searched for information concerning merchandise through the internet, and 26% of them purchased products on the internet (Jun & Jaafar, 2011). In the first half year of 2016, 14.4% of the internet users in China booked air tickets online (China Internet Network Information Center (CNNIC), 2016). The increase in online shopping means more Chinese passengers will become capable of searching for online information about LCCs and purchasing tickets from LCCs' websites, which could influence the intention to use LCCs. The role of technology self-efficacy in the use of LCCs has received little attention in the literature. It is thus necessary to add this factor to the TPB model. Table 7 shows the operational definitions of the factors in the LCC model. Table 8 summarizes the reviewed studies for the LCC's additional factor selection.

Table 7

Operational Definitions of Study Constructs (LCC model)

Factor	Operational Definition
Attitudes	A passenger's feeling of favorableness or unfavourableness toward LCCs.
Subjective Norms	The social pressure a passenger feels from his/her significant others who desire the individual to use or not use LCCs.
Perceived Behavioral Control	The extent to which a passenger feels able to control the choice of LCCs.
Price	The perception of a passenger about how well the LCC price meets his/her expectations.
Service Quality	A measure of how well the service level that is provided by LCCs matches a passenger's expectation.
Frequency	The perception of a passenger about how well the LCC frequency meets his/her needs.
Access	The perception of a passenger about the efficiency of accessing the airport for taking LCC flights.
Uncertainty Avoidance (Cultural Influence)	A passenger's avoidance of LCCs due to the perceived uncertainty (influenced by culture in China) associated with LCCs.
Technology Self-efficacy	A passenger's own technology competency in order for him/her to search for information about LCCs and purchase a LCC ticket online.

Table 8

Major Studies Reviewed for the Additional Factor Selection (LCCs)

Factor	Market	Findings with regards to the Factor	Reference
Price			
	Malaysia	Fares were significant in passengers' choice toward LCCs.	Ong & Tan (2010)
	Malaysia	LCC passengers placed greatest emphasis on low price. Price was a major determinant among the younger age group (below 30) in the choice of LCCs.	Sai et al. (2012)
	U.K.	LCC passengers were sensitive to price increase.	Davison & Ryley (2010)
	Taiwan	Price was important for non-business passengers, and these passengers were willing to trade-off service with price.	Chen & Wu (2009)
	South Africa	Passengers paid attention to factors such as safety and punctuality in addition to price when selecting LCCs.	Campbell & Vigar-Ellis (2012)
Service Quality			
	Taiwan	Service quality had a significant impact on the behavioral intention of LCC passengers.	Yang et al. (2012)
	South Korea	Five service attributes were assessed. Responsiveness and Tangible were most important in passenger satisfaction, which in turn affected the intention of LCC passengers.	Kim & Lee (2011)
	Malaysia	Five service attributes were assessed. Caring and Tangible were important in explaining passengers' satisfaction for LCCs.	Ariffin et al. (2010)
	Thailand	Five service attributes were assessed. Assurance, Reliability and Empathy significantly influenced post-purchase intentions of LCC passengers.	Lerrthaitrakul & Panjakajornsak (2014)
	Australia	Six service dimensions (in-flight service, reservation and ticketing, airport service, reliability, employee service, and flight availability) were developed for measuring airline service quality. In-flight service and employee service were important in satisfaction, which affected intentions.	Park et al. (2006)

Table 8 (*continued*)

Factor	Market	Findings with regards to the Factor	Reference
Frequency			
	U.K.	Business passengers taking LCCs and FSCs attached similar importance to flight frequency.	Mason (2001)
	South Africa	Two groups of business passengers (those who took LCCs and those took FSCs) viewed service attributes such as flight frequency in different ways.	Fourie & Lubbe (2006)
	Europe	Flight frequency had a significant effect on FSC users but was insignificant for LCC passengers.	Mikulić & Prebežac (2011)
Airport Accessibility			
	South Korea	Access time was significant in passengers' choice involving LCCs, especially for business, short-haul passengers.	Jung & Yoo (2014)
	U.S.	SWA passengers chose a less convenient airport not only because of lower fares but also fewer delays and easier ground transport. Leisure travel, traveling with family, and frequent flyer program significantly affected the choice of a secondary airport.	Tierney & Kuby (2008)
Uncertainty Avoidance			
	Norway, Germany, U.S.	There were significant differences in online shopping behavior across the three cultures, particularly in the relationship between perceived ease of use and behavioral intentions to shop online.	Smith et al. (2013)
	South Korea & France	HSR passengers in the two countries experienced different levels of ride comfort due to cultural influence.	Lee et al. (2009)
	Taiwan	Four ethnic groups expressed different levels of cabin service satisfaction. Caucasian group expressed the highest satisfaction, followed by Koreans, Chinese, and the Japanese showed the lowest satisfaction.	Liu (2012)
Self-efficacy			
	Austria	Low self-efficacy could lead to an active avoidance of using E-ticket machines, especially for older and middle-aged passengers.	Schreder et al. (2009)
	Iran	Self-efficacy positively influenced PBC, which affected the intention to buy airline tickets online	Vakilalroaia & Fatorehchi (2015)
	Taiwan	Booking channels were significant for both adoption duration and customer loyalty in LCC passengers.	Chang & Hung (2013)
	Europe	Ticket purchase experience had the strongest impact on service quality perceptions, indicating the importance of convenience and simplicity when booking for an LCC flight.	Mikulić & Prebežac (2011)

Summary of external factor selection. The prior research provided useful indications of the factors that could affect passengers' choice of LCCs. Taking into account both previous findings and the LCC context in China, this section adds six external factors to the TPB model, including price, service quality, frequency, access, uncertainty avoidance, and technology self-efficacy. The next section develops a theoretical framework and proposes hypotheses for the use of LCCs in China.

Theoretical Framework and Hypotheses (LCCs)

Based on the literature review, this study proposed a theoretical framework for passengers' intentions to use LCCs in China, shown in Figure 5. The independent variables included three TPB components - attitudes, subjective norms, and PBC - and six external constructs - price, service quality, frequency, access, uncertainty avoidance, and technology self-efficacy. The outcome variable was passengers' behavioral intentions to use LCCs in China. Again, this model focused on the impact of the predictors on behavioral intentions instead of actual behaviors. As shown in Figure 5, each predicting variable directly influenced the behavioral intention. In addition, service quality influenced attitudes toward LCCs. Due to the limited scope of this research, the LCC model focused primarily on the direct relationships between the predicting variables and outcome variable. The remainder of this section proposes the hypothesis statements and theoretical framework for the use of LCCs in China.

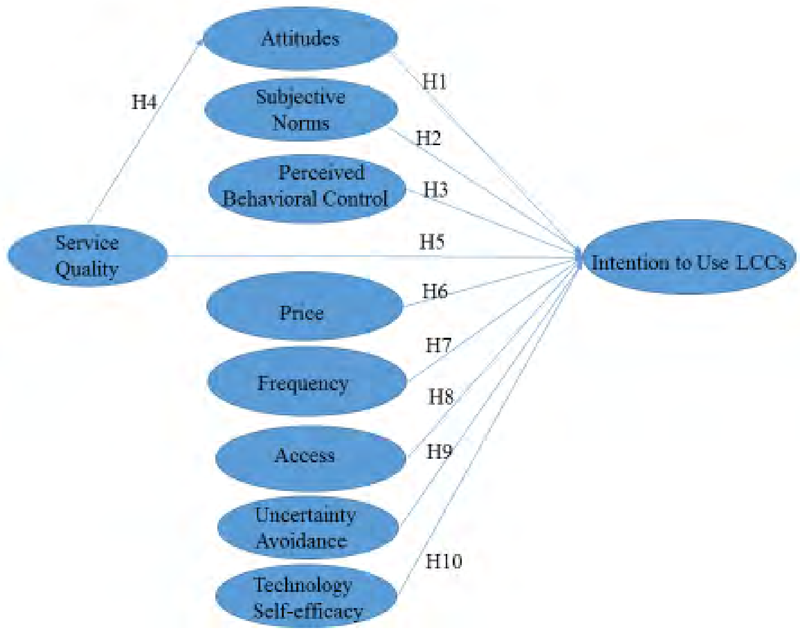

Figure 5. Research theoretical framework and hypotheses (LCCs).

Attitudes are an index of an individual's beliefs about a particular behavior and the assessment of the consequence as a result of engaging or not engaging in the behavior (Rivera, Burley, & Adams, 2009). Attitudes are an important psychological factor influencing public transport use behaviors (Mi & Gulsah, 2014; Zou, Wu, Xiong, & Li, 2013). Attitudes are also an important determinant of passengers' use of HSR (Hsiao & Yang, 2010). Only a small number of studies examined the role of attitudes in the air transport industry. One study suggested that attitudes may not always be a reliable indicator of air travel behaviors when other factors were involved (Davison, Littleford, & Ryley, 2014). Noticeably, a number of studies found that demographical factors significantly influenced passengers' attitudes toward LCCs (Charoensettasilp & Wu, 2013). Given the role of attitudes in air transport, H1 was proposed:

H1: Passengers’ attitudes are positively related to passengers’ intentions to use LCCs in China.

Subjective norms refer to the influence of one’s significant referents (family, friends, and colleagues, among others) on his/her behavior (Ajzen, 1991; Schofield, 1975). While a number of studies found subjective norms useful in explaining behavioral intentions (Yi, Jackson, Park, & Probst, 2006), some studies indicated weak relationships between the two factors (Armitage & Conner, 2001). In the rail context, different views exist about whether subjective norms influenced passengers’ intention to use HSR (Hsu et al., 2006; Jing & Juan, 2013). One study found subjective norms important in passengers’ intentions to use airline websites (Kim, Kim, & Shin, 2009). There is, however, limited research on the relationship between subjective norms and passengers’ intentions to use LCCs. This relationship merits a close examination in China where low-cost travel is uncommon, and opinions of significant others could be important in one’s decision to use LCCs. H2 was thus proposed:

H2: Subjective norms are positively related to passengers’ intentions to use LCCs in China.

PBC reflects the access of resources necessary for performance of a particular behavior (Ajzen, 1991; Armitage & Conner, 1999; Armitage & Conner, 2001; Conner & Armitage, 1998). While studies indicated the importance of PBC in traveling (Yen, Hung, & Liu, 2014; Hsiao & Yang, 2010) and air ticket purchase in Spain (Ruiz-Mafe, Sanz-Blas, Hernandez-Ortega, & Brethouwer, 2013), little research has examined the role of PBC in passengers’ use of airlines. The availability of resources, such as money, time, and opportunity could affect passengers' intentions to use LCCs. Therefore, H3 was proposed:

H3: Perceived behavior control is positively related to passengers' intentions to use LCCs in China.

Although attitudes, subjective norms, and PBC can explain a considerable amount of variance in intentions and behaviors, there is room for improvement. The specific context of this study means context-related factors were required for better understanding the behavioral intention of LCC passengers in China. Six external factors were included in the model, including price, service quality, frequency, access, uncertainty avoidance, and technology self-efficacy.

The first external factor was service quality. Although service quality is often considered less important for LCCs, it has received growing attention (Forgas et al., 2010), especially in the Asian markets (Kim & Lee, 2011; Yang et al., 2012). A number of studies of LCCs showed that service quality directly influenced passengers' behavioral intentions (Lerrthaitrakul & Panjakajornsak, 2014; Yang et al., 2012). There were also studies indicating that service quality mainly affected passenger satisfaction, which in turn influenced behavioral intentions (Forgas et al., 2010; Kim & Lee, 2011). Based on the review of the literature, this study made two hypotheses involving service quality, which were represented by H4 and H5.

H4: Service quality has a positive influence on LCC passengers' attitudes in China.

H5: Service quality has a positive influence on passengers' intentions to use LCCs in China.

The second factor considered was price. Due to lower costs, LCCs can offer fares significantly lower than that of FSCs (Lawton, 2002; O'Connell & Williams, 2005). A large number of studies indicated the dominant impact of price on passengers' choice of LCCs (Chen & Wu, 2009; Forgas et al., 2010; Jung & Yoo, 2014; O'Connell & Willianms, 2005; Ong & Tan, 2010), although some research pointed to a reduced influence of price due to the market change (Assaf, 2009; Kim & Lee, 2011). As a new market trend, business passengers have started to choose LCCs because of the low price (Fourie & Lubbe, 2006; Mason, 2001). Clearly, the low-fare strategy remains significant for LCCs to attract and retain passengers. H6 was thus stated:

H6: Price has a positive influence on passengers' intentions to use LCCs in China.

The third external factor was flight frequency. LCCs gain competitiveness partially through high flight frequency (Gillen & Lall, 2004; Tierney & Kuby, 2008). This strategy, as shown in the literature, affected passengers' perception of LCCs (Evangelho et al., 2005; Fourie & Lubbe, 2006; Mason, 2001; Tierney & Kuby, 2008). In China, LCCs find it difficult to offer high flight frequency due to the lack of uncongested, secondary airports (Liang & James, 2011), which could affect passengers' choice toward LCCs. H7 was thus proposed:

H7: Flight frequency has a positive influence on passengers' intentions to use LCCs in China.

The fourth external factor was access. While traditional LCCs use less convenient, far-away secondary airports in order to save costs, a new generation of LCCs have started to move away from this strategy, especially in the Asian markets (Damuri & Anas, 2005; Kim & Lee, 2011). In China, Spring Airlines use primary airports (Spring

Airlines Annual Report, 2015), providing its passengers with quick airport access. H8 was thus proposed:

H8: Access has a positive influence on passengers' intentions to use LCCs in China.

The fifth external factor was uncertainty avoidance (cultural influence). Culture distinguishes the members of one group of society from others (Hofstede, 1984). A culture factor is relevant to this study because it influences psychological processes and behaviors (Triandis, 2004; Weber & Hsee, 1999) and therefore determines how people make decisions. Cultural influence in the LCC context is under-researched, especially in China where LCCs have a relatively small market share. In this study, uncertainty avoidance, one of the cultural dimensions uncovered by Hofstede (1984), was selected as the cultural factor in the model. This aspect of culture is distinct from subjective norms, an original component of the TPB model, which emphasize peer pressure in performing or not performing a behavior. H9 was stated as:

H9: Uncertainty avoidance is negatively related to passengers' intentions to use LCCs in China.

The last external factor was technology self-efficacy. Self-efficacy refers to a person's internal abilities (e.g., skill and knowledge) as opposed to access to external resources (e.g., opportunity, money, and time) that are required for performing a particular behavior (Armitage & Conner, 1999; Bandura, 1986; Conner & Armitage, 1998). Technology self-efficacy could be an important factor in the use of LCCs because LCC passengers generally need sufficient IT knowledge and skills for acquiring information and purchasing tickets online (Lawton & Solomko, 2005). The lack of self-efficacy, particularly technology-related self-efficacy, could lead to a reduced use of LCCs (Lawton & Solomko, 2005). In China, the number of internet users has grown rapidly (Jun & Jaafar, 2011), which could promote the use of LCCs. H10 was thus stated:

H10: Technology self-efficacy has a positive influence on passengers' intentions to use LCCs in China.

Chapter Summary

This chapter expands the literature- and methodology-related subjects introduced in Chapter I. It achieves two purposes. On the one hand, it identifies major findings related to the gap in the literature specified in Chapter I. On the other hand, it establishes the theoretical framework for passengers' use of LCCs and HSR in China and justifies the selection of additional factors for building the predicting models.

This chapter reviews a wide range of studies with respect to the use of LCCs and HSR. Although some studies examined passengers' choice of LCCs and HSR in China, they failed in providing in-depth analysis on passengers' motivation in using LCCs and HSR. Indeed, substantial gaps exist in understanding passengers' intentions to choose LCCs and HSR in China. The review of the literature also revealed the importance of some factors, such as price, service, and frequency, in passengers' choice of LCCs and HSR. Given the cultural and economic context in China, it remains unclear whether other factors also play a significant role in passengers' mode use behaviors. Clearly, there is a need to examine context-related factors in order to understand passengers' intentions toward HSR and LCCs in China. The review of the literature confirmed the gaps in the knowledge outlined in Chapter I.

This chapter provides an extensive review of the TPB studies and determines that the TPB is a suitable ground theory for the current research. The TPB model was extended with context-related factors for the use of LCCs and HSR, each including the three TPB components and six external factors. The external factor selection was justified based on previous research and the transportation context in China. The next chapter discusses the research design and methodologies used for testing the hypotheses.

CHAPTER III

RESEARCH METHODOLOGY

The goal of this study was to gain a deeper understanding of passengers' intentions to use LCCs and HSR in China. The previous chapter established the academic basis for choosing research methodology and design. This chapter describes the research methods used in this research, including the research approach, research design, population and sample, instrument development, treatment of the data, and ethical issues. It also provides other investigators sufficient methodological information to replicate the study.

Research Approach

This study took a deductive, non-experimental, and survey approach to identify factors that affect passengers' choice of HSR and LCCs in China. Two types of research approaches - deductive and inductive reasoning - are common in social research (Babbie, 2013). Deductive approach moves from general to specific, whereas inductive approach is the opposite of deductive reasoning (Babbie, 2013). The current study developed models based on the TPB and tested the models using empirical data. As such, it followed the path of deductive reasoning.

It is also common to classify research into experimental and non-experimental research (Vogt et al., 2012). An experimental approach is suitable when the research problem is causal, the researcher can manipulate the causal variables of interest, and the researcher can randomly assign cases into experimental and control groups (Vogt et al., 2012). Given that it was not feasible for this author to manipulate the variables and the purpose of this study was to understand passengers' behavioral intentions rather than to identify causal relationships, a non-experimental design was both practical and suitable.

Surveys are the most commonly used research design in the social and behavioral sciences (Vogt et al., 2012). A survey approach best serves the needs of this study for three reasons. First, because this study sought subjective data about the inner states of passengers, such as their attitudes, beliefs, or values (Vogt et al., 2012), it was appropriate to collect the data directly from passengers. It is reasonable to believe that passengers would honestly discuss their travel experience and factors affecting their decisions to take HSR or LCCs. Second, the adequacy of SEM measurement models in behavioral research depends on their ability to accurately represent the responses of participants to measurement items (Chin, Peterson, & Brown, 2008). As such, the quality of data is important in SEM studies. Surveys conducted anonymously provide an avenue for more honest and unambiguous responses than other types of research methodologies, especially if it is clearly stated that survey answers will remain completely confidential (Yusuf & Shafri, 2013). Third, the present study sought a broader view on factors affecting passengers' use of HSR and LCCs, and a survey can provide this broad capacity and useful description of the characteristics of a larger population (Babbie, 2013). A survey focuses on groups instead of individuals (Babbie, 2013). It combines the answers of individual respondents in statistical computing steps to construct statistics describing a more abstract, larger entity (Groves et al., 2009). As such, the survey method can increase the generalizability of the findings.

Research Design

The present study used a cross-sectional survey design, followed by a quantitative analysis. It employed a SEM technique for data analysis.

A research design can be quantitative, qualitative, or a combination of both (Azorín & Cameron, 2010). Quantitative research is informed by objectivist epistemology and thus seeks to develop explanatory universal laws in social behaviors by statistically measuring what it assumes to be a static reality (Yilmaz, 2013). Qualitative methods, on the other hand, are based on a constructivist epistemology and explore what it assumes to be a socially constructed dynamic reality through a framework that is value-laden, flexible, descriptive, holistic, and context sensitive (Yilmaz, 2013). The two designs differ in terms of generalization (Polit & Beck, 2010). Generalization is a major goal for a quantitative study, while the goal of most qualitative studies is not to generalize but rather to provide a rich, contextualized understanding of human experience (Polit & Beck, 2010). Because this research aimed to identify factors affecting passengers' mode use intentions through numerical evidence and generalize the results to a larger population, a quantitative design was appropriate.

There were predicting variables and outcome variables in this quantitative study. For the HSR model, the predicting variables included attitudes, subjective norms, PBC, trust, price, service quality, total travel time, frequency, and access. For the LCC model, the predicting variables included attitudes, subjective norms, PBC, uncertainty avoidance, price, service quality, frequency, access, and technology self-efficacy. The outcome variables were passengers' intentions to use HSR and passengers' intentions to use LCCs.

A cross-sectional design involves observations of a sample of a population at one point in time (Babbie, 2013). For the present study, a cross-sectional design was utilized to record useful information about passengers without manipulating the study environment. The information collected allows for comparison of different population groups and variables at the same time (Babbie, 2013). In addition, the cross-sectional design is least costly in terms of both time and money required (Vogt et al., 2012). This study enabled the collection of passenger characteristics such as age, income, and educational level in relation to the mode use intention with little additional cost.

This study followed a survey design. As shown in the literature review in Chapter II, most studies of passengers' choice of LCCs and HSR involved the use of a survey design for gathering passengers' opinions. To investigate the intention to use HSR and LCCs, structured questionnaires were developed for data collection. The survey questions were short, clear, and precise, and they collectively allowed for unambiguous and meaningful answers (Babbie, 2013). The survey conductor distributed the questionnaires to a sample of passengers traveling by HSR in Beijing and Shanghai and a sample of passengers traveling by LCCs in Shanghai and Shijiazhuang. Before using the questionnaires for large-scale surveys, small-scale pilot studies were performed for testing the validity and reliability of the questionnaires.

When the large-scale data became available, a SEM method was employed for data analysis. As the literature shows, SEM is a frequently used method when the study purpose involves examination of relationships between latent constructs (Westland, 2010). As the present research had a similar purpose and the factors of interest were mostly latent variables, SEM was an appropriate method to use.

Research Procedures

The research procedure contained steps such as survey instrument development, sampling, data collection, Institutional Review Board (IRB) process, and data analysis. Figure 6 depicts this procedure. The survey instruments were developed based on the findings of previous studies and the specific context under which the subjects were being investigated. The sample consisted of passengers that used LCCs and HSR in China. Before starting the survey, this researcher submitted the instruments to IRB for review and approval. The survey followed a random sampling method for data collection. Descriptive statistics, factor analysis, and SEM were used to analyze the data and answer the research questions. The level of statistical significance of the models was set at $p < .05$.

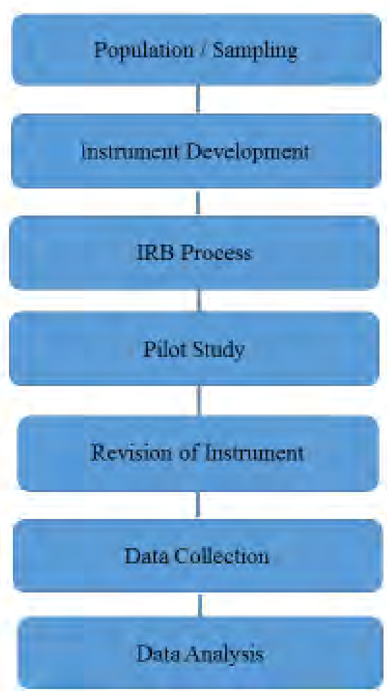

Figure 6. Research procedure.

Population

It is important to distinguish the concepts of target population and sampling frame in this study. A target population is the group of elements for which the survey investigator wants to make inferences by using the sample statistics (Groves et al., 2009). In this research, the target population contained all passengers taking LCCs and HSR in China. It is impossible to collect data from this population due to practical restraints.

A sampling frame is the list or quasi list of elements from which a probability sample is selected (Babbie, 2013). It is the restricted population from which a sample is actually selected (Groves et al., 2009). For this research, the sampling frame consisted of passengers taking LCCs at Pudong International Airport in Shanghai and Zhengding International Airport in Shijiazhuang and passengers taking HSR at South Railway Station in Beijing and Hongqiao Railway Station in Shanghai. The survey administrator selected the actual sample from this sampling frame. It is essential to ensure that passengers at these locations were representative of the population.

Pudong International Airport is the largest airport in Shanghai with over 60 million annual passengers (Shanghai Airport Authority Annual Report, 2015). It is a major hub of Spring Airlines, China's largest LCC (Fu et al., 2015). Although the exact number of LCC passengers in China is unknown, it can be estimated from different sources that Spring Airlines carry over half of China's LCC passengers (Fu et al., 2015; CAAC, 2015; Spring Airlines Annual Report, 2015). Spring Airlines place most of its operations at Hongqiao International Airport and Pudong International Airport in Shanghai (Spring Airlines Flight Schedule, 2016). Of the two airports, Pudong International Airport handles significantly more of Spring Airlines flights (Spring

Airlines Flight Schedule, 2016). In addition, Pudong International Airport hosts another three domestic LCCs and eight international LCCs (Shanghai Airport Authority, 2016), making it a popular airport for domestic and international LCC passengers. Shijiazhuang Zhengding Airport is famous for its effort of attracting LCCs (Hebei Airport Authority, 2016). It is now the regional hub of two important LCCs in China - Spring Airlines and China United Airlines (Spring Airlines Annual Report, 2015; China United Airlines, 2016), with the latter transporting over 6 million passengers in 2014 (China United Airlines, 2016). At present, four LCCs account for nearly 40% of the total passenger traffic at Zhengding International Airport (Hebei Airport Authority, 2016; Wang, 2015). Pudong International Airport and Zhengding International Airport were selected because they host large numbers of LCCs. More importantly, the well-established LCC operations at these airports attract not only local LCC passengers but also large amounts of LCC passengers from other cities domestically and internationally. As such, passengers being surveyed at these locations were likely to represent the LCC population in China.

Beijing and Shanghai are major HSR hubs in the HSR network (Wang, Niu, Chen, Lu, & Tang, 2015). They are also key HSR markets due to their political and economic importance in China (Wang et al., 2015). Beijing South Railway Station is the largest railway station in Beijing (Cheng, 2016). It is the departure station of Jing-Hu HSR, which carries over 100 million passengers annually (Ollivier et al., 2014). Shanghai Hongqiao Railway Station is the largest railway station in China (Shanghai Railway Authority, 2010). With only a walking distance between the HSR station and Hongqiao International Airport, the railway station is an important part of the Hongqiao integrated transportation hub in Shanghai (Shanghai Railway Authority, 2010). Hongqiao Railway Station hosts a number of important HSR lines, including the Jing-Hu line and Hu-Hang line (Shanghai Railway Authority, 2010). Again, large in capacity and the number of HSR lines, Beijing South Railway Station and Shanghai Hongqiao Railway Station attract HSR passengers both locally and from across China, making them representative of the HSR population in China.

Sample

For SEM analysis, sample size is an important consideration because SEM is more sensitive to sample size than other multivariate approaches (Hair, Black, Babin, & Anderson, 2010). As small sample size typically results in poor model fit, SEM research generally requires large sample sizes (Kline, 2011).

Different opinions exist with respect to the minimal sample size for SEM studies. Yuan, Wu, and Bentler (2011) indicated that an appropriate sample size for SEM with ordinal and continuous data should be between 300 and 400, while Iacobucci (2010) suggested that SEM models performed well even with small samples, such as between 50 and 100. Westland (2010) pointed out that many existing methods for determining the minimal sample size for SEM were misleading. The author developed a formula for calculating the lower bound of the sample size for the SEM analysis and then compared the sample sizes actually used in drawing conclusions in 74 research articles with the lower bounds calculated using the newly developed equation (Westland, 2010). The results indicated that, on average, actual sample sizes in these 74 research articles were only 50% of the minimum needed to draw the conclusions the studies claimed (Westland, 2010). Equation 1 shows Westland's formula for calculating the minimal sample size for SEM studies (Westland, 2010):

$$n = \frac{1}{2H}\left(A\left(\frac{\pi}{6} - B + D\right) + H\right.$$
$$\left. + \sqrt{\left(A\left(\frac{\pi}{6} - B + D\right) + H\right)^2 + 4AH\left(\frac{\pi}{6} + \sqrt{A} + 2B - C - 2D\right)}\right) \quad (1)$$

Where :

$A = 1 - \rho^2$.

$B = \rho \arcsin(\frac{\rho}{2})$.

$C = \rho\ arcsin\ (\rho)$.

$D = A / \sqrt{3 - A}$.

$H = (\frac{\delta}{z_{1-\frac{\alpha}{2}} - z_{1-\beta}})^2$.

Equation 1 was used for determining the minimal sample size for the LCC and HSR models. Due to the complexity of the calculation, an online sample size calculator was used for performing the actual calculation. Setting the effect size at 0.2, the statistical power level at 0.8, and using 10 latent variables and 38 observable variables for each model, the calculator yielded a minimal sample size of 475 for each model.

Because this study aimed to generalize the results to a broader population, it is important that the sample was representative. A simple random sampling technique was used to increase the representativeness of the sample. This method gives each member of the population an equal probability of being selected for inclusion in the sample, and this equal probability means that the sample is representative of the population (Vogt et al., 2012). Passengers waiting for boarding at the selected airports and railway stations in

Shanghai, Beijing, and Shijiazhuang were randomly selected for participation in the survey. To achieve this, a marketing firm was hired that had a permit for distributing and collecting questionnaires in these areas. The random sampling process is explained in detail in the following section. In total, 260 respondents in Beijing South Railway Station and 260 respondents in Shanghai Hongqiao Railway Station participated in the survey. For the LCC survey, 360 respondents in Shanghai Pudong International Airport and 260 respondents in Zhengding International Airport filled out and returned the questionnaire. Figure 7 shows the sample size and locations for data collection.

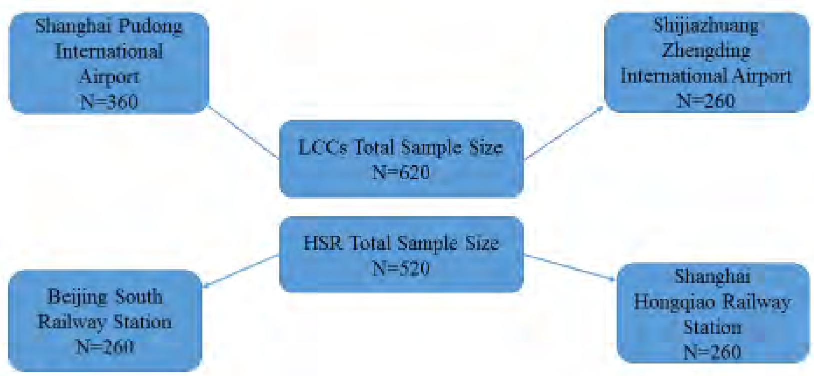

Figure 7. Sample size and locations.

Sources of the Data

Data collected by the survey questionnaires became the source of quantitative data for this study. This section explains the issues related to the source of data, including the mode, setting, and time of the survey, and the data collection procedures.

Mode. There are three modes of administering a survey: face-to-face, telephone, and self-administration (Babbie, 2013). This study used a face-to-face mode of survey administration for two reasons. First, because many questions in the questionnaires asked for passengers' perceptions of various aspects of LCCs and HSR, it is likely that participants would require clarification. A face-to-face mode of survey administration would allow the data collector to interact with participants and provide clarification when there is a need (Vogt et al., 2012). Second, a face-to-face survey can be effective for obtaining a large sample. The typical response rate for a survey is less than 20% (Vogt et al., 2012). Such a low response rate makes it difficult to generalize the result. By directly interacting with potential respondents, data collectors can increase the response rate.

Setting. There were four survey locations: Shanghai Pudong International Airport, Shijiazhuang Zhengding International Airport, Beijing South Railway Station, and Shanghai Hongqiao Railway Station. These locations were selected to ensure that survey participants would have some travel experience to provide useful information about their travel intentions. The data collection took place at the boarding areas of these locations. Doing so ensured that respondents had enough time and a hassle-free environment to complete the questionnaires. To serve the research purpose, the survey administrator only collected survey data from Chinese passengers traveling by LCCs and HSR.

Shanghai Pudong International Airport served about 100 airlines and 60 million passengers in 2015 (Shanghai Airport Authority, 2016). It hosts four domestic LCCs -

Spring Airlines, China United Airlines, China West Air, and Chengdu Airlines - and eight international LCCs including Jinair, Eastar Jet, Cebu Pacific, and Peach Aviation (China United Airlines, 2016; Shanghai Airport Authority, 2016). The data collection took place at randomly selected boarding gates for LCC flights on the day of the survey. Shijiazhuang Zhengding International Airport, located in the Hebei province, is a major airport close to Beijing (Hebei Airport Authority, 2016). At present, the airport hosts 17 airlines, including three domestic LCCs - Spring Airlines, China United Airlines, and China West Air (Hebei Airport Authority, 2016). The data collection took place at randomly selected boarding gates for LCC flights on the day of the survey.

The survey administrator collected 360 questionnaires from Pudong International Airport and 260 questionnaires from Zhengding International Airport. The survey covered seven LCCs operating from the two airports. The passengers participating in the survey came from 28 provinces or direct-controlled municipalities, and they were traveling to 22 destinations at the time of the survey. Chapter IV explains the passenger demographics in more detail.

Beijing South Railway Station is China's first rail terminal dedicated to HSR service (China National Railway Authority, 2014). It has five floors, with the boarding areas located at the second floor (China National Railway Authority, 2014). The boarding areas provide 5,000 seats and consist of several sub-areas for passengers taking JingJin HSR trains, JingHu HSR trains, and other HSR trains (Beijing Youth Daily, 2015). Data collection took place at these sub-areas. Shanghai Hongqiao Railway Station operates a number of busy HSR lines that connect Shanghai with major domestic cities such as Beijing and Hangzhou (Shanghai Railway Authority, 2010). With a total area of 1.3 million square meters, Hongqiao Railway Station covers five floors (GongJiao.com, 2014). The departure hall, which can accommodate more than 10,000 passengers, is located on the second floor (Gongjiao.com, 2014). Data collection took place in this area.

The survey administrator collected 260 questionnaires from Beijing South and 260 questionnaires from Hongqiao Station. The survey covered several important HSR lines, including Jing-Hu HSR line and Hu-Hang HSR line. Because of the large number of intermediate stops on these lines, passengers being surveyed covered a wide range of geographic markets. The HSR respondents came from 27 provinces and direct-controlled municipalities, and they were traveling to 10 destinations at the time of the survey. The passenger characteristics are explained in more detail in Chapter IV.

Time. After receiving the approval from the IRB, this researcher conducted pilot studies for HSR and LCCs and revised the questionnaires based on the result. It is important that the questionnaires met the reliability and validity requirement. The revised questionnaires were used in the formal survey, which took place in February and March of 2017.

Procedures. Boarding gates at the airports and railway stations were randomly selected for the survey to take place. Before conducting the survey, the team from the marketing firm hired for the survey tasks received a 2-hour training session for interacting with survey participants, answering possible questions, and following the required data collection process. During the formal survey, two survey administrators were responsible for distributing the questionnaires and collecting the completed questionnaires at the survey locations. They followed a four-step procedure to administer the survey. Figure 8 depicts the data collection procedure.

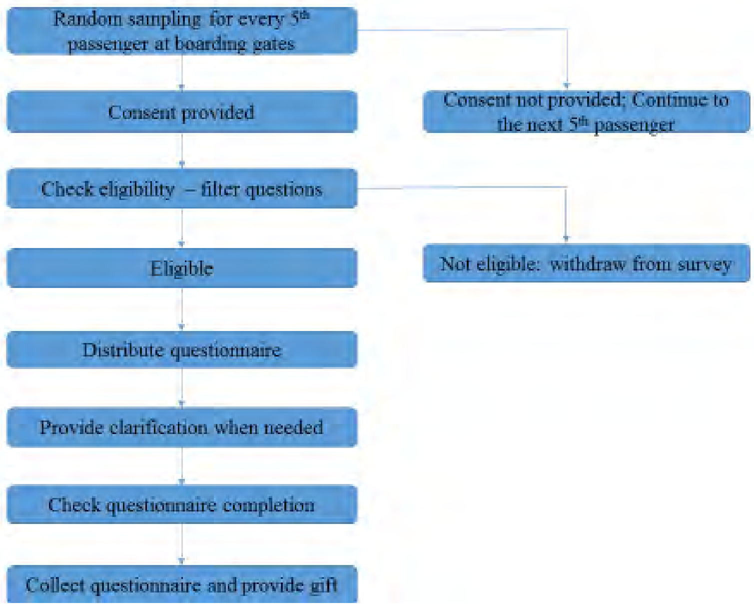

Figure 8. Data collection procedure.

First, once in the sampled boarding gate, two administrators divided the area into two halves to conduct the survey separately. Second, one of them selected the first passenger from the extreme left of the area and provided him or her with the questionnaire. After finishing with the first passenger, the administrator counted five more passengers to the right, and took the 5th passenger for the survey. Once the survey for this passenger was completed, the researcher repeated the process by counting another five passengers for the next interview. The other survey administrator followed the same procedure to cover the other half of the boarding area. The method can ensure that the sample was randomly selected, and it was representative of the population. It also prevented the survey administrators from obtaining data from a convenient sample or deliberately avoiding certain types of passengers. Three screening questions (explained in the next section) at the beginning of the questionnaire were used to determine the eligibility of the respondents for participating in the survey. Each respondent needed no more than ten minutes to complete the questionnaire. Third, if the passenger selected did not want to participate, the survey administrator would ask him or her three simple demographic questions - *What is your age range? What is your highest education? How often do you travel by HSR (LCCs) each year*? The information was useful for performing a non-response bias test once the survey was completed. Then, the survey administrator moved on to the next 5th passenger. The sampling process would continue until desired numbers of completed questionnaires were achieved. Fourth, once a sampled passenger completed and returned the questionnaire, the administrator would give him or her a luggage tag. It served as a way to show appreciation and an incentive for other potential respondents to participate in the survey.

In total, the survey team collected 520 and 620 questionnaires from HSR and LCC passengers, respectively. During the data collection process, 68 HSR passengers and 107 LCC passengers declined the invitation to participate in the survey. The non-response rate was 12% for HSR and 15% for LCCs. Chi-square tests were conducted for assessing the non-response bias, and the results indicated no significant difference between respondent and non-respondent groups for both HSR and LCC surveys.

Two rounds of data cleaning were conducted. The initial one identified and eliminated cases with missing data, which reduced the sample to 484 for HSR and 596 for LCCs. The second data cleaning was conducted at the phase of CFA using AMOS for assessing normality and outliers. All the cases in the sample met the normality requirement and no outliers were identified. Thus, the final sample for the CFA and SEM analysis was n=484 for HSR and n=596 for LCCs.

Data Collection Device

The survey instruments in this study were two questionnaires each including five sections for HSR and LCC passengers, respectively. Section 1 contained three screening questions - *Are you a Chinese passenger? Are you eighteen years or older?* and *Are you leaving Shanghai (Shijiazhuang) by LCCs or leaving Beijing (Shanghai) by HSR?* The purpose of the screening questions was to ensure the eligibility of participants. The information was obtained by asking yes-no questions. Eligible participants must be Chinese, eighteen years or older, and leaving Shanghai or Shijiazhuang by LCCs or leaving Beijing or Shanghai by HSR. Section 2 sought passenger demographic information, such as age, education level, income level, and occupation. The information was collected by using categorical questions. For example, age was indicated by six values, including 20 or younger, 21-30 years, 31-40 years, 41-50 years, 51-60 years, and older than 60 years (Buaphiban, 2015). Section 3 collected information on passengers' travel experience, such as travel frequency, purpose, and destination. The questions were designed such that they offered respondents unordered response categories.

Section 4 and 5 assessed the factors (constructs) that may influence passengers' intentions to use HSR or LCCs. Many of these constructs, as discussed in Chapter II (summarized in Table 6 and 8), have been used in prior studies. Measurement instruments were used for measuring the constructs. At least three question items were used to assess each construct (Hair et al., 2010). Many measurement items in this study were borrowed from previous studies, with some modifications to better reflect the context of this study. Table 9 and 10 show the sources for the measurement instruments. Appendix C1 and C2 show the same content in more detail. Based on the question items, survey participants were asked to rate the constructs using a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The item format devised by Likert is one of the most commonly used formats in contemporary questionnaire design (Babbie, 2013). It allows study participants to provide information based on the unambiguous ordinality of response categories (Babbie, 2013).

Table 9

Sources for Study Construct Measurement (HSR Model)

Constructs	Number of Indicators	Sources
Attitudes	3	Al Ziadat, 2015; Hsiao & Yang (2010); Liu et al. (2013); Taylor & Todd (1995)
Subjective Norms	4	Jing et al. (2014); Jalilvand & Samiei (2012); Liu et al. (2013); Taylor & Todd (1995)
PBC	4	Hsiao & Yang (2010); Liu et al. (2013); Jing et al. (2014);
Price	4	Chou & Yeh (2013); Kuo et al. (2013); Self-designed
Trust	3	Fang et al. (2009); Forgas et al. (2010); Hsiao & Yang (2010); Tsai, Chin, & Chen (2010); Self-designed
Frequency	4	Park et al. (2006); Self-designed
Access	4	Chou & Kim (2009); Self-designed
Total Travel Time	4	Kuo et al. (2013); Harvey et al. (2014); self-designed
Service Quality	4	Chou & Kim (2009); Harvey et al. (2014); Wen, Lan, & Cheng (2005); Self-designed
Behavioral Intention	4	Al Ziadat, 2015; Chou & Kim (2009); Kuo & Tang (2011); Taylor & Todd (1995)

Table 10

Sources for Study Construct Measurement (LCC Model)

Constructs	Number of Indicators	Sources
Attitudes	3	Al Ziadat, 2015; Liu et al. (2013); Taylor & Todd (1995)
Subjective Norms	4	Liu et al. (2013); Jing et al. (2014); Jalilvand & Samiei (2012); Taylor & Todd (1995)
PBC	3	Hsiao & Yang (2010); Jing et al. (2014); Liu et al. (2013)
Price	4	Liu & Lee (2016); Park et al. (2006); Self-designed
Uncertainty Avoidance	3	Quintal et al. (2010); Self-designed
Frequency	3	Park et al. (2006); Self-designed
Access	4	Chou & Kim (2009); Self-designed
Technology Self-efficacy	4	Taylor & Todd (1995)
Service Quality	3	Park et al. (2006); Self-designed
Behavioral Intention	3	Al Ziadat, 2015; Chou & Kim (2009); Kuo & Tang (2011); Taylor & Todd (1995)

In Sections 4 and 5, item indicators were developed for assigning items to designated constructs. For the HSR questionnaire, attitudes consisted of three items and were measured by AT1, AT2, and AT3. Subjective norms consisted of four items and were measured by SN1, SN2, SN3, SN4. Perceived behavioral control consisted of four items and was measured by PBC1, PBC2, PBC3, and PBC4. Price consisted of four items and was measured by PR1, PR2, PR3, and PR4. Trust consisted of five items and was measured by TR1, TR2, TR3, TR4, and TR5. Access consisted of four items and was measured by AC1, AC2, AC3, and AC4. Frequency consisted of four items and was measured by FR1, FR2, FR3, and FR4. Total travel time consisted of four items and was measured by TT1, TT2, TT3, and TT4. Service consisted of five items and was measured by SQ1, SQ2, SQ3, SQ4, and SQ5. Behavioral intention consisted of five items and was measured by BI1, BI2, BI3, BI4, and BI5.

For the LCC questionnaire, attitudes consisted of four items and were measured by AT1, AT2, AT3, and AT4. Subjective norms consisted of four items and were measured by SN1, SN2, SN3, SN4. Perceived behavioral control consisted of five items and was measured by PBC1, PBC2, PBC3, PBC4, and PBC5. Price consisted of four items and was measured by PR1, PR2, PR3, and PR4. Uncertainty avoidance consisted of three items and was measured by UA1, UA2, and UA3. Access consisted of five items and was measured by AC1, AC2, AC3, AC4, and AC5. Frequency consisted of four items and was measured by FR1, FR2, FR3, and FR4. Technology self-efficacy consisted of four items and was measured by SE1, SE2, SE3, and SE4. Service consisted of four items and was measured by SQ1, SQ2, SQ3, and SQ4. Behavioral intention consisted of six items and was measured by BI1, BI2, BI3, BI4, BI5, and BI6.

The questionnaires were developed in English and then translated into Chinese for use in the Chinese market. It was essential to ensure that the translation accurately retained the meaning of the English version of the questionnaire. A back-translation method was used (Wild et al., 2005) as a quality assessment tool to ensure the accuracy of the translation. This researcher translated the initial questionnaire from English to Chinese and asked academic experts whose first language is Chinese to review the translated version. Then, a translator who had no knowledge of this study (Wild et al., 2005) translated the Chinese version of the questionnaire back to English. The two English versions were compared to make sure the difference was not significant.

After developing the questionnaires and obtaining the approval from the IRB, this researcher conducted pilot studies for the HSR and LCC models, respectively. A small sample (50 responses) was used for the pilot study for each mode. Cronbach's alpha, with 0.7 being the lower limit of acceptability (Hair et al., 2010), was used for testing the reliability of the question items. The questionnaires were revised based on the result before being used for the formal surveys. Table 9, Table 10, Appendix C1 and C2 show item indicators used in the revised HSR and LCC questionnaires for collecting large-scale survey data.

Instrument reliability. Because the present research used modified scales for measuring the factors in the expanded TPB models, it is important to test the reliability of the instrument. In simple words, reliability addresses the question of whether respondents are consistent or stable in their answers (Groves et al., 2009). This study took three measures to ensure the reliability of the scales.

First, it is important to make the survey questions simple, clear, and relevant. This study investigated behavioral intention, which is a subtle and complicated issue. When such a topic presents, it is likely that a person arrives at a different interpretation of the question when being asked a second time (Babbie, 2013). Therefore, it is essential to avoid ambiguity in the question design and ask relevant things the respondents are likely to know the answer to, in order to create reliable measures (Babbie, 2013).

Second, the instrument used multiple items for assessing the same underlying construct. This measure is particularly important when the survey measures subjective states (Groves et al., 2009). Reliability is a concern when a single observer is the source of data because there is no certain guard against the impact of that observer's subjectivity (Babbie, 2013). For each construct in the HSR and LCC models, at least three questions were asked for a reliable assessment.

Third, pilot studies were conducted and Cronbach's alpha was used for testing the reliability of the multi-item scales. Cronbach's alpha is the most widely used measure for assessing the consistency of the entire scale (Hair et al., 2010). A high value of Cronbach's alpha implies high reliability or low response variance whereas a low value can indicate low reliability or that the items do not really measure the same construct (Groves et al., 2009). This study compared the resulting values against a basic Cronbach's alpha level of 0.7. Hair et al. (2010) suggested that Cronbach's alpha ranges from 0 to 1, with values of .60 to .70 deemed the lower limit of acceptability. In the current research, items with Cronbach's alpha lower than .70 were revised or removed. For the HSR questionnaire, an initial pilot study involving 50 respondents revealed some low Cronbach's alpha values, indicating inconsistency among scales measuring the same construct. The problematic scales were identified, reworded or removed to improve the overall Cronbach's alpha scores. The second pilot study (n=50) showed satisfactory reliability of the HSR instrument. The revised questionnaire was then used for the large-scale survey. Similarly, the initial pilot study (n=50) for the LCC instrument revealed low Cronbach's alpha values associated with some scales, indicating poor reliability of these scales. After rewording or deleting these scales, the second pilot study was conducted and the result indicated adequate instrument reliability. The revised questionnaire was then used for collecting large-scale data for the LCC model.

Although reliability promises that all the items of the scale consistently measure the same thing, it does not ensure that the items actually measure what they are supposed to measure (Babbie, 2013). Reliability is a necessary but insufficient condition for a safe application of a measure (Babbie, 2013). The measure must also be valid.

Instrument validity. Validity is the extent to which the survey measure accurately reflects the intended constructs (Groves et al., 2009). Two types of validity were assessed in this research - face validity and construct validity.

Face validity refers to the extent to which a scale looks like it measures what it is intended to measure (Babbie, 2013). In this study, expert review and users' feedback provided judgement about the face validity of the instruments. The survey instruments were reviewed by two external experts to ensure that the information collected met the objectives of the survey. Specifically, the experts reviewed the wording of the questions, the structure of the questions, and the response alternatives to provide insights into question problems, breakdowns in the question-answering process, and other potential measurement errors (Olson, 2010).

In addition to opinions of external experts, three LCC passengers and three HSR passengers were recruited to fill out the questionnaires in order to provide empirical feedback. These passengers were asked to identify ambiguities and difficult questions. Such questions were reworded or, if they were deemed unnecessary, were discarded. It is important that the answers of these passengers provided required and relevant information. If this was not achieved, the researcher would re-word the questions that were not answered as expected. The researcher also recorded the time taken to complete the questionnaires and decided whether it was reasonable.

It is important to ensure that the experts and users fully acknowledged and understood the operational definitions of the constructs in order for them to provide accurate judgment. Although face validity is a less scientific approach to assess the validity of the instruments, it provides useful opinions of whether the measure is valid “on its face”, regardless of its accuracy (Babbie, 2013). As suggested by Hair et al. (2010), it is important to establish face validity prior to any theoretical testing when using CFA, which was one of the primary analytical methods used in this research.

Construct validity is based on the logical relationships among variables (Babbie, 2013). It is the extent to which a set of measured items actually reflects the theoretical latent construct those items are designed to measure (Hair et al., 2010). This study used CFA to test the construct validity of the instruments. According to Hair et al. (2010), one of the primary objectives of CFA is to assess the construct validity of a proposed measurement theory.

Ethical Issues

Ethical concerns in survey research are relatively minor as compared with either participant observation or experiments that require more direct contact and interaction with people being studied (Babbie, 2013). However, survey research involves a request that people provide information about themselves that is not readily available (Babbie, 2013). As such, ethical issues were important in the present research. This study addressed the ethical considerations concerning the following five aspects, each containing measures to protect participants.

Voluntary consent

1. The researcher provided an explanation in writing at the beginning of the questionnaire disclosing the nature of the research and its purpose. The survey followed a face-to-face data collection method. Before agreeing to participate, potential respondents were free to seek clarification from the survey administrator.
2. Potential respondents were free to decide if they wanted to participate in the survey.
3. The survey administrator provided a form of informed consent for potential respondents' signature before they participated in the survey.

Protection from harm

1. Because this study focused on passengers' behavioral intentions, it asked survey questions about passengers' attitudes, beliefs, and values. It is important for the researcher to be sensitive in the question design.
2. Participants were free to skip any question they did not want to answer. The survey administrator would not insist upon an answer when a participant was reluctant to give one (Vogt et al., 2012).
3. The questionnaire can be completed within a reasonable timeframe. The survey administrator informed potential respondents the time needed for completing the questionnaire, in order for them to avoid any delay that could be caused by participating in the survey.

Privacy

1. No personal identifiers were required during the data collection process. The questionnaires only collected general demographic information. The survey administrator ensured that respondents' identities were not identified through these characteristics (Vogt et al., 2012).
2. The survey administrator kept the data as confidential information in password-protected computer systems (Vogt et al., 2012).

IRB

1. As required by the IRB, all research involving human subjects must be reviewed and approved by the IRB prior to initiation of the research (Embry-Riddle Aeronautical University, 2016). The purpose is to protect the rights and welfare of human research participants and ensure the proposed research follows ethical principles of the Belmont Report (Embry-Riddle Aeronautical University, 2016). For this research, an application was submitted to the IRB at Embry Riddle Aeronautical University to ensure that the survey instruments and data collection procedure met the ethical requirement. The data collection did not commence until the IRB approved the application.
2. Because the survey took place in China, the researcher submitted the survey questionnaires to Central University of Finance and Economics in Beijing for review. The relevant department of the university reviewed the questionnaires and issued a letter supporting the use of the questionnaires in China.

3. As a student of Embry-Riddle Aeronautical University, this researcher completed the IRB training before conducting research using human participants, as required by the university policy.

Treatment of the Data

This study used structural equation modeling (SEM) as the primary analytical method. SEM is a statistical methodology that takes a confirmatory approach to the analysis of a structural theory bearing on some phenomenon (Byrne, 2010). This researcher selected the SEM method for two reasons.

First, SEM can deal with a more structural and complex model (Nachtigall et al., 2003; Schreiber, 2008), which is suitable for this study. Both HSR and LCC models in this study were complex models containing 10 hypothesized relationships. SEM is superior compared to other research methods when the interrelationship among variables is complex (Nachtigall et al., 2003).

Second, while logit regression is commonly used for predicting an outcome variable (categorical) from predictor variables (continuous and/or categorical) (Field, 2009), SEM focuses more on interrelationships between variables and how a pre-estimated model fits the data (Schreiber, 2008). As the purpose of this research was to find out how and to what extent the selected factors affected passengers' use of HSR and LCCs in China, SEM was a more suitable method. As the literature shows, a number of studies employed the SEM technique for examining passengers' intentions and behaviors in choosing a transportation mode (Chiou & Chen, 2010; Chou & Kim, 2009; Forgas et al. (2010); Hsiao & Yang, 2010; Kuo & Tang, 2013; Saha & Theingi, 2009).

SEM consists of a structural model representing the relationship between latent variables of interest and measurement models representing the relationships between latent variables and their manifest or observable indicators (Byrne, 2010). There were three steps in the data analysis of this research.

Descriptive statistics. As the first step in the data analysis, descriptive statistics were conducted to describe the main features of the survey data (Babbie, 2013). Because this study involved human subjects, description of passenger demographics and travel experience was performed. In addition, mean values of the scales measuring individual constructs were also calculated. The results of the descriptive statistics were summarized using tables and graphs. These summaries formed the basis for the subsequent, more extensive statistical analysis. During the data collection process, the survey administrator obtained simple demographic information from those who declined to participate in the survey. The information was used for determining non-response bias, which can arise if non-respondents differed from respondents in general characteristics (Whitehead, Groothuis, & Blomquist, 1993). The measure can help assess the generalizability of the survey results (Whitehead et al., 1993).

Confirmatory factor analysis (CFA). The second step in the data analysis was confirmatory factor analysis (CFA). According to Byrne (2010), CFA is appropriately used when the researcher has some knowledge of the underlying latent variable structure so he can postulate relations between the observed measures and the underlying factors a priori and then test this hypothesized structure statistically. As the literature provided indications of factors that could influence passengers' choice of HSR and LCCs, and the TPB provided a theoretical framework for this research, it was appropriate for the researcher to perform a CFA for validating the measurement model.

Before running a CFA, it is necessary to check for the extent and pattern of missing data (Hair et al., 2010). Statistical Package for the Social Sciences (SPSS) provides the function for this task. Hair et al. (2010) suggested that missing data must be addressed if the missing data are in a non-random pattern or more than 10% of the data items are missing. In the present study, 36 HSR questionnaires and 24 LCC questionnaires were incomplete, which represented 7% and 4% of the total HSR and LCC samples, respectively. These questionnaires were removed from the analysis. As the percentage of missing data was less than 10% in both surveys, no further action was taken in addition to eliminating the incomplete questionnaires from the study.

It is also important to check for normality. Multivariate normality is assumed for most CFA estimation methods (Harrington, 2008). Although it is difficult to assess all aspects of multivariate normality, checking for univariate normality and outliers will detect most cases of multivariate non-normality (Kline, 2005). Looking for significant skew or kurtosis using SPSS is a method for detecting non-normality (Harrington, 2008). Outliers are another concern in the CFA analysis because they could skew the data, causing non-normality (Harrington, 2008). To identify the outlier, this researcher examined square Mahalanobis distance (D^2) values for any value that stood distinctively apart from all the other D-square values (Hair et al., 2010). In this study, all cases in the HSR and LCC samples met the normality requirement and no outlier was identified.

This study used IBM SPSS AMOS 24 to perform the CFA. Major model fit indices used for evaluating the CFA model include χ^2 statistics, CMIN/df, RMSEA, GFI, NFI, and CFI (Byrne, 2010). The choice of these criteria is based on their variant approaches to the assessment of model fit and their support in the literature as important indices of fit that should be reported (Byrne, 2010). Byrne (2010) provided suggestions for the optimal values for these criteria. For χ^2 statistics, the higher the probability associated with χ^2, the closer the fit between the hypothesized model and the perfect fit; for CFI, values > .95 are acceptable and for NFI and GFI, values > .90 are acceptable; for CMIN/df, the value should be <=3; for RMSEA, values < .06 indicate good fit (Byrne, 2010). For both HSR and LCC models, the initial CFA estimation showed unsatisfactory model fit. A post-hoc analysis was performed for re-specifying the originally hypothesized model (Byrne, 2010). Measures taken included deleting and rewording item questions with poor factor loadings (< .70) and correlating error terms with high modification indices (MI) values. These measures improved model fit for both HSR and LCC models, with all the fit indices falling within the acceptable ranges.

After obtaining a satisfactory measurement model fit, this researcher performed a convergent validity test, a reliability test, and a discriminant validity test to assess the construct validity of the measurement model (Hair et al., 2010). According to Hair et al. (2010), convergent validity assesses whether the items that are indicators of a specific construct converge or share a high proportion of variance in common, while discriminant validity assesses the extent to which a construct is truly distinct from other constructs. Average Variance Extracted (AVE) is a common tool for assessing convergence validity, with an AVE of .5 or higher suggesting adequate convergence (Hair et al., 2010).

Equation 2 is the formula of AVE. Discriminant validity is assessed by comparing AVE and the correlation coefficient between the constructs (Zait & Bertea, 2011). If the square root of AVE is greater than the correlation coefficient, the discriminant validity is supported (Zait & Bertea, 2011).

$$\text{AVE} = \frac{\sum_{i=1}^{n} L_i^2}{n}, \tag{2}$$

Where:

L_i = standardized factor loading.

i = the number of items.

n = n items.

This study performed a reliability test using construct reliability (CR) index (Hair et al., 2010). A reliability estimate of .70 or higher suggests good reliability (Hair, et al., 2010). Equation 3 shows the formula of CR index:

$$CR = \frac{(\sum_{i=1}^{n} \lambda_i)^2}{(\sum_{i=1}^{n} \lambda_i)^2 + (\sum_{i=1}^{n} \delta_i)} \tag{3}$$

Where:

λ_i = standardized factor loading.

i = the number of items.

n = n items.

δ_i = error variance terms for a construct.

All the constructs in the HSR and LCC models passed the convergent, discriminant, and reliability tests, demonstrating satisfactory construct validity for both HSR and LCC measurement models.

Structural equation modeling (SEM). The last step of the data analysis was the test of the SEM model. A complete SEM analysis involves the tests of a measurement theory and the structural theory that links constructs together in a logically meaningful way (Hair et al., 2010). While both aim at testing theory, CFA focuses on relationships between observable indicators and individual constructs, whereas SEM focuses on relationship between constructs (Schreiber, 2008). The SEM model testing follows the same guideline that applies to CFA models (Hair et al., 2010).

In this study, the SEM model for both HSR and LCCs achieved a satisfactory model fit. After that, hypotheses were tested. Results of standardized regression weights, *t*-values, and significant level were reported based on the AMOS output for the HSR and LCC models. This researcher examined relationships between predicting factors and passengers' intentions to use LCCs and HSR and identified key factors that affected passengers' mode use intentions. In addition, this researcher compared the significant factors and magnitude of their effects between the two models. Chapter IV presents the analytical results in more detail.

CHAPTER IV

RESULTS

The present study investigated passengers' intentions to use HSR and LCCs in China. To fulfill the research purpose, this researcher collected empirical data and analyzed the data using SEM. This chapter presents the primary findings in four sections - pilot study, descriptive statistics, measurement model assessment (CFA), and structural model assessment (SEM). For clarity purposes, this chapter starts with the results of HSR, followed by those of LCCs.

HSR Results

This section presents the HSR results. The section consists of four parts - pilot study, passenger characteristics and descriptive statistics, measurement model assessment (CFA), and structural model testing (SEM).

Pilot study. An initial pilot study involving 50 HSR passengers was performed for testing the reliability of the HSR instrument. Cronbach's alpha, with .70 being the lower limit of acceptability (Hair et al., 2010), was used for assessing consistency of the scales. Six of the 10 scales showed unsatisfactory Cronbach's alpha results (< .70), indicating inconsistency in the scale items. Four items such as "HSR pays attention to the interest of customers" and "HSR offers complete facilities onboard" did not correlate well with other items, indicating that they may not measure the same underlying construct in their designated scales. These problematic items were deleted for improving the overall Cronbach's alpha scores of the scales. Two items - "HSR offers convenient frequencies” and “HSR is advanced” – were poorly answered likely due to the question wording. The two items were reworded by adding useful details that allowed for more accurate response. To test the revised questionnaire, the second pilot study involving another 50 HSR passengers was performed. The Cronbach’s alpha values ranged from .687 to .924, all passing or very close to the .70 threshold. The instrument thus demonstrated satisfactory reliability. Table 11 shows the question items and Cronbach’s alpha results in the second pilot study. These items were used in the large-scale survey.

Table 11

Cronbach’s Alpha – HSR Second Pilot Study

Construct		Item Question	α
Attitudes	AT1	I think traveling by HSR would be a good idea	.891
	AT2	I think traveling by HSR would be pleasant	
	AT3	I think traveling by HSR would be relaxed	
Subjective Norms	SN1	My family and friends hope that I choose HSR	.732
	SN2	I feel I should choose HSR because my family/ friends recommend it	
	SN3	Those close to me approve that I choose HSR	
	SN4	Those whose opinions I value think I should choose HSR	
Behavioral Control	PB1	It's mainly up to me whether I choose HSR or not	.687
	PB2	I have entire control on using HSR	
	PB3	For me, traveling by HSR is easy to achieve	
	PB4	If I want to, I can travel by HSR soon	
Price	PR1	I think the price of HSR is affordable	.806
	PR2	I think the price of HSR is fair and reasonable	
	PR3	I think the price of HSR matches my consumption level	
	PR4	I am satisfied with the price of HSR	
Trust	TR2	I expect that HSR operates in a reliable manner	.924
	TR3	I expect that HSR is technologically advanced	
	TR5	I expect that HSR is trustworthy	

Table 11 *(continued)*

Construct		Item Question	α
Access	AC1	HSR station is conveniently located	.773
	AC2	HSR station is easy to access	
	AC3	Transportation to HSR station is easy	
	AC4	I can quickly access HSR station	
Frequency	FR1	The number of trains provided by HSR is adequate	.787
	FR2	HSR operates with high frequency	
	FR3	HSR trains depart at convenient times	
	FR4	The time interval between trains is satisfactory	
Total Travel Time	TT1	I think the total travel time of HSR is easy to manage	.697
	TT2	I think the total travel time of HSR is being assured	
	TT3	I think the total travel time of HSR is satisfactory	
	TT4	I think the total travel time meets my needs	
On-Board Service	SQ1	HSR provides a quiet cabin environment	.796
	SQ2	HSR provides a clean cabin environment	
	SQ3	Seats are comfortable on HSR trains	
	SQ5	HSR provides satisfactory food choices	
Behavioral Intention	BI2	It's likely I will choose HSR again in the future	.720
	BI3	HSR is likely to be my first choice	
	BI4	Even if other transportation options were recommended, I still like to choose HSR	
	BI5	I intend to travel by HSR frequently	

Note. α = Cronbach's Alpha.

Passenger characteristics and descriptive statistics. The formal survey data were collected at South Railway Station in Beijing and Hongqiao Railway Station in Shanghai. A total of 520 questionnaires were collected. Two rounds of data screening were performed. The initial data screening identified questionnaires with missing responses using SPSS and removed these questionnaires accordingly. This process resulted in removal of 36 unqualified questionnaires, leaving a usable sample consisting of 484 cases for the final analysis. As such, the completion rate of the survey was 93%.

The second round of data screening focused on data normality and outliers, which was performed using AMOS in the stage of CFA. After completing the initial round of data screening, respondent characteristics and descriptive statistics were examined.

Demographics. Demographic information such as gender, age, educational level and income were collected during the survey. Among all the HSR respondents, 60.5% were men and 39.5% were women. The gender ratio was slightly different from that of the national population in China, which has a male-female ratio of 51.22% to 48.78% (National Bureau of Statistics of the People's Republic of China, 2015). Most respondents fall within the age groups of 20-30 (50.6%) and 31-40 (29.6%). Only a small number of participants aged below 20 (5.4%), between 41-50 (10.5%), between 51-60 (3.7%), and above 60 (0.2%). The survey respondents were younger compared to the national population, of which 66.3% are between the age of 16 and 59 (National Bureau of Statistics of the People's Republic of China, 2015). With respect to educational attainment, respondents with a bachelor's degree (41.1%) and some college degree (22.5%) comprised the majority of the total sample, followed by high school diploma (20.7%). Participants with lower than high school education (8.3%), a master's degree (6%) and a doctoral degree (1.4%) accounted for a much smaller portion of the total respondents. Only 12.5% of the Chinese population has a bachelor's degree, which means that the survey respondents received a higher education compared to the national population (National Bureau of Statistics of the People's Republic of China, 2015). In terms of monthly income, nearly half of the respondents reported a monthly income between RMB 4001-8000 (USD 580-1161), followed by 28.5% below RMB 4000

(USD580), and 23% over RMB 8001 (USD 1161). Again, the income of the respondents was higher than the national average, which is estimated to be RMB 2600 (USD 377) for urban population in China (National Bureau of Statistics of the People's Republic of China, 2015). The occupation of the respondents varied, with non-government (business) employee being the most selected one (69.8%), followed by student (11%), business owner (6%), government employee (2.7%), and government official (0.2%). Table 12 summarizes the demographic characteristics of the HSR respondents. The survey sample, although slightly different in some demographical characteristics from the national population, can represent the HSR population due to the HSR market characteristics in China. Chapter V discusses the representation of the sample in more detail.

The respondents also answered questions about their trip destinations and residential locations (provinces). Figures 9 and 10 show the results. It can be seen that, although the survey was conducted in Shanghai and Beijing, it covered respondents from 27 provinces/direct-controlled municipalities, who were traveling to 10 domestic destinations at the time of the survey.

Table 12

Demographic Characteristics – HSR Respondents

Characteristics	Subgroup Categories	Frequency	Percentage
Age	<20	26	5.4%
	20-30	245	50.6%
	31-40	143	29.6%
	41-50	51	10.5%
	51-60	18	3.7%
	>60	1	0.2%
		484	100%
Gender	Male	293	60.5%
	Female	191	39.5%
		484	100%
Education	Below high school	40	8.3%
	High school	100	20.7%
	Voc/Tech School	109	22.5%
	Bachelor's degree	199	41.1%
	Master's degree	29	6%
	Doctoral degree	7	1.4%
		484	100%
	<2000	48	9.9%
Personal Monthly Income (RMB)	2000-4000	90	18.6%
	4001-6000	124	25.6%
	6001-8000	111	22.9%
	8001-12000	63	13%
	12001-15000	27	5.7%
	>15000	21	4.3%
		484	100%
Occupation	Student	53	11%
	Non-government (Business) employee	338	69.8%
	business owner	29	6%
	Government employee	13	2.7%
	Government official	1	0.2%
	Others	50	10.3%
		484	100%

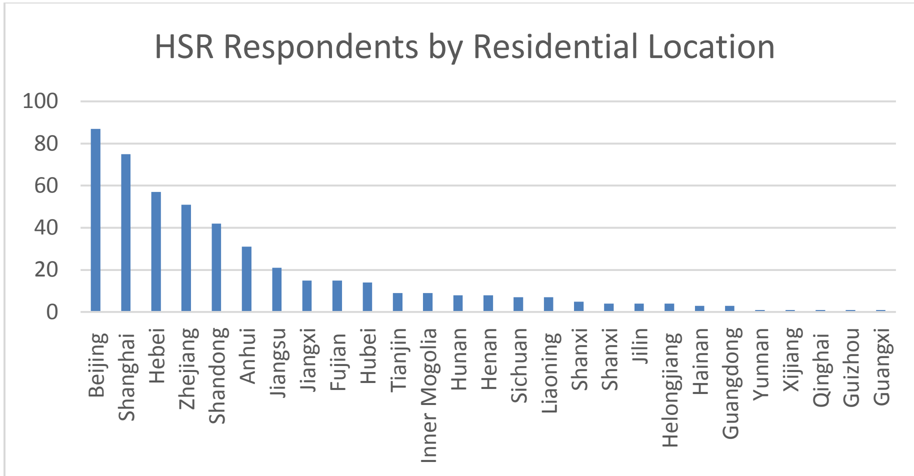

Figure 9. HSR respondents by residential location.

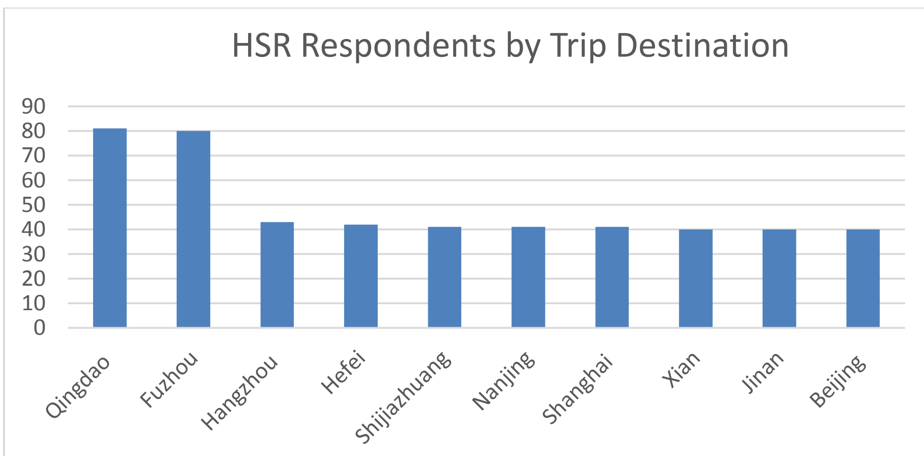

Figure 10. HSR respondents by trip destination.

Travel experience. The respondents' travel experience with HSR, such as travel frequency, purpose, and ticket purchase channel, were collected during the survey. Most respondents were regular users of HSR, with 62% of them traveling more than three times by HSR a year, followed by 29.5% for 2-3 times, and 8.5% for less than 2 times. Fifty-six percent of the respondents traveled alone compared to 44% traveling in a group.

The reason for traveling by HSR varied, with business (42.4%) being the most common reason, followed by leisure/vacation (20%), visiting family/friends (19.4%), conference/training (7.2%), and study (5.4%).

Nearly half (47.9%) of the respondents obtained ticket information from the HSR website and 36% from other online resources. Only about 15% of the respondents used traditional resources, such as friend/family, newspaper, and travel agent for ticket information. Almost half of the respondents bought their ticket from the HSR ticket office (45%), followed by 27.5% from the HSR website. The third and fourth popular channels for purchasing HSR ticket were train station (11.4%) and travel website (11.2%). Nearly half of the respondents spent RMB 401-600 (USD 58-87) (47.3%) on their HSR tickets, followed by 27.1% for RMB 200-400 (USD 29-58), and 24.6% for RMB 601-800 (USD 87-116) (24.6%). Only a small number of respondents spent more than RMB 801 (USD 116) (1%) on their HSR tickets. Table 13 summarizes the respondents' travel experience.

Variables. The current study examined the impact of nine factors - attitudes, subjective norms, perceived behavioral control, price, trust, access, frequency, total travel time, and service - on passengers' intentions to use HSR. In the survey questionnaire, each factor was measured by three to four item questions. The respondents were asked to evaluate these items based on a 5-point Likert scale, from 1 (strongly disagree) to 5 (strongly agree). Table 14 shows the values of mean and standard deviation of the scale items.

Table 13

Respondents' Travel Experience – HSR

Travel Experience		Frequency	Percentage
Travel Frequency	<1 time/year	21	4.3%
	1 time per year	20	4.2%
	2-3 times per year	143	29.5%
	>3 times per year	300	62%
Accompany	Travel alone	272	56.2%
	Travel with someone	212	43.8%
Travel Purpose	Leisure/vacation	97	20%
	Business	205	42.4%
	Conference/training	35	7.2%
	Study	26	5.4%
	Visiting family/friends	94	19.4%
	Others	27	5.6%
Ticket Information	HSR website	232	47.9%
	Commercial/advertisement	6	1.2%
	Friends/family	54	11.2%
	Online searching engine	119	24.6%
	Travel website	55	11.4%
	Newspaper	2	0.4%
	Travel agent	3	0.6%
	Others	13	2.7%
Ticket Purchase	HSR ticket office	218	45%
	Railway station	55	11.4%
	Tourist website	54	11.2%
	HSR website	133	27.5%
	Travel agent	1	0.2%
	Others	23	4.7%
Ticket Price (RMB)	<200	0	0
	200-400	131	27.1%
	401-600	229	47.3%
	601-800	119	24.6%
	801-1000	5	1%
	>1000	0	0

Table 14

Mean and Standard Deviation Scores of Constructs – HSR

Construct		Item Question	Mean (N=484)	SD
Attitudes	AT1	I think traveling by HSR would be a good idea	4.15	.74
	AT2	I think traveling by HSR would be pleasant	4.12	.72
	AT3	I think traveling by HSR would be relaxed	4.15	.76
Subjective Norms	SN1	My family and friends hope that I choose HSR	4.02	.83
	SN2	I feel I should choose HSR because my family/ friends recommend it	3.92	.86
	SN3	Those close to me approve that I choose HSR	4.02	.83
	SN4	Those whose opinions I value think I should choose HSR	3.96	.84
Behavioral Control	PB1	It's mainly up to me whether I choose HSR or not	4.30	.73
	PB2	I have entire control on using HSR	4.23	.76
	PB3	For me, traveling by HSR is easy to achieve	4.19	.80
	PB4	If I want to, I can travel by HSR soon	4.18	.84
Price	PR1	I think the price of HSR is affordable	3.86	.86
	PR2	I think the price of HSR is fair and reasonable	3.54	.98
	PR3	I think the price of HSR matches my consumption level	3.71	.90
	PR4	I am satisfied with the price of HSR	3.50	.06
Trust	TR2	I expect that HSR operates in a reliable manner	4.18	.72
	TR3	I expect that HSR is technologically advanced	4.32	.70
	TR5	I expect that HSR is trustworthy	4.19	.72
Access	AC1	HSR station is conveniently located	3.84	.99
	AC2	HSR station is easy to access	3.94	.89
	AC3	Transportation to HSR station is easy	4.01	.79
	AC4	I can quickly access HSR station	3.88	.88

Table 14 *(continued)*

Construct		Item Question	Mean (N=484)	SD
Frequency	FR1	The number of trains provided by HSR is adequate	4.11	.86
	FR2	HSR operates with high frequency	4.10	.83
	FR3	HSR trains depart at convenient times	4.14	.80
	FR4	The time interval between trains is satisfactory	4.13	.81
Total Travel Time	TT1	I think the total travel time of HSR is easy to manage	3.99	.71
	TT2	I think total travel time of HSR is assured	4.02	.74
	TT3	I think total travel time of HSR is satisfactory	4.01	.74
	TT4	I think the total travel time meets my needs	4.07	.74
On-Board Service	SQO1	HSR provides a quiet cabin environment	3.99	.84
	SQO2	HSR provides a clean cabin environment	4.13	.73
	SQO3	Seats are comfortable on HSR trains	4.07	.73
	SQO5	HSR provides satisfactory food choices	3.36	1.17
Behavioral Intention	BI2	It's likely I will choose HSR again in the future	4.21	.66
	BI3	HSR is likely to be my first choice	3.86	.82
	BI4	Even if other transportation options were recommended, I still like to choose HSR	3.88	.82
	BI5	I intent to travel by HSR frequently	3.89	.81

Note. SD = Standard deviation.

Attitudes, subjective norms, PBC, and behavioral intentions are the original components of the TPB model. Mean scores for items measuring these factors ranged from M=3.86 (BI3: HSR is likely to be my first choice) to M=4.30 (PBC1: It’s mainly up to me whether I choose HSR or not). Overall, the mean values can be described as moderately high. On average, items measuring PBC had the highest mean scores while those measuring behavioral intentions scored the lowest.

Price, trust, access, frequency, total travel time, and service quality were external factors added to the expanded TPB model. Mean scores for items measuring this group of factors ranged from M=3.36 (SQ5: HSR provides satisfactory food choices) to M=4.32 (TR3: I expect that HSR is technologically advanced). Noticeably, SQ5 also had the highest standard deviation (1.17), indicating largely different opinions on onboard food choices provided by HSR. Mean scores for items measuring trust, frequency, and total travel time showed high values, while those for price, access, and service quality showed only moderately high values. The items for price demonstrated the lowest mean scores, with all of them being at a 3-level.

Non-response bias analysis. Non-respondents in this research refer to those who declined the offer of participating in the survey or those who initially agreed to participate but later chose to opt out. During the data collection process, the survey administrator collected simple demographic information from non-respondents by asking three questions - “What is your age range?”, “What is your highest education?”, and “How often do you travel by HSR?”. Sixty-eight non-respondents answered these questions during the survey. A non-response bias analysis was performed using a chi-square test to compare the characteristics of respondents and non-respondents. The results revealed no significant difference between the two groups, indicating representativeness of the survey data. Table 15 shows the chi-square test results.

Table 15

Chi-Square Test Results for Non-Response Bias - HSR

Demographic Characteristics	Comparing Groups	X^2 (N=552)	p
Age	Respondents Non-respondents	1.616	.899
Gender	Respondents Non-respondents	.335	.335
Education	Respondents Non-respondents	10.992	.052
Trip frequency	Respondents Non-respondents	15.504	.080

Note. p is significant at $p < .05$.

Measurement model assessment (CFA). The second part of the data analysis is CFA, which is the measurement model of SEM (Hair et al., 2010). The objective of CFA is to test the reliability of the observed variables in measuring their designated latent constructs and provide a test of convergent and discriminant validity (Schreiber, 2008). In this study, the CFA was performed using IBM SPSS AMOS 24. The model assessment involved three steps - data screening and estimation method, model evaluation and adjustment, and model validity test.

Data screening and estimation method. A critically important assumption associated with SEM analysis is that the data have a multivariate normal distribution (Byrne, 2010). In this study, the survey data were generated using ordinal items. As such, kurtosis is more meaningful than skewness in measuring normality (Byrne, 2010). Byrne (2010) suggested that Kurtosis values < 5.00 indicated acceptable data normality. The AMOS results showed that all kurtosis values were below the 5.00 threshold.

Outliers were identified using squared Mahalanobis distance (D^2) values, with a value that stands distinctively apart from all the other D-square values being considered a multivariate outlier (Byrne, 2010). Again, the AMOS results indicated acceptable D-square values for all cases. Thus, the survey data consisting of 484 responses met the data requirement of CFA.

The type of data and distributional qualities of the data should determine the estimation method for CFA/SEM (Schreiber, 2008). For normally distributed data, maximum likelihood estimation (MLE) is the most common SEM estimation procedure (Hair et al., 2010). Because the survey data met normality and outlier assumptions, the MLE method was employed for the CFA model estimation.

Model evaluation and adjustment. Model fit indices were used to evaluate how well the collected data fit the hypothesized model (Schreiber, 2008). Although there lacks an agreement on which fit indices should be reported (Chin et al., 2008), commonly reported fit indices include Chi-square value (X^2) and degrees of freedom, goodness-of-fit (GFI), root mean square error of approximation (RMSEA), Normed fit index (NFI), and comparative fit index (CFI) (Byrne, 2010; Hair et al., 2010; Schreiber, 2008). The current study adopted the following fit indices and their expected values for producing adequate CFA model fit: CFI > .95; GFI and NFI > .90; CMIN/df <= 3; and RMSEA < .06 (Byrne, 2010)

CFA was performed on the HSR survey sample (n=484). The Chi-square value associated with the model is significant, $X^2 = 1589.207$ (df = 620, p = .000), which suggested that the model was not consistent with the observed data. Based on the significant statistic, the model did not achieve a satisfactory fit. However, because X^2 statistic is heavily influenced by the sample size and number of observed variables, it may not always be a meaningful index (Hair et al., 2010). A large sample size, as is the case with the current study, is likely to inflate X^2 statistics and erroneously imply a poor model fit. As such, Chi square statistics should always be accompanied by additional model fit measurements in order to accurately evaluate the model fit (Hair et al., 2010).

Fit indices including GFI, CFI, NFI, CMIN/df, and RMSEA were used to further assess the model fit. The results - CFI = .929; GFI = .844; NFI = .889; CMIN/df = 2.563; and RMSEA = .057 - indicated an acceptable but not great model fit. In order to improve the model fit, factor loadings of the question items were examined. According to Chin (1998), standardized factor loading for each scale item should be greater than .70 to demonstrate reliability. Low loadings suggest that a variable is a candidate for deletion from the model (Hair et al., 2010). Three items (SQO5, PR1, BI2) had lower than .70 loadings, indicating possible problems with these items. In addition, a number of items, including SN4, PBC4, AC1, FR1, and TT4, provided statements very similar to that of other items in their designated scales, suggesting potential redundancy due to content overlap. For example, TT3 stated that “I think total travel time of HSR is satisfactory”, whereas TT4 provided that “I think total travel time meets my needs”. The Likert scale scores for these items also showed similar results. As such, the five redundant items were removed from the model.

Then, modification indices were evaluated, which revealed large MI values between error terms that argued for the presence of error covariances. These large MIs represented systematic rather than random measurement error in item responses (Byrne, 2010). To address the issue, respecification of the hypothesized model was conducted through adding freely estimated parameters to the model (Byrne, 2010). It is important to add only one parameter at a time to the model as the MI values can change substantially from one tested parameterization to another (Byrne, 2010). Two pairing error terms with the largest MI values were correlated. Then, the model was re-estimated and the model fit statistics showed an adequate fit between the hypothesized model and empirical data: $X^2 = 623.421$ (df = 358, p = .000); CFI = .975; GFI = .923; NFI = .943; CMIN/df = 1.741; and RMSEA = .039. Thus, the measurement model containing 10 factors was validated by CFA. Table 16 compares the model fit indices before and after the model improvement. Appendix D1 illustrates the final CFA model.

Table 16

Model Fit Indices for Initial and Final Measurement Model - HSR

Model Fit Indices	Acceptance Value	Initial CFA Model	Final CFA Model
X^2	-	1589.207***	623.421***
df	-	620	358
GFI	> .90	.844	.923
NFI	> .90	.889	.943
CFI	> .95	.929	.975
CMIN/df	<=3	2.563	1.741
RMSEA	< .06	.057	.039

Note. ***p is significant at p < .001.

Reliability and validity. One of the primary objectives of CFA is to assess the construct validity of a proposed measurement theory (Hair et al., 2010). Construct validity deals with the accuracy of measurement by showing the extent to which a set of measured items actually reflects the theoretical latent construct those items are designed to measure (Hair et al., 2010). Two components of construct validity, including convergent validity and discriminant validity, were tested in the current study.

Convergent validity helps establish construct validity when the items that are indicators of a specific construct share a high proportion of variance in common (Hair et al., 2010). Three indicators of convergent validity were evaluated in this research - factor loading, average variance extracted (AVE), and construct reliability (CR). High loadings on a factor would indicate that they converge on the latent construct (Hair et al., 2010). AVE is calculated as the mean variance extracted for the items loading on a construct and is a summary indicator of convergence (Hair et al., 2010). CR is computed from the squared sum of factor loadings for each construct and the sum of the error variance terms for a construct (Hair et al., 2010). The following acceptance values were adopted for convergent validity: standardized loading estimates >= .70, or at least >= .50; AVE >= .50; and CR >= .70 (Hair et al., 2010). Discriminant validity examines the uniqueness of construct by providing evidence that a construct is truly distinct from other constructs (Hair et al., 2010). It is established by comparing AVE for any two constructs with the square of the correlation estimate between these two constructs (Hair et al., 2010). To pass the discriminant validity test, AVE should always be greater than the squared correlation estimate (Hair et al., 2010). Table 17 presents the result of the convergent validity for the measurement model.

Table 17

Convergent Validity - HSR

Construct	Item	Factor Loading	Construct Reliability	AVE
Attitudes	AT1	.772	.875	.701
	AT2	.879		
	AT3	.857		
Subjective Norms	SN1	.899	.905	.761
	SN2	.829		
	SN3	.887		
Perceived Behavioral Control	PB1	.794	.867	.685
	PB2	.885		
	PB3	.800		
Price	PR2	.832	.882	.714
	PR3	.857		
	PR4	.846		
Trust	TR2	.786	.845	.645
	TR3	.797		
	TR5	.826		
Access	AC2	.885	.896	.743
	AC3	.856		
	AC4	.844		
Frequency	FR2	.836	.917	.788
	FR3	.931		
	FR4	.893		
Total Travel Time	TT1	.818	.896	.743
	TT2	.895		
	TT3	.871		
Service Quality	SQO1	.809	.870	.691
	SQO2	.876		
	SQO3	.807		
Behavioral Intention	BI3	.834	.857	.667
	BI4	.852		
	BI5	.761		

All factors met the CR criterion (CR > .70), indicating satisfactory consistency among items. AVE for all factors was greater than .50, demonstrating good convergent validity. All estimated factor loadings were within the acceptable range (> .70). Table 18 compares the AVE with the squared correlation estimate for any two constructs. As can be seen, all AVE scores were greater than the squared correlation estimates, indicating sufficient discriminant validity of the constructs.

Because all the constructs demonstrated satisfactory construct validity, they were retained in the HSR model. The measurement model of HSR was thus successfully validated and ready for the structural model analysis.

Table 18

Discriminant Validity – HSR

	FR	**AT**	**AC**	**SN**	**PB**	**TR**	**TT**	**PR**	**SQ**	**BI**
FR	**.788**									
AT	.328	**.701**								
AC	.331	.334	**.743**							
SN	.263	.590	.292	**.761**						
PB	.426	.486	.219	.353	**.685**					
TR	.450	.531	.365	.457	.634	**.645**				
TT	.269	.325	.348	.336	.280	.438	**.743**			
PR	.194	.157	.295	.163	.125	.210	.189	**.714**		
SQ	.249	.358	.341	.294	.257	.406	.390	.099	**.691**	
BI	.166	.307	.306	.297	.160	.196	.309	.203	.321	**.667**

Note. AT = Attitudes; SN = Subjective Norms; PB = Perceived Behavioral Control; PR = Price; TR = Trust; AC = Access; FR = Frequency; TT = Total Travel Time; SQ=Service Quality; BI = Behavioral Intentions.

Structural model testing (SEM). While the measurement model provides an empirical measure of assessing relationships among observed variables and constructs, the structural model evaluates the relationship between latent constructs (Nachtigall et al., 2003). To recap, the current study developed the HSR model based on the literature review and TPB, with external factors being added to the model to reflect the research context in China. The exogenous variables (independent variables) were attitudes, subjective norms, PBC, price, trust, access, frequency, total travel time, and service quality. The endogenous variable (dependent variable) was the behavioral intention to use HSR. In addition, the relationship between service quality of HSR and attitudes toward HSR was also examined.

The data were again checked for normality and outliers. All kurtosis values fell within the acceptable range (< 5.00), and squared Mahalanobis distance (D^2) values showed minimal evidence of suspicious outliers, indicating normally distributed data. As such, the MLE method was used for model estimation. The focus in the structural model analysis was on two issues: (1) overall model fit of the proposed structural model and (2) hypothesis testing and parameter estimates (Hair et al., 2010).

Overall model fit. The evaluation of the structural model used the same fit indices and cut-off values as for the CFA: CFI > .95; GFI and NFI > .90; CMIN/df <= 3; and RMSEA < .06 (Byrne, 2010). The results of the SEM model indicated adequate model fit: X^2 = 863.475 (df = 365, p = .000); GFI = .900; CFI = .953; NFI = .921; CMIN/df = 2.366; and RMSEA = .053. Table 19 depicts the overall model fit indices of the SEM model and compares that to the fit statistics of the CFA model validated in the previous section. As can be seen, the overall model fit of the structural model did not change substantially from that of the CFA model.

Table 19

Model Fit Comparison Between SEM Model and CFA Model

Model Fit Index	Structural Model	Measurement Model
X^2(Chi-square)	863.475	623.421
Degrees of freedom	365	358
Probability	***	***
GFI	.900	.923
NFI	.921	.943
CFI	.953	.975
CMIN/df	2.366	1.741
RMSEA	.053	.039

Note. *** significant at $p < .001$.

Hypothesis testing. Following the model estimation, hypotheses were tested. Figure 11 illustrates the standardized path estimates for the SEM model. Table 20 shows the standardized path coefficients and t-values for the SEM model. Of the 10 structural paths hypothesized by the model, H1, H2, H4, H5, H7, H8, and H10 had the path estimates that were statistically significant and in the expected direction. Therefore, H1, H2, H4, H5, H7, H8, and H10 were supported. Two path estimates reflecting H3 and H9 were not significant, and the path estimate reflecting H6 was significant but not in the hypothesized direction. Therefore, H3, H6, and H9 were not supported. Because 7 out of 10 path estimates were consistent with the hypotheses, the results in general supported the theoretical model.

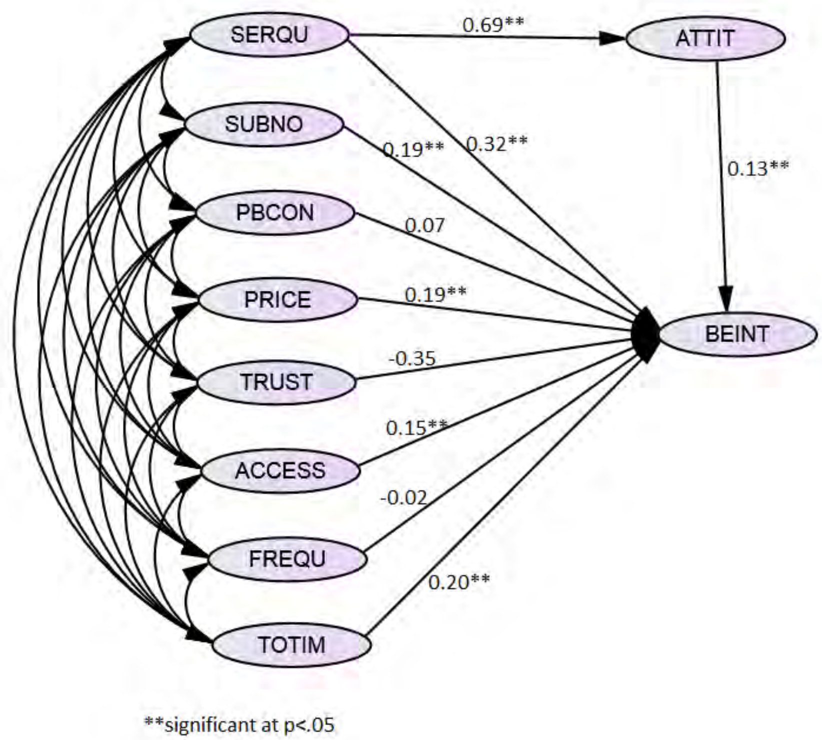

Figure 11. Standardized path coefficients for SEM model - HSR. SERQU = Service Quality; ATTIT = Attitudes; SUBNO = Subjective Norms; PBCON = Perceived Behavioral Control; PRICE = Price; TRUST = Trust; ACCESS = Access; FREQU = frequency; TOTIM = Total Travel Time; BEINT = Behavioral Intentions.

Table 20

Structural Model Hypothesis Testing – HSR

Hypothesis	Estimate	t-value	p-value	Result
H1: Attitudes → Behavioral Intentions	.140	2.040	.041	Supported
H2: Subjective Norms → Behavioral Intentions	.161	3.141	.002	Supported
H3: PBC → Behavioral Intentions	.070	.845	.398	NS
H4: Service Quality → Attitudes	.643	12.53	***	Supported
H5: Service Quality → Behavioral Intentions	.335	3.414	***	Supported
H6: Trust → Behavioral Intentions	-.359	-3.022	.003	NS
H7: Price → Behavioral Intentions	.131	3.542	***	Supported
H8: Total Travel Time → Behavioral Intentions	.186	2.971	.003	Supported
H9: Frequency → Behavioral Intentions	-.016	-.303	.762	NS
H10: Access → Behavioral Intentions	.124	2.214	.027	Supported

Note. *** significant at $p < .001$. NS = Not Supported

H1 proposed a relationship between passengers' attitudes and their intentions to use HSR. The path coefficient revealed a positive relationship between passengers' attitudes and their behavioral intentions ($P_{BI,AT}$ =.13), which was significant at $p = .041$. Thus, H1 was supported, indicating that the more positive the attitude toward HSR, the higher the intention to use HSR in China.

Testing of H2 showed a positive relationship between subjective norms and passengers' intentions to use HSR ($P_{BI,SN}$ = .19), and this relationship was significant ($p = .002$). H2 was supported. It indicated that subjective norms played an important role in the use of HSR in China.

H3 tested the relationship between PBC and passengers' intentions to use HSR. This relationship was found insignificant ($p = .398$) and thus was not supported. This suggested that PBC was not an important factor in passengers' motivation in using HSR.

Testing of H4 revealed a positive and strong relationship between service quality and attitudes toward HSR. This relationship was found positive and significant ($P_{AT,SQ} = .69$; $p < .001$), thus H4 was supported. Service quality played an important role in attitudes toward HSR.

The relationship between service quality and passengers' intentions to use HSR was positive ($P_{BI,SQ} = .32$) and significant at $p < .001$. H5 was thus supported, indicating that the better the service quality, the higher the intention of passengers to use HSR.

H6 predicted a positive relationship between trust and passengers' intentions to use HSR. The path estimate ($P_{PBI,TR} = -.35$), although statistically significant ($p = .003$), failed to follow the hypothesized direction. H6 was thus not supported, indicating that trust was not an important factor in passengers' motivation in using HSR.

Testing of H7 revealed a moderate, positive effect of price on passengers' intentions to use HSR ($P_{BI,PR} = .19$), which was statistically significant ($p < .001$). Thus, H7 was supported. The result indicated that price was a significant determinant of passengers' use of HSR.

The impact of total travel time on passengers' intentions to use HSR, as stated by H8, was supported. The effect was found positive ($P_{BI,TT} = .20$) and statistically significant ($p = .003$), indicating that total travel time was a significant predictor of passengers' intentions to use HSR.

H9 hypothesized a positive relationship between frequency and passengers' intentions to use HSR. The relationship was not statistically significant ($p = .762$) and was thus not supported. It showed that frequency was not an important factor in passengers' intentions to use HSR.

Testing of H10 revealed a positive influence of access on passengers' intentions to use HSR. The path estimate indicated a positive relationship ($P_{BI,AC} = .15$), which was statistically significant ($p = .027$). Thus, H10 was supported, indicating that the more convenient the station access, the higher the motivation of passengers in using HSR.

The remainder of this chapter presents the results of the LCC model. Because both HSR and LCC models used the same analytical methods and procedures, the presentation of the LCC results omitted some shared explanation already given in the section of HSR, to avoid duplication.

LCC Results

This section presents the results for the LCC model. The section consists of four parts - pilot study, passenger characteristics and descriptive statistics, measurement model assessment (CFA), and structural model assessment (SEM).

Pilot study. In the initial pilot study involving 50 LCC passengers, some scale items showed unsatisfactory Cronbach's alpha results (< .70), indicating inconsistency in the scales. Nine items, such as "LCCs offer convenient frequencies" and "The access time to the airport used by LCCs is reasonable" did not correlate well with other items in their own groups, suggesting that they may not measure the same underlying construct in their designated scales. These problematic items were deleted to improve the overall Cronbach's alpha scores of the scales. Another three items, such as "The LCC prices are cheap enough for me to consider" were poorly answered possibly because of their wording. These items were reworded to make it easier for the respondents to give clear answers. The second pilot study was then conducted for testing the revised questionnaire. The result indicated improvement, with Cronbach's alpha values ranging from .705 to .892, all passing the .70 threshold. The instrument thus demonstrated satisfactory reliability. Table 21 shows the Cronbach's alpha results and question items for the second pilot study. These items were used in the large scale survey.

Table 21

Cronbach's Alpha – LCC Second Pilot Study

Construct		Item Question	α
Attitudes	AT2	I think traveling by LCCs would be pleasant	.730
	AT3	I think traveling by LCCs would be relaxing	
	AT4	I have a good perception toward LCCs	
Subjective Norms	SN1	My family and friends want me to choose LCCs	.797
	SN2	I feel I should choose LCCs because my family/ friends recommend it	
	SN3	Those close to me approve that I choose LCCs	
	SN4	Those whose opinions I value think I should choose LCCs	
PBC	PB1	It's mainly up to me whether I choose LCCs or not	.705
	PB4	If I want to, I can obtain an LCC ticket soon	
	PB5	For me, traveling by LCCs is easy to achieve	
Price	PR1	I think the price of LCCs is affordable	.856
	PR2	I think the price of LCCs is fair and reasonable	
	PR3	I think the price of LCCs matches my consumption level	
	PR4	I am satisfied with the price of LCCs	

Table 21 (*continued*)

Construct		Item Questions	α
Uncertainty Avoidance	UA1	If I perceived uncertainty of LCCs' future growth in the Chinese market, I will seek clear information in this regard before choosing an LCC	.786
	UA2	If I perceived uncertainty of LCCs' safety, I will seek clear information of LCCs' safety before choosing an LCC	
	UA3	If I perceived uncertainty of LCCs' on-time performance, I will seek unambiguous information of LCCs' on-time performance before choosing an LCC	
Access	AC1	The airport used by LCCs is conveniently located	.761
	AC2	The airport used by LCCs is easy to access	
	AC3	Transportation to the airport used by LCCs is easy	
	AC5	There are multiple transportation options to get to the airport used by LCCs	
Frequency	FR1	The number of flights provided by LCCs is adequate	.865
	FR2	LCCs operate with high frequency	
	FR4	The time interval between LCC flights is satisfactory	
Technology Self-efficacy	SE1	If I wanted to, I could easily search for LCC information on the internet on my own	.892
	SE2	If I wanted to, I could easily purchase an LCC ticket on the internet on my own	
	SE3	I would be able to purchase an LCC ticket on the internet even if there is no one around to show me how to do it	
	SE4	If I wanted to, I could search/compare prices of airlines online	
Service Quality	SQ2	LCCs provide a clean cabin environment	.734
	SQ3	Seats are comfortable on LCC flights	
	SQ4	Onboard facilities of LCCs are complete	
Behavioral Intentions	BI1	I intend to buy an LCC ticket	.712
	BI5	I intend to travel by LCCs frequently	
	BI6	It's likely I will recommend LCCs to others	

Note. α = Cronbach's Alpha.

Passenger characteristics and descriptive statistics. The large-scale data were collected at Pudong International Airport in Shanghai and Zhengding International Airport in Shijiazhuang. A total of 620 questionnaires were collected. The initial data screening identified questionnaires with missing responses, resulting in removal of 24 unqualified questionnaires. The remaining sample consisting of 596 cases was used for the final analysis, which represented a completion rate of 96%. As the first step of the data analysis, descriptive statistics were performed for summarizing respondents' characteristics.

***Demographic characteristics*.** Demographic information including gender, age, educational level, monthly income, and occupation were collected during the survey. Among all the LCC respondents, 54% were men and 46% were women. The gender ratio was similar to the national average, which indicated a male-female ratio of 51.22% to 48.78% in 2015 (National Bureau of Statistics of the People's Republic of China, 2015). Most respondents fell within the age groups of 20-30 (50%) and 31-40 (25.3%), followed by that below the age of 20 (10.9%), and between 41-50 (9.9%). Older respondents accounted for only a small portion of the total respondents, with 3.2% aged between 51-60 and 0.7% above age of 60. The survey sample contained younger respondents (75.3% between the age of 20 and 40) compared to the national population, which report that 66.3% of the total population are between the age of 16 and 59 (National Bureau of Statistics of the People's Republic of China, 2015). In terms of educational attainment, 43.8% of the respondents possessed a bachelor's degree, followed by 19.9% with a high school diploma and 19.2% with some college education. Those with lower than high school education (9.2%), a master's degree (6.4%), and a doctorate degree (1.5%) accounted for a less significant portion of the total respondents. The educational level was higher in the survey sample than in the national population, of which only 12.5% have a bachelor's degree (National Bureau of Statistics of the People's Republic of China, 2015). With respect to average income, about a quarter of the participants reported a monthly income between RMB 4000-6000 (USD 580-871), followed by 18.4% below RMB2000 (USD 290), 17.7% between RMB 2000-4000 (USD 290-580), 16.1% between RMB 6001-8000 (USD 871-1161), and 11.4% between RMB 8001-12000 (USD 1161-1742). Only 4.1% of the respondents earned RBM 12001-15000 (USD 1742-2177) and 6.5% above RMB 15000 (USD 2177). Again, the incomes reported by the survey respondents were higher than the national average, which is around RMB 2600 (USD 377) for the urban population in China (National Bureau of Statistics of the People's Republic of China, 2015). Occupation of the respondents varied, with non-government (business) employee being the most selected occupation (56.2%), followed by student (23.6%), business owner (11.7%), government employee (7%), and others (1.5%). Table 22 summarizes the demographic characteristics of the LCC respondents. In addition, the respondents answered questions about trip destination, residential location, and airline taken for the trip, which are illustrated in Figure 12, Figure 13, and Figure 14, respectively.

Although the survey sample slightly differed from the national population in some demographic attributes, it can represent the LCC population due to the market characteristics of LCCs in China. The representation of the sample is discussed in more detail in Chapter V.

Table 22

Demographic Characteristics – LCCs

Characteristics	Subgroup Categories	Frequency	Percentage
Age	<20	65	10.9%
	20-30	299	50%
	31-40	151	25.3%
	41-50	59	9.9%
	51-60	19	3.2%
	>60	3	0.7%
		596	100%
Gender	Male	325	54%
	Female	271	46%
		596	100%
Education	Below high school	55	9.2%
	High school	119	19.9%
	Voc/tech school	115	19.2%
	Bachelor's degree	262	43.8%
	Master's degree	38	6.4%
	Doctoral degree	7	1.5%
		596	100%
Personal Monthly Income (RMB)	<2000	110	18.4%
	2000-4000	106	17.7%
	4001-6000	154	25.8%
	6001 - 8000	96	16.1%
	8001-12000	68	11.4%
	12001 -15000	23	4.1%
	>15000	39	6.5%
		596	100%
Occupation	Student	141	23.6%
	Non-government (business) employee	334	56.2%
	Business owner	70	11.7%
	Government employee	42	7%
	Others	9	1.5%
		596	100%

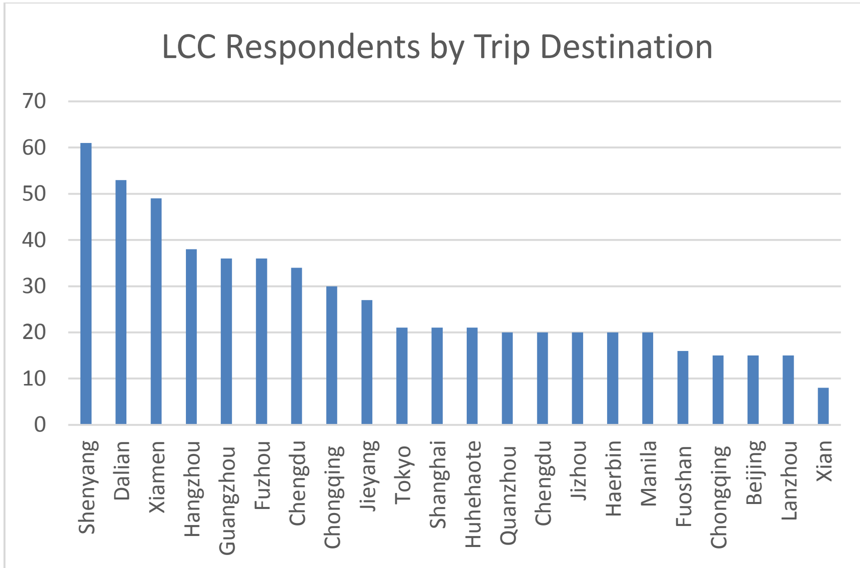

Figure 12. LCC respondents by trip destination.

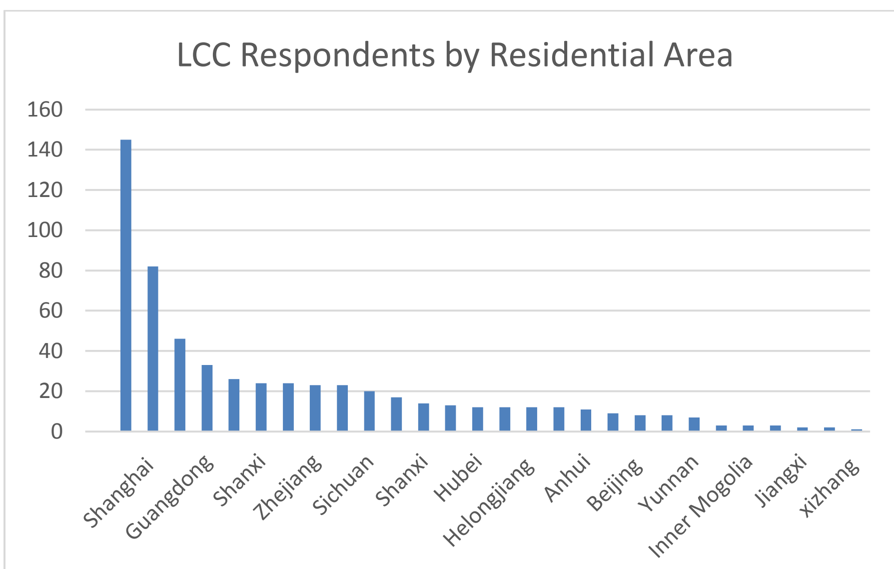

Figure 13. LCC respondents by residential location.

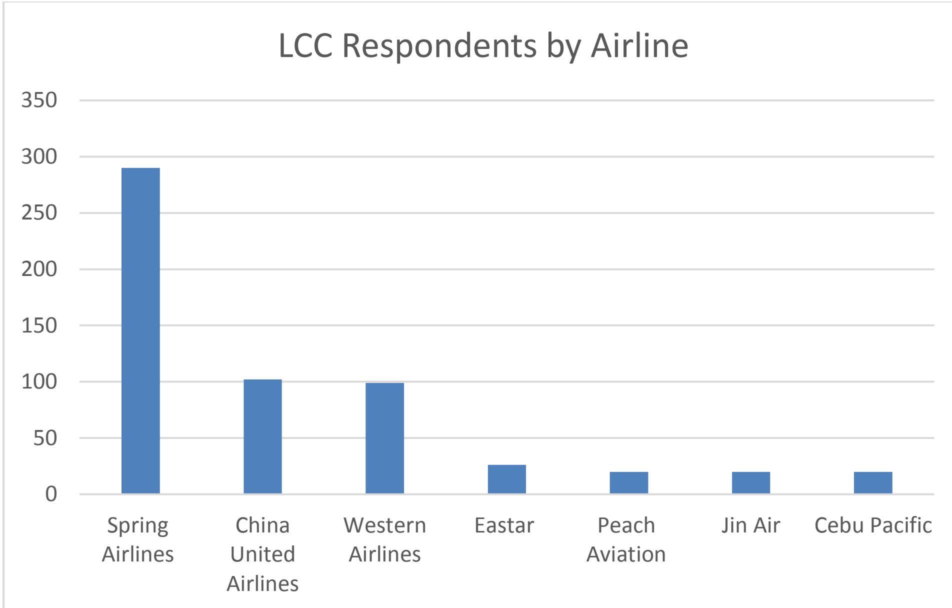

Figure 14. LCC respondents by airline.

Travel experience. Respondents' travel experience with LCCs, such as travel frequency, purpose, ticket purchase channel, and price were collected during the survey. Nearly half of the respondents (47.4%) traveled 2-3 times a year by LCCs, followed by 28% for over 3 times, 14.3% for 1 time, and 10.3% for less than 1 time. Over half of the respondents (53.7%) traveled alone compared to 46.3% traveling in group. The reason for traveling with LCCs varied, with leisure/vacation (28.5%) being the most common reason, followed by business (22.6%), visiting family/friends (16.7%), study (15.6%), conference/training (9.4%), and others (7.2%). The respondents obtained LCC ticket information and purchased their tickets from various channels. Over three quarters of the respondents obtained ticket information from the internet (29.1% from travel websites, 26.8% from LCC websites, and 23.6% from online search engine), followed by family/friends (9.5%), travel agent (3.3%), advertisement (3.2%) and others (4.5%). While one-third of the respondents bought their LCC tickets from travel websites

(35.6%), a similar amount of respondents obtained their tickets in the LCC ticket office (30.1%). It is followed by LCC website (20.7%), travel agency (4%), and at the airport (4.2%). In terms of the ticket price, one-third of the respondents spent RMB 401-600 (USD 58-87) (35.7%) on their LCC tickets, followed by RMB 601-800 (USD 87-116) (23.3%) and RMB 200-400 (USD 29-58) (21.1%). Only a small number of respondents spent RMB 801-1000 (USD 116-145) (10.7%), over RMB 1000 (USD 145) (6.9%), and below RMB 200 (USD 29) (2.3%) on their LCC tickets. Table 23 summarizes the respondents' travel experience.

Variables. The current research examined the impact of nine factors - attitudes, subjective norms, perceived behavioral control, price, uncertainty avoidance, access, frequency, technology self-efficacy, and service quality - on passengers' intentions to use LCCs. In the survey questionnaire, each factor was measured by three to four item questions. The respondents evaluated the items using a 5-point Likert scale, from 1 (strongly disagree) to 5 (strongly agree). Table 24 shows the values of mean and standard deviation of the items.

Table 23

Respondents' Travel Experience – LCCs

Travel Experience		Frequency	Percentage
Travel Frequency	<1 time per year	61	10.3%
	1 time per year	85	14.3%
	2-3 times per year	283	47.4%
	>3 times per year	167	28%
Accompany	Travel alone	320	53.7%
	Travel with someone	276	46.3%
Travel Purpose	Leisure/vacation	170	28.5%
	Business	135	22.6%
	Conference/training	56	9.4%
	Study	93	15.6%
	Visiting family/friends	99	16.7%
	Others	43	7.2%
Ticket Information	LCC website	160	26.8%
	Commercial/advertisement	19	3.2%
	Friends/family	57	9.5%
	Online searching engine	141	23.6%
	Travel website	174	29.1%
	Travel agent	20	3.3%
	Others	25	4.5%
Ticket Purchase	LCC ticket office	180	30.1%
	Airport	25	4.2%
	Tourist website	213	35.6%
	LCC website	124	20.7%
	Travel agent	24	4%
	Others	30	5.4%
Ticket Price (RMB)	<200	14	2.3%
	200-400	126	21.1%
	401-600	212	35.7%
	601-800	139	23.3%
	801-1000	64	10.7%
	>1000	41	6.9%

Table 24

Mean and Standard Deviation Scores of Constructs – LCCs

Construct		Item Question	Mean (N=596)	SD
Attitudes	AT2	I think traveling by LCCs would be pleasant	3.711	.964
	AT3	I think traveling by LCCs would be relaxing	3.720	.917
	AT4	I have a good perception toward LCCs	3.701	.940
Subjective Norms	SN1	My family and friends want me to choose LCCs	3.652	.967
	SN2	I feel I should choose LCCs because my family/friends recommend it	3.600	.995
	SN3	Those close to me approve that I choose LCCs	3.643	.967
	SN4	Those whose opinions I value think I should choose LCCs	3.555	.980
PBC	PB1	It's mainly up to me whether I choose LCCs or not	3.992	.927
	PB4	If I want to, I can obtain an LCC ticket soon	3.69	.947
	PB5	For me, traveling by LCCs is easy to achieve	3.703	.902
Price	PR1	I think the price of LCCs is affordable	4.041	.832
	PR2	I think the price of LCCs is fair and reasonable	3.896	.861
	PR3	I think the price of LCCs matches my consumption level	3.827	.841
	PR4	I am satisfied with the price of LCCs	3.821	.881
Uncertainty Avoidance	UA1	If I perceived uncertainty of LCCs' future growth in the Chinese market, I will seek clear information in this regard before choosing an LCC	3.757	.873
	UA2	If I perceived uncertainty of LCCs' safety, I will seek clear information of LCCs' safety before choosing an LCC	3.839	.880
	UA3	If I perceived uncertainty of LCCs' on-time performance, I will seek unambiguous information of LCCs' on-time performance before choosing an LCC	3.829	.891

Table 24 *(continued)*

Construct		Item Question	Mean (N=596)	SD
Access	AC1	The airport used by LCCs is conveniently located	3.436	.953
	AC2	The airport used by LCCs is easy to access	3.587	.949
	AC3	Transportation to the airport used by LCCs is easy	3.658	.885
	AC5	There are multiple transportation options to get to the airport used by LCCs	3.718	.843
Frequency	FR1	The number of flights provided by LCCs is adequate	3.431	1.047
	FR2	LCCs operates with high frequency	3.390	1.032
	FR4	The time interval between LCC flights is satisfactory	3.545	.951
Technology Self-efficacy	SE1	If I wanted to, I could easily search for LCC information on the internet on my own	3.972	.776
	SE2	If I wanted to, I could easily purchase an LCC ticket on the internet on my own	3.847	.861
	SE3	I would be able to purchase an LCC ticket on the internet even if there is no one around to show me how to do it	3.978	.810
	SE3	If I wanted to, I could search/compare prices of airlines online	4.007	.826
Service Quality	SQ2	LCCs provide a clean cabin environment	3.755	.868
	SQ3	Seats are comfortable on LCC flights	3.624	.933
	SQ4	Onboard facilities of LCCs are complete	3.661	.873
Behavioral Intentions	BI1	I intend to buy an LCC ticket	3.947	.776
	BI5	I intend to travel by LCCs frequently	3.834	.847
	BI6	It’s likely I will recommend LCCs to others	3.866	.790

Note. SD = Standard deviation.

Attitudes, subjective norms, perceived behavioral control, and behavioral intentions are the original components of the TPB model. Mean scores for these factors ranged from M = 3.555 (SN4: Those whose opinions I value think I should choose LCCs) to M = 3.992 (PB1: It is mainly up to me whether I choose LCCs or not). On average, items for behavioral intentions had the highest mean scores (mostly at a high 3-level) while items for subjective norms scored the lowest (mostly at a mid 3-level).

Price, uncertainty avoidance, frequency, access, technology self-efficacy, and service quality were external factors being added to the expanded TPB model. Mean scores for this group of factors ranged from M = 3.390 (FR2: LCCs operate with high frequencies) to M = 4.041 (PR1: I think the price of LCCs is affordable). Mean scores for most items in this group of factors show only moderate results (at a 3-level), indicating moderate perceptions toward LCCs.

Non-response bias analysis. During the data collection process, the survey administrator collected simple demographic information from non-respondents by asking three questions - "What is your age range?", "What is your highest education?", and "How often do you travel by LCCs?". One hundred and seven non-respondents answered these questions during the survey. The chi-square test results revealed no significant difference between the respondent and non-respondent groups, indicating that the survey data should be representative of the LCC population. Table 25 shows the chi-square test results.

Table 25

Chi-Square Test Results for Non-response Bias - LCCs

Demographic Characteristics	Comparing Groups	X^2 (N=703)	p
Age	Respondents Non-respondents	3.049	.692
Gender	Respondents Non-respondents	.253	.615
Education	Respondents Non-respondents	10.718	.057
Trip frequency	Respondents Non-respondents	13.014	.050

Note. p significant at < .05.

Measurement model assessment (CFA). The measurement model of LCCs was assessed using CFA. The procedure involved three steps - data screening and estimation method, model evaluation and adjustment, and model validity test.

Data screening and estimation method. The survey data were checked for normality and outliers. According to Byrne (2010), Kurtosis values below 5.00 indicated acceptable data normality. For the LCC data, all kurtosis values were within the acceptable range. Outliers were identified using Mahalanobis D-square, with values distinctively larger than other values being candidates for deletion and transformation in order to improve the model fit (Byrne, 2010). Again, the data indicated acceptable Mahalanobis distance (D^2) values for all cases. Because the survey data met the data requirement of CFA, MLE was used for model estimation.

Model evaluation and adjustment. The following fit indices and their expected values were adopted for producing adequate model fit: CFI > .95; GFI and NFI > .90; CMIN/df <= 3; and RMSEA < .06 (Byrne, 2010). CFA was performed on the entire sample consisting of 596 responses.

The initial CFA results indicated room for improvement: $X^2 = 1458.049$ (df = 482, p = .000); CFI = .939; GFI = .869; NFI = .912; CMIN/df = 3.025; and RMSEA = .058. Measures were taken to improve the model fit. This researcher first examined the factor loading of the scale items. According to Chin (1998), standardized factor loading for each item question should be greater than .70 to demonstrate reliability, but a value between .50 to .60 was still acceptable. Except for PBC1, all other items passed the .70 threshold. The factor loading of PBC1 was .530, which was still considered acceptable. This researcher decided to retain this item in the model to meet the three-indicator requirement of CFA. Four items (SN1, PR2, AC2, and SE2) provided statements similar to that of other items in their scales, indicating potential redundancy due to content overlap. For example, SE2 stated that "If I wanted to, I could easily purchase an LCC ticket on the internet on my own", whereas SE3 stated that "I would be able to purchase an LCC ticket on the internet even if there is no one around to show me how to do it". The potential overlap of content between these two items may negatively affect the model fit. As such, the four redundant items were removed from the model.

The modification indices revealed some large MI values, suggesting a need for model respecification. Error covariance was added to the model between error terms with the largest MI values. In total, six parameters were added, one at a time, to the model. The model was then re-estimated and showed an adequate fit between the hypothesized model and empirical data: X^2 = 877.939 (df = 354, p = .000); CFI = 961; GFI = 911; NFI = 937; CMIN/df = 2.480; and RMSEA = .050. All the standardized factor loadings then passed the 0.7 threshold. Table 26 compares the model fit indices before and after the model improvement. Appendix D2 illustrates the final CFA model.

Table 26

Model Fit Indices for Initial and Final Measurement Model – LCCs

Model Fit Indices	Acceptance Value	Initial CFA Model	Final CFA Model
X^2	-	1458.049***	877.939***
df	-	482	354
GFI	> .90	.869	.911
NFI	> .90	.912	.937
CFI	> .95	.939	.961
CMIN/df	<=3	3.025	2.480
RMSEA	< .06	.058	.050

Note. *** significant at p < .001.

Reliability and validity. Convergent validity and discriminant validity were assessed for the LCC model. Three indicators of convergent validity were evaluated, including factor loading, average variance extracted (AVE), and construct reliability (CR). The following acceptance values were adopted: standardized loading estimates >= .70 or at least >= .50; AVE >= .50; and CR >= .70 (Hair et al., 2010). To pass the discriminant validity test, AVE should always be greater than the squared correlation estimate (Hair et al., 2010).

Table 27 presents the results of the convergent validity test for the CFA model. All estimated factor loadings were greater than .70, and all factors met the reliability requirement (CR > .70), indicating satisfactory consistency among items. AVE for all factors was greater than .50, demonstrating satisfactory convergent validity.

Table 27

Convergent Validity – LCCs

Construct	Item	Factor Loading	Construct Reliability	AVE
Attitudes	AT2	.906	.922	.798
	AT3	.905		
	AT4	.868		
Subjective Norms	SN2	.796	.882	.714
	SN3	.876		
	SN4	.861		
Perceived Behavioral Control	PB1	.820	.875	.699
	PB4	.861		
	PB5	.827		
Price	PR1	.811	.851	.655
	PR3	.795		
	PR4	.822		
Uncertainty Avoidance	UA1	.793	.848	.651
	UA2	.805		
	UA3	.822		
Access	AC1	.801	.858	.668
	AC3	.867		
	AC5	.782		
Frequency	FR1	.894	.913	.778
	FR2	.925		
	FR4	.824		
Technology Self-efficacy	SE1	.847	.882	.713
	SE3	.849		
	SE4	.837		
Service Quality	SQO2	.855	.899	.749
	SQO3	.885		
	SQO4	.856		
Behavioral Intention	BI1	.788	.861	.675
	BI5	.856		
	BI6	.819		

Table 28 compares the AVE with squared correlation estimate for any two constructs. As can be seen, all AVE scores were greater than the squared correlation estimates, indicating sufficient discriminant validity of the constructs (Hair et al., 2010).

Table 28

Discriminant Validity – LCCs

	AT	SN	PB	PR	AC	UA	SE	SQ	FR	BI
AT	**.798**									
SN	.702	**.714**								
PB	.404	.398	**.699**							
PR	.588	.549	.569	**.655**						
AC	.365	.346	.249	.349	**.668**					
UA	.398	.396	.419	.629	.361	**.651**				
SE	.401	.333	.360	.588	.326	.410	**.713**			
SQ	.345	.365	.227	.347	.347	.229	.362	**.749**		
FR	.166	.217	.215	.194	.498	.202	.135	.257	**.778**	
BI	.382	.441	.240	.445	.299	.233	.398	.472	.127	**.675**

Note. AT=Attitudes; SN=Subjective Norms; PB=Perceived Behavioral Control; PR=Price; UA=Uncertainty Avoidance; AC=Access; FR=Frequency; SE=Technology Self-efficacy, SQ=Service Quality; BI=Behavioral Intentions.

Because all the constructs demonstrated satisfactory convergent and discriminant validity, they were retained in the LCC model. The measurement model of LCCs consisting of 10 constructs was thus successfully validated and ready for the structural model analysis.

Structural model testing (SEM). After validating the CFA model, the structural model was estimated with the purpose of examining relationships among constructs in the LCC model. To recap, the LCC model was developed based on the literature review and ground theory of TPB, with external factors being included to reflect the research context in China. The exogenous variables were attitudes, subjective norms, PBC, price, uncertainty avoidance, access, frequency, technology self-efficacy, and service quality. The endogenous variable was the behavioral intention to use LCCs. In addition, the relationship between service quality of LCCs and attitudes toward LCCs was examined.

The data were again assessed for normality and outliers. All kurtosis values were less than 5.00, and squared Mahalanobis distance (D^2) values showed minimal evidence of outliers, indicating normal distribution data. The MLE method was thus used for model estimation. The focus in the SEM analysis was on two issues: (1) overall model fit of the proposed model and (2) hypothesis testing and parameter estimates (Hair et al., 2010).

Overall model fit. The criteria for evaluating the SEM model followed the same rules applied to CFA: CFI > .95; GFI and NFI > .90; CMIN/df <= 3; and RMSEA < .06 (Byrne, 2010). The results of the initial SEM model indicated poor model fit: X^2 = 1277.203 (df = 361, p = .000); GFI = .882; CFI = .932; NFI = .909; CMIN/df = 3.538; and RMSEA = .065. Thus, modification in specification was performed.

Model respecification was conducted based on the modification indices, which showed a number of large values between error terms. Covariances were added between five pairing error terms with the largest values. The revised SEM model was re-estimated and indicated an acceptable model fit: $X^2 = 1076.597$ (df = 355, p = .000); GFI = .896; CFI = .947; NFI = .923; CMIN/df = 3.033; and RMSEA = .058, all within or very close to the range of recommended values. Table 29 shows the model fit indices of the revised SEM model and compares that to the fit statistics of the CFA model validated in the previous section. As can be seen, the overall model fit did not change substantially from the CFA model.

Table 29

Model Fit Comparison Between SEM Model and CFA Model

Model Fit Index	Structural Model	Measurement Model
X^2 (Chi-square)	1076.597	877.939
Degrees of freedom	355	354
Probability	***	***
GFI	.896	.911
NFI	.923	.937
CFI	.947	.961
CMIN/df	3.033	2.480
RMSEA	.058	.050

Note. *** (p < .001).

Hypothesis testing. After the structural model achieved a satisfactory model fit, hypotheses were tested. Figure 15 illustrates the standardized path estimates for the SEM model. Table 30 shows the standardized path coefficients and t-values for the SEM model. Eight structural path estimates reflecting H1, H2, H4, H5, H6, H8, H9, and H10 were significant and in the expected direction. Therefore, H1, H2, H4, H5, H6, H8, H9, and H10 were supported. The path estimate reflecting H3 was not significant, and the one reflecting H7 was not in the hypothesized direction. Therefore, H3 and H7 were not supported. Because 8 out of 10 path estimates were consistent with the hypotheses, the results in general supported the theoretical model.

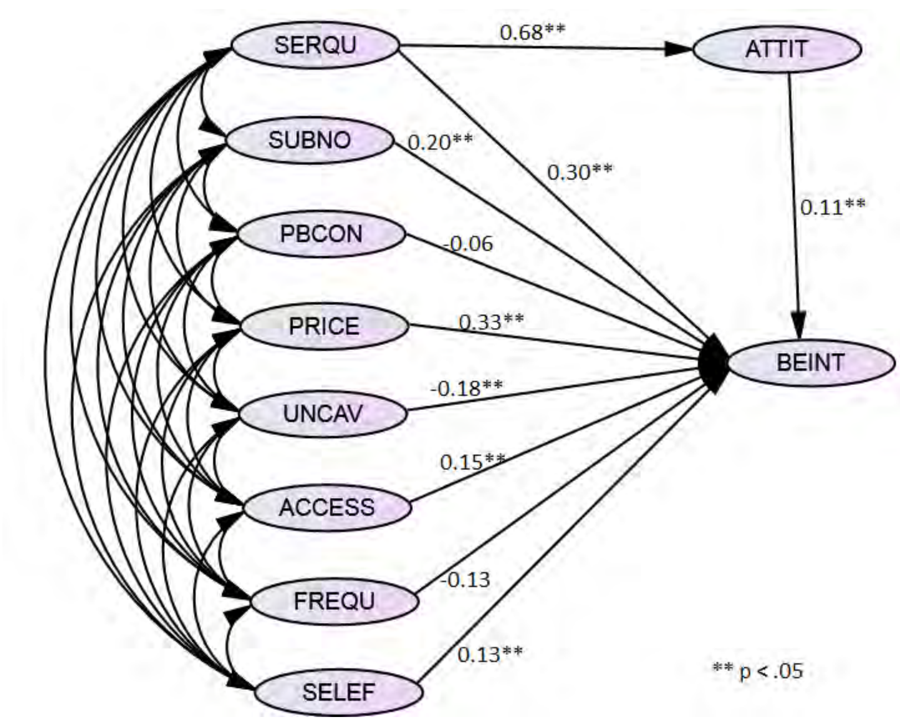

Figure 15. Standardized path coefficients for SEM model - LCCs. SERQU = Service Quality; ATTIT = Attitudes; SUBNO = Subjective Norms; PBCON = Perceived Behavioral Control; PRICE = Price; UNCAV = Uncertainty Avoidance; ACCESS = Access; FREQU = Frequency; SELEF = Technology Self-efficacy; BEINT = Behavioral Intentions.

Table 30

Structural Model Hypothesis Testing – LCCs

Hypothesis	Estimate	t-value	p-value	Result
H1: Attitudes → Behavioral Intentions	.086	2.282	.023	Supported
H2: Subjective Norms → Behavioral Intentions	.157	4.36	***	Supported
H3: PBC → Behavioral Intentions	-.044	-1.083	.279	NS
H4: Service Quality → Attitudes	.762	15.931	***	Supported
H5: Service Quality → Behavioral Intentions	.264	4.495	***	Supported
H6: Price → Behavioral Intentions	.290	3.268	.001	Supported
H7: Frequency → Behavioral Intentions	-.108	-2.457	.014	NS
H8: Access → Behavioral Intentions	.151	2.346	.019	Supported
H9: Uncertainty Avoidance → Behavioral Intentions	-.165	-2.569	.010	Supported
H10: Technology Self-efficacy → Behavioral Intentions	.124	2.046	.041	Supported

Note. *** significant at $p < .001$. NS = Not Supported.

H1 was supported. Attitudes were positively related to passengers' behavioral intentions to choose LCCs ($P_{BI,AT} = .11$), indicating that the more positive the attitude toward LCCs, the higher intention to use LCC service. This relationship was significant at $p = .023$.

Testing of H2 revealed a positive effect of subjective norms ($P_{BI,SN} = .20$) on passengers' intentions to use LCCs, and this relationship was significant ($p < .001$). Thus, H2 was supported. It suggested that the stronger the subjective norms, the higher the intention to use LCCs in China.

H3 hypothesized a positive relationship between PBC and passengers' intentions to use LCCs. The path estimate was not statistically significant ($p = .279$), indicating that

PBC was not a significant predictor of the intention to use LCCs. H3 was thus not supported.

Hypothesis testing showed a positive and strong relationship between service quality of LCCs and attitudes toward LCCs ($P_{AT,SQ} = .68$), and this relationship was significant ($p < .001$). H4 was thus supported, indicating that the better the service quality, the more favorable the attitude toward LCCs.

Testing of H5 revealed a strong, positive relationship ($P_{BI,SQ} = .30$) between service quality and passengers' use of LCCs, and this relationship was significant ($p < .001$). H5 was supported, suggesting that service quality played an important role in the use of LCCs in China.

Testing of H6 showed a strong and positive effect of price on the use of LCCs ($P_{BI,PR} = .33$), and this relationship was significant ($p = .001$). Thus, H6 was supported. It indicated that price was an important determinant of passengers' use of LCCs in China.

H7 predicted a positive relationship between frequency and passengers' intentions to use LCCs. The path coefficient was negative ($P_{BI,FR} = -.13$), which was not in line with the hypothesized direction. Thus, H7 was not supported. The result suggested that frequency was not an important factor in passengers' use of LCCs in China.

Testing of H8 revealed a positive relationship between access and passengers' intentions to use LCCs. This relationship was found to be moderate ($P_{BI,AC} = .15$) and statistically significant ($p = .019$). Thus, H8 was supported, indicating that the more convenient the access, the higher the intention to use LCCs.

H9 hypothesized a negative relationship between uncertainty avoidance and passengers' intentions to use LCCs. The testing showed a negative path coefficient for this relationship ($P_{BI,UA} = -.18$), which was significant at $p = .010$. Thus, H9 was supported, indicating that the higher the uncertainty avoidance, the lower the intention to use LCCs.

Testing of H10 showed a positive relationship ($P_{BI,SE} = .13$) between technology self-efficacy and passengers' intentions to use LCCs. This relationship was statistically significant ($p = .041$). Thus, H10 was supported, indicating that the stronger the technology self-efficacy, the higher the intention to use LCCs.

Model Comparison

Both HSR and LCC models used the TPB as the ground theory. Seven constructs - attitudes, subjective norms, PBC, price, service quality, frequency, and access, were shared factors in the two models. The standard regression weights of these factors were compared for their effects on the intention to use HSR and LCCs.

Attitudes significantly influenced the intention to use HSR and LCCs. The magnitudes of effect, $\beta = .13$ for HSR and $\beta = .11$ for LCCs, were similar for both modes.

Subjective norms related positively and significantly to intentions to use HSR and LCCs. The effects, $\beta = .19$ for HSR and $\beta = .20$ for LCCs, showed that subjective norms had a similar impact on passengers' decisions to use both modes.

PBC was not statistically significant in both HSR and LCC models. It indicated that HSR and LCC passengers did not find perceived control important in their decisions to use HSR and LCCs.

Price had a significant impact on the use of HSR and LCCs. The magnitude of impact was larger on LCC passengers ($\beta = .33$) than on HSR passengers ($\beta = .19$).

Service quality was an important factor in the intention to travel by HSR and LCCs. It had a similar impact on the use of HSR (β = .32) and LCCs (β = .30).

Frequency did not pass the significance testing in both HSR and LCC models. For HSR and LCC passengers, frequency was not a significant factor in their mode use decisions.

The hypothesis testing showed a positive, significant relationship between access and intentions to use HSR and LCCs. Access had a same impact (β = .15) on the use of both HSR and LCCs. Table 31 compares the effects of the predicting factors in the two models.

Table 31

Comparison of Construct Effects on the Use of HSR and LCCs

Construct	HSR	LCCs
Attitudes	.13*	.11*
Subjective Norms	.19*	.20*
PBC	.07	-.06
Price	.19*	.33*
Service Quality	.32*	.30*
Frequency	-.02	-.13
Access	.15*	.15*
Total Travel Time	.20*	n/a
Trust	-.35	n/a
Technology Self-Efficacy	n/a	.13*
Uncertainty Avoidance	n/a	-.18*

Note. * = significant at $p < .05$; n/a= Not applicable.

Chapter Summary

This chapter presents the analytical results of the HSR and LCC data. Both HSR and LCC questionnaires were tested and improved through the pilot study before being used for large-scale surveys. The sample size for the final analysis was 484 for the HSR model and 596 for the LCC model. Descriptive statistics summarized passenger characteristics and travel experience, and calculated the values of mean and standard deviation for individual scale items in the questionnaires.

The measurement model assessment of HSR was performed using CFA. The model, initially showing only an acceptable fit, was improved through respecification for achieving a satisfactory model fit: $X^2 = 623.421$ (df = 358, p = .000); CFI = .975; GFI = .923; NFI = .943; CMIN/df = 1.741; and RMSEA = .039. The CFA model passed convergent and discriminant validity tests, indicating sufficient construct validity. The structural model was assessed using SEM, which showed a satisfactory model fit: $X^2 = 863.475$ (df = 365, p = .000); GFI = .900; CFI = .953; NFI = .921; CMIN/df = 2.366; and RMSEA = .053. The hypothesis testing showed that H1, H2, H4, H5, H7, H8, and H10 were supported, while H3, H6, and H9 were not supported. In other words, attitudes, subjective norms, service quality, price, access, and total travel time were significant factors in the intention to use HSR in China, while PBC, trust, and frequency were not important.

For the LCC model, the measurement model assessment initially showed inadequate model fit. The model was improved through respecification and achieved a satisfactory fit: $X^2 = 877.939$ (df = 354, p = .000); CFI = .961; GFI = .911; NFI = .937; CMIN/df = 2.480; and RMSEA = .050. All the constructs in the CFA model demonstrated satisfactory convergent and discriminant validity and thus were retained in the model. The structural model achieved a satisfactory model fit after model re-specification: X^2 = 1076.597 (df = 355, p = .000); GFI = .896; CFI = .947; NFI = .923; CMIN/df = 3.033; and RMSEA = .058. The result of hypothesis testing showed that H1, H2, H4, H5, H6, H8, H9, and H10 were supported, while H3 and H7 were not supported. In other words, attitudes, subjective norms, price, service quality, access, uncertainty avoidance, and technology self-efficacy were significant determinants of passengers' use of LCCs, while PBC and frequency were not important. The next chapter discusses the HSR and LCC results in the theoretical and research contexts, draws conclusions for the current study, and proposes recommendations for future research.

CHAPTER V

DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

The present research investigated passengers' use of HSR and LCCs in China. Specifically, it examined the factors that influenced passenger intentions to use HSR and LCCs, and the extent of influence of these factors. In addition, this study compared the effects of the factors that influenced the use of both HSR and LCCs, in order to gain insights into potential competition between HSR and LCCs in China.

Research models were developed for HSR and LCCs based on the literature review, transport context in China, and the ground theory of the TPB. This researcher collected the empirical data from HSR passengers following a random sampling approach at South Railway Station in Beijing and Hongqiao Railway Station in Shanghai and from LCC passengers at Pudong International Airport in Shanghai and Zhengding International Airport in Shijiazhuang. The data were analyzed using a SEM technique. The results indicated that 7 out of 10 hypotheses (H1, H2, H4, H5, H7, H8, H10) proposed by the HSR model were supported, whereas 8 out of 10 hypotheses (H1, H2, H4, H5, H6, H8, H9, H10) related to the LCC model were supported. Chapter V, the final chapter, discusses the results and presents the conclusion of this study. There are six sections in Chapter V - discussion of the HSR model, discussion of the LCC model, model comparison, conclusions, recommendations, and future research.

Discussion of HSR Results

In this section, the HSR results presented in Chapter IV are discussed in relation to other study findings and the ground theory of the TPB. In addition, this researcher critically examined the findings, which offer new insights into the factors that influence the use of HSR.

Passenger characteristics. More men (60.5%) than women (39.5%) participated in the survey, and the respondents were mostly between the age of 20 and 40 (80.2%), had a college or bachelor's degree (63.6%), earned 2000-8000 RMB (USD 290-1161) monthly income (67.1%), and worked in the area of business (75.8%). Compared to the national average, the HSR respondents were younger, more educated, and earned higher incomes (National Bureau of Statistics of the People's Republic of China, 2015). The results are not surprising, as previous studies also suggest that HSR passengers tend to be young and middle-aged (Chou & Kim, 2009; Chou & Yeh, 2013), more-educated (Chou & Yeh, 2013), earn higher incomes (Harvey et al., 2014), and many of them work in business and service industries (Chou & Yeh, 2013; Ollivier et al., 2014).

More respondents traveled for business purposes (42.4%) than for other purposes. Most respondents (62%) used HSR over 3 times a year. While most respondents (83.9%) obtained information about HSR tickets from online resources, nearly half of the ticket purchases (45%) were completed at the HSR ticket office, indicating that HSR in China sells large amounts of tickets through traditional channels. Nearly three quarters of the respondents (71.9%) paid 401-800 RMB (USD 58-116) for their HSR tickets. The prices can be considered moderate given the monthly income disclosed by the respondents. It is also in line with relatively low HSR fares in China compared to other countries, as indicated in prior studies (Fu et al., 2012; Ollivier et al., 2014; Yang & Zhang, 2012).

The survey sample, although different in some attributes from the national population, is considered representative of the HSR population in China. First, some attributes of the survey sample, such as higher education and earnings compared to the national average, match the characteristics of the HSR population. High-speed trains in China are mostly operated between large, economically-developed cities, where the population is expected to have more education and higher earnings compared to other cities. Because of the strong economy, people living in these cities have more opportunity to work in the business sector. Prior research also provides support to these matching characteristics (Chou & Yeh, 2013; Harvey et al., 2014; Ollivier et al., 2014). Second, this study used a random sampling process, which allowed for reduced sample error and more accurate generalization of the findings to the population. Third, a non-response bias test was performed, which indicated no significant difference with regard to important demographic attributes between those who declined to participate in the survey and those who agreed to participate. Finally, the survey sample contained HSR passengers from 27 provinces who were traveling to 10 destinations at the time of the survey. As such, the survey sample covered a large number of domestic markets, which can increase the generalizability of the study.

Model results. The HSR model contained nine predicting variables - attitudes, subjective norms, PBC, price, trust, total travel time, access, frequency, and service quality; and one outcome variable - the intention to use HSR in China. The mean values of the items measuring these variables, as shown in Table 14 in Chapter IV, offered preliminary insights into the motivation in using HSR. Overall, the HSR respondents held moderately positive perceptions of HSR, as indicated by the 4-level mean values for most scales. Noticeably, the items measuring price (3.86, 3.54, 3.71, and 3.50) only indicated moderate perceptions on price. It may imply that the survey participants were not very satisfied with HSR fares, despite the fact that HSR in China charges relatively low fares compared to other countries (Ollivier et al., 2014).

Of the 10 hypotheses related to the use of HSR, H1, H2, and H3 represented the relationships between the TPB components (attitudes, subjective norms, and PBC) and the behavioral intention; H4 represented the relationship between service quality and attitudes; and H5 to H10 described the relationships between the external factors (price, trust, access, frequency, service quality, total travel time) and the intention to use HSR. H1, H2, H4, H5, H7, H8, and H10 were supported, while H3, H6, and H9 were not supported. The following paragraphs discuss the relationships in detail.

Attitudes. In the HSR context, attitudes represent a psychological tendency of consumers to associate HSR with favorable or unfavorable feelings (Hsiao & Yang, 2010). In this study, attitudes had a positive influence ($\beta = .13$) on passengers' intentions to choose HSR in China. The finding is in agreement with prior TPB-related studies, which indicate positive effects of attitudes on consumer intentions (Dowd & Burke, 2013; Liu et al., 2013; Ma et al., 2012) and on behavioral intentions in the transport industry (Jalilvand & Samiei, 2012). In the HSR context, low intentions to use HSR may be attributed to a lack of positive attitude toward HSR (Hsiao & Yang, 2010). The finding of this research revealed a similar effect of attitudes on HSR passengers' behavioral intentions in China.

The positive effect of attitudes on the use of HSR, as indicated by this study, should be interpreted against the specific context in China. China has developed 12,183 km of HSR lines, a length that is more than the rest of the world's HSR lines combined (Fu et al., 2012; Ollivier et al., 2014). As such, Chinese people tend to associate HSR with positive feelings. On a more practical level, HSR delivers many benefits, particularly in service and travel time. The favorable feeling toward HSR and practical benefits of HSR can help shape positive attitudes toward HSR, which can in turn influence consumers' intentions to use HSR. The finding is important because it provided empirical evidence, from a psychological perspective, to the positive relationship between attitudes and consumer choices in the rapidly developing HSR market in China.

Subjective norms. Subjective norms are concerned with the impact of important referent individuals or groups on an individual's behavior (Azjen, 1991). In this study, subjective norms had a positive, moderate impact ($\beta = .19$) on passengers' intentions to use HSR in China. The finding suggested that the survey respondents considered opinions of other people, particularly those important to them, when deciding on the use of HSR. For travel decision-making, subjective norms are often an influencing factor (Jalilvand & Samiei, 2012; Lam & Hsu, 2006; Tsai, 2010), but their effect on the choice of rail services remains unclear. Subjective norms were a less significant factor compared to the other two TPB components in passengers' intentions to choose HSR in Taiwan (Hsiao & Yang, 2010). The finding of this study, however, demonstrated a stronger effect of subjective norms in the use of HSR in China.

In China, HSR is a high profile project, with information such as price, schedule, service, and safety of HSR widely available to the public. Consumers have easy and quick access to the information, which would be sufficient for them to make mode use decisions. The finding that the respondents still valued and relied on opinions of their important others in their use of HSR indicated that social influence remains significant in the choice of HSR in China, even though consumers are able to obtain important information of HSR from various sources. The positive effect of subjective norms in this study may be associated with the collective culture in China, which emphasizes on harmony and group orientation in interpersonal relationships (Wei & Li, 2013). Chinese people may have a psychological tendency of aligning with remarks and behaviors of others (Zhao, 2011). The finding of this study shed a new light on the impact of normative influence on the mode use motivation. In China, the choice of HSR can be significantly influenced by what others think of HSR, and it remains so even consumers have sufficient information to make a reasonable decision.

Perceived behavioral control. PBC is defined as the control of external resources for an individual to successfully perform the behavior of interest (Armitage & Conner, 1999, 2001). As indicated by this study, PBC was not a significant predictor of the respondents' intentions to use HSR in China. The result differs slightly from some TPB-related works that argue for the importance of perceived control in social behaviors. Perceived control on external resources such as opportunity and money is often considered important in behavioral achievement (Ajzen, 1991; Conner & Armitage, 1998). Studies reviewed in Chapter II indicated that PBC influenced behavioral intentions in multiple contexts (Dowd & Burke, 2013; Lam & Hsu, 2006; Liu et al., 2013; Jalivand & Samiei, 2012; Ma et al., 2012). In the HSR context, however, PBC has been found insignificant in passengers' choice of HSR in mainland China (Jing & Juan, 2013). This study produced a similar result in the Chinese market.

The finding of this study is important because it indicated a low need for perceived control in the use of HSR in China. The insignificant effect of PBC could be attributed to the well-established ticket distribution system in China, which allows consumers to obtain HSR tickets easily from ticket office, train station, and the internet. With the availability of and easy access to HSR tickets, consumers could feel that they have full control of their decisions of traveling by HSR, thus would not consider perceived control an important factor. Another likely reason could relate to the demographics of the survey respondents. Most respondents in this study worked in the business sector and traveled for business purposes. Therefore, it is likely that once the respondents specified their intentions to travel by HSR for a business trip, their companies would take care of issues such as schedule arrangement and ticket purchase. In such a circumstance, the perceived control of external resources for the HSR trip would not be an important factor.

Total travel time. Total travel time refers to "*door-to-door*" time, which contains time spent on all components of a passenger's trip, including ground access, boarding process, train portion, unboarding process, and ground egress (Belobaba, 2015). As indicated by the estimate coefficient ($\beta = .20$), total travel time had a positive, moderate influence on passengers' use of HSR in China. The result is in agreement with the literature, which indicates that total travel time is important for passengers to choose HSR (Valeri, 2014), that total travel time is a significant factor especially for business passengers (Behrens & Pels, 2012), and that total travel time is a more accurate factor to use when comparing the travel time of HSR and air transport (Fu et al., 2012; Goldman Sachs, 2010). Studies conducted in the Chinese markets, although not focusing on the intention to use HSR, also support the benefit of total time saving of HSR (Chen et al., 2014; Fu et al., 2012).

The positive effect of total travel time on the behavioral intention, as revealed in this study, clearly reflects the market situation in China. Traditional rail transport has been the dominant transport mode in China, which carried about 25% of the world's rail traffic (Fu et al., 2012). Rail transport is able to compete with air transport in China only after HSR dramatically increased train speeds. It is estimated that about 70% of China's HSR network is designed to operate at 350 km/h, 13% at 250 km/h, and 16% at 200 km/h (Fu et al., 2012; Goldman Sachs, 2010). The time saving benefit resulting from speed escalation of the train has significantly reduced total travel time, which can stimulate interest in using HSR. The time saving benefit is further enhanced by the convenient location of HSR stations and simplified station process, especially in large cities. The finding of this study revealed a new understanding of consumer motivations in using HSR in China. While China is often associated with low per capita income and thus low value of time (Fu et al., 2012), this study indicated that HSR passengers in China may have relatively high value of time. In other words, consumer motivations in using HSR are shaped to a large degree by the length of total travel time of the trip.

Price. Price had a positive, moderate impact (β = .19) on passengers' intentions to use HSR in China. The result is consistent with prior studies, which find price important for HSR to stay competitive (Finger et al., 2014; González-Savignat, 2014), to increase market share (Yao et al., 2013), and to attract passengers from other transportation modes (Kuo et al., 2013), including LCCs (Chantruthai et al., 2014).

HSR is costly to develop, and it is usually difficult to generate profits (Ryder, 2012). As such, HSR companies must price strategically to ensure adequate operational income and at the same time attract and retain customers. In China, HSR is able to charge lower fares compared to other countries due to the low-cost structure and government support (Fu et al., 2012; Ollivier et al., 2014). An interesting observation in this study is that, while price showed a positive effect on the use of HSR, the respondents appeared to be less satisfied with the price of HSR compared to other HSR attributes, as revealed by the mean values of the question items in the survey questionnaire. It may indicate that the respondents still perceived the HSR price as being too expensive. The price perception could be related to conventional rail transportation in China, which has a long-established reputation for providing affordable services. The price range of a conventional train is RMB 0.10-0.15 (USD 0.015-0.022)/passenger-kilometer, which is substantially lower than RMB 0.43-0.48 (USD 0.062-0.070)/passenger-kilometer for HSR (Zhao et al., 2015). The finding of this study is valuable because it suggested that Chinese consumers may have a tendency of comparing HSR fares with conventional rail fares instead of HSR fares in other countries. Such tendency could explain the moderate perception of the HSR price in this study, despite the fact that China actually charges much lower fares of HSR compared to other countries (Fu et al., 2012; Ollivier et al., 2014).

Service quality. Service quality of HSR is measured by how well the service level provided by HSR matches a passenger's expectation. In the current study, service quality positively and strongly influenced attitudes toward HSR in China ($\beta = .69$). At the same time, service quality had a strong, positive impact on passengers' intentions to use HSR ($\beta = .32$). The findings are largely consistent with the literature presented in Chapter II, which indicated positive relationships between service quality and the use of HSR (Kuo et al., 2013) and between service quality and attitudes in the HSR context (Chou & Kim, 2009; Chou et al., 2011; Kuo & Tang, 2013).

Noticeably, service quality, among all the factors in the current study, had the strongest effect on the intention to use HSR. The finding indicated that passengers in China choose HSR primarily for its service. The result is not surprising given the market image of HSR in China, which is often associated with service excellence. Compared to conventional railway, HSR offers greatly improved efficiency and service quality. Particularly, HSR in China is able to provide high-quality service onboard, which significantly improves passengers' ride comfort. Service quality not only sets HSR apart from the conventional train, but also allows it to compete with airlines. The finding of this study showed that HSR in China has successfully built a market reputation based on its service. Consumers not only value service quality of HSR, but make it a primary consideration in their choice of HSR.

Trust. Trust is important in business relationships, where consumers expect the trusted party to fulfill its commitment (Hsiao & Yang, 2010). In this study, trust was not a significant predictor of passengers' intentions to use HSR in China. The result differs from the studies reviewed in Chapter II, which revealed positive relationships between trust and behavioral intentions (Forgas-Coll et al., 2015; Han & Hwang, 2014; Hong & Cha, 2013). In the HSR context, safety concern is important, and therefore trust can be an influencing factor in the use of HSR (Hsiao & Yang, 2010). Trust can also influence consumer attitudes toward HSR, which in turn affect the intention to travel by HSR (Hsiao & Yang, 2010).

The insignificant effect of trust revealed in this study provided a new understanding of trust in the HSR context. The finding indicated that trust can play a different role in the use of HSR in different markets. Trust is essential in relationships characterized by a high degree of risk, uncertainty, and/or lack of knowledge or information on the consumers' part (Hsiao & Yang, 2010; Mayer, Davis, & Schoorman, 1995). The weak effect of trust in this study could be associated with consumer perceptions of HSR in China. HSR is a national priority in China, with a high degree of consumer awareness. Consumers are fully aware of the development of HSR, and they have access to large amounts of information of HSR. In addition, consumers generally hold positive attitudes toward HSR and consider HSR a safe and reliable transport mode. As a result, Chinese consumers may associate HSR with a low level of risk, and therefore would not go through the intermediary step of trust before deciding on the use of HSR.

Access. Station access had a moderate, positive impact on passengers' intentions to choose HSR in China ($\beta = .15$). The finding is in agreement with prior studies, which suggest that accessibility to HSR facilities can be a major factor of success for HSR (Cascetta et al., 2011; Clever & Hansen, 2008; Pagliara et al., 2012). HSR is more competitive than air service partially because HSR stations are more accessible than airports (Pagliara et al., 2012). Station accessibility is particularly important to frequent and business passengers (Cokasova, 2005; Jung & Yoo, 2014), and in some markets, it can be a more significant determinant than journey time of passengers' choice of HSR (Jung & Yoo, 2014).

This study pointed to the importance of station access in consumers' choice of HSR. HSR stations are generally located in or near the city center (Fu et al., 2012). In China, improvement of inner-city transportation, such as the expansion of the subway system in Beijing, has further enhanced accessibility to HSR facilities. The positive effect of access revealed in this study indicated that passengers in China value the benefit of being close to the HSR station and able to access the station easily and hassle-free. The importance of access in this study could also relate to passenger characteristics. As most respondents traveled frequently and for business purposes, station accessibility can be particularly important in their intentions to use HSR.

Frequency. The proposed relationship between frequency and the intention to use HSR was not supported. In other words, the survey respondents did not find frequency important in their decisions to choose HSR. The finding differs slightly from some prior studies (Park & Ha, 2006), especially that in the European markets (Behrens

& Pels, 2012; Dobruszkes, 2011) where HSR achieves success partially due to its high frequencies (Pagliara et al., 2010). In some markets where air transport competes strongly with HSR, airlines opt to maintain high frequencies with smaller planes in order to attract passengers from HSR (Pagliara et al., 2010).

The insignificant effect of frequency revealed by this study is surprising given the convenient, high frequency of HSR in China, which is often viewed as a benefit. It, however, provided new insights into the effect of frequency in the HSR context. HSR is characterized by a high frequency of train services. For example, there are 54 pairs of high-speed trains running daily between Wuhan and Guangzhou (Zhao et al., 2015). On the Beijing-Shanghai Corridor, there are 41 pairs of HSR trains operating at a speed of 300 km/h every day (Zhao et al., 2015). It should be noted that conventional railway, which offers high train frequencies, has been the most common transportation mode in China for decades. It is likely that Chinese consumers, due to the long history of using rail transportation, have become used to high frequencies of rail services. As a result, they may not see frequency as a particularly important benefit of HSR, and would instead focus on other factors in choosing HSR.

Effect of the TPB. The TPB, proposed by Ajzen (1991), has been widely used for investigating social behaviors. The TPB model contains attitudes, subjective norms, and PBC as its original predicting variables. The model is flexible and inclusive, which means it allows for addition of new factors to the model for examining intentions and behaviors in various contexts (Ajzen, 1991). This study used the TPB as the ground theory and included six external factors to the model to reflect the HSR context in China.

Of the three TPB components, attitudes and subjective norms were significant factors in passengers' intentions to use HSR, while PBC was found insignificant. Of the six external factors, price, service quality, access, and total travel time were significant determinants of the behavioral intentions, while trust and frequency were not important. Overall, the TPB is a suitable ground theory for this study, with two TPB components and four external factors collectively explaining 50% of the variance in the intention to use HSR.

Discussion of LCC Results

This section discusses the LCC results in relation to other study findings and the ground theory of the TPB. In addition, the findings are examined against the LCC context in China to gain new insights into the use of LCCs.

Passenger characteristics. The LCC survey included more men (54%) than women (46%). Compared to the national average (National Bureau of Statistics of People's Republic of China, 2015), the respondents were in general younger (75.3% between age 20 to 40), more educated (63% with either bachelor's degree or some college degree), and earned higher incomes (59.6% of RMB2000-8000, or USD290-1161). Most of them worked in the area of business (67.9%). The results are partially supported by findings of prior studies, which show that LCCs attract a higher number of young people (Chang & Hung, 2013; Kim & Lee, 2011; O'Connell & Williams, 2005) and many LCC passengers receive a good education (Chang & Hung, 2013; Lerrthaitrakul & Panjakajornsak, 2014; Yang et al., 2012). However, the literature generally indicates that LCC passengers earn relatively low personal income (Chang & Hung, 2013; Yang et al., 2012). The medium to high earnings of the respondents in this study may be related to the LCC market in China. As LCCs, particularly Spring Airlines, are based at major airports in economically-developed, large cities, people with higher education and earnings have a better chance to choose LCCs.

Most respondents traveled for non-business purposes (70.2%). The result is consistent with prior studies, which indicate that LCC passengers primarily travel for non-business reasons (Kim & Lee, 2011; Lerrthaitrakul & Panjakajornsak, 2014). Most respondents obtained ticket information (79.5%) and purchased their ticket (56.3%) on the internet, which is supported by the literature (Koo et al., 2011). The current study also found that about three quarters of the respondents (75.4%) used LCCs over 2 times a year and paid RMB 200-800 (USD 29-116) for their tickets (80.1%). These prices can be considered moderate given the incomes disclosed by the respondents.

The survey sample, while differing in some characteristics from the national population, can represent the LCC population in China. First, the current research utilized a random sampling method, which is important for the survey sample to represent a larger population. Second, there are shared attributes between the survey sample and LCC population, indicating a match (representativeness) between the two groups. The survey respondents were young and well-educated. The LCC population in general shares these characteristics (Chang & Huang, 2013; O'Connell & Williams, 2005). The medium to high incomes of the respondents can also represent the LCC population in China. As most LCCs in China operate from primary airports in large, economically developed cities, they have a better chance to tap into a higher-earning market segment

(Fu et al., 2015). Third, the test of non-response bias showed that the sample members who declined to participate in the survey were not significantly different in terms of important demographic attributes from those who agreed to participate, indicating representativeness of the sample to the LCC population. Finally, the survey sample contained LCC travelers from 28 provinces, who were flying to 22 destinations by 7 LCCs at the time of the survey. The sample thus covered a large number of domestic markets, which can increase the generalizability of the study.

Model results. The LCC model contained nine predicting variables - attitudes, subjective norms, PBC, price, uncertainty avoidance, access, frequency, technology self-efficacy, and service quality, and one outcome variable - passengers' intentions to use LCCs in China. The mean values of the items measuring these variables provided preliminary insights into the perception of LCCs. In general, the LCC respondents held a moderate perception of LCCs, as most mean values are at a 3 level.

Ten hypotheses were proposed. H1, H2, and H3 represented the hypothesized relationships between the TPB components (attitudes, subjective norms, and PBC) and the behavioral intention, as originally proposed by Ajzen (1991). H4 represented the relationship between service quality and attitudes. H5 to H10 described the hypothesized relationships between the external factors (price, uncertainty avoidance, access, frequency, service quality, and technology self-efficacy) and the intention to use LCCs. Of the 10 hypotheses, H1, H2, H4, H5, H6, H8, H9, and H10 were supported, while H3 and H7 were not supported. The following paragraphs discuss the proposed relationships in greater detail.

Attitudes. Attitudes are important in consumer behaviors (Fen & Sabaruddin, 2008; Hsiao & Yang, 2010; Mi & Gulsah, 2014; Zuo et al., 2013). In this study, attitudes demonstrated a positive effect on passengers' intentions to use LCCs in China (β = .11). The finding indicated the significant role of attitudes in behavioral intentions in the LCC context in China. The more favorable the attitudes toward LCCs, the higher the intention to travel by LCCs. The result is consistent with prior studies in the Asian markets, which suggest the importance of attitudes in passenger's choice of LCCs (Buaphiban, 2015; Buaphiban & Truong, 2017).

It should be noted that China differs from other countries in terms of the LCC market. While low-cost travel is a common travel option in many countries, it is still a relatively new phenomenon in China. Many Chinese travelers, including LCC passengers, are not familiar with the low-cost, low fare concept of LCCs. The finding of this study is important because it revealed that Chinese consumers, like consumers in matured LCC markets, rely on their cognitions and emotions toward LCCs in choosing an LCC. In China, consumers would be motivated to choose LCCs if they had positive cognitions and emotions toward LCCs (Buaphiban & Truong, 2017), and would avoid LCCs if they associated LCCs with unfavorable feelings or outcomes.

Subjective norms. Subjective norms in this study referred to social pressure an individual felt from his/her significant others who desired the individual to use or not use LCCs. The finding revealed a moderate, positive relationship (β = .20) between subjective norms and passengers' intentions to use LCCs in China. The result is in agreement with studies in Asian countries, which find subjective norms important in passenger motivations in using airline websites (Kim et al., 2009) and in passengers' intentions to choose LCCs (Buaphiban, 2015). The finding of this research provided additional evidence that subjective norms can be a significant determinant of passengers' use of LCCs in Asian markets.

The positive effect of subjective norms revealed in this study also provided a new understanding of passenger motivations in emerging LCC markets. As low-cost travel is still new and information about LCCs is limited in China, consumers would turn to their important ones for opinions when making a decision about traveling by LCCs. When consumers receive positive recommendations about LCCs, they would feel more confident in choosing LCCs. The positive effect of subjective norms could also relate to the Chinese tradition that emphasizes collectiveness and social connections (Wei & Li, 2013). In such a social environment, an individual's decision can be influenced by opinions of others. In the LCC context in China, it means that consumer intentions to use LCCs can be influence by what other people think of LCCs.

Perceived behavioral control. Perceived behavioral control refers to the access of resources necessary for performing a particular behavior (Armitage & Conner, 1999; Armitage & Conner, 2001; Conner & Armitage, 1998). While the literature in general supports the importance of PBC in activities involving traveling (Hsiao & Yang, 2010; Yen et al., 2014) and air ticket purchase (Ruiz-Mafe et al., 2013), this study showed a slightly different result. For the survey respondents, the perceived control was not significant in their intentions to use LCCs. The finding, however, is supported by a recent study in the Thai market, which suggested that PBC did not influence the intention to use LCCs, but rather, it affected the actual choice behavior of Thai passengers (Buaphiban & Truong, 2017). The reason for the insignificant effect of PBC, however, may differ in the two studies.

In Southeast Asia, because passengers are able to obtain low-cost tickets more easily than FSC tickets, they often feel they can afford the LCC services and have full control of their decisions (Buaphiban & Truong, 2017). As such, they would move forward to actually buying the ticket instead of having to go through the planning as an intermediary step (Buaphiban & Truong, 2017). The LCC market in China is different because it offers only limited low-cost services, and therefore other reasons should be responsible for the weak effect of PBC on the intention to use LCCs. In consumer decisions, one important perceived control often relates to financial control (Ajzen, 2002, 2005; Buaphiban & Truong, 2017). In the present study, the respondents had higher earnings compared to the national average, and they were satisfied with the price of LCCs, as indicated by the mean values of the scales in the survey questionnaire. As such, they may not see financial resources required for an LCC trip as a difficult obstacle. The perceived financial control can be an important reason that the survey respondents did not need to feel they had control when selecting LCCs in China.

Price. As expected, price demonstrated a strong, positive influence on passengers' choice of LCCs ($\beta = .33$). The result is consistent with existing knowledge, which shows that price is often the major consideration of passengers when choosing an LCC (Chang & Sun, 2012; Chen & Wu, 2009; Forgas et al., 2010; Jung & Yoo, 2014; O'Connell & Williams, 2005; Ong & Tan, 2010). Noticeably, among all the predicting factors in this study, price had the strongest effect on the intention to use LCCs in China. The finding is important, given the arguably reduced influence of price on LCC passengers in recent years due to changing market conditions. As the air transport market has become increasingly competitive, traditional airlines have lowered prices in order to attract and retain passengers. As such, LCCs may need to rely on factors other than price to attract passengers. Some studies point out that price may no longer be the most important factor in choosing an airline, even for LCCs (Assaf, 2009; Campbell & Vigar-Ellis, 2012; Kim & Lee, 2011).

The result of this study provided support to the dominant impact of price on passenger decisions in the emerging LCC market. In China, price remains the most important factor for passengers to use LCCs. The finding indicated that LCC passengers in China are price-sensitive and would consider price first when choosing LCCs as the transport mode. Price, however, may not be the only significant determinant of the intention to use LCCs in China. Due to the nature of the airline industry and regulatory constraints, 80% of the cost incurred by Chinese airlines are out of the airlines' control (Fu et al., 2015), leaving LCCs limited room for lowering their prices. Therefore, Chinese consumers are likely to combine price with other airline attributes in their decisions to use LCCs.

Uncertainty avoidance. As revealed by the finding, uncertainty avoidance had a moderate, negative impact on the use of LCCs in China ($\beta = -.18$). In other words, the more passengers feel uncertain about LCCs, the more likely they would avoid using LCCs.

Uncertainty avoidance is one of the five cultural dimensions proposed by Hofstede (1984) for measuring observed cultural differences between countries. By adding this factor to the model, the current study explored a possible relationship between culture and passengers' intentions to use LCCs in China. Although many studies suggest the impact of culture on social behaviors (Smith et al., 2013; Yoon, 2009), only limited research has examined the role of culture in the use of a transportation mode. One study found that culture in general influenced the perception of ride comfort in HSR passengers in different countries (Lee et al., 2009), which provided some support to the finding of the present study.

The result of this study offered new insights into the relationship between cultural factors and intentions to use LCCs in China. Choosing a transportation mode can bring a certain degree of uncertainty, and it is likely to be more so in choosing an LCC in China where the concept of low-cost travel has not yet been widely accepted. Because many consumers are not familiar with the on-time performance, restrictive rules, and particularly the safety record of LCCs, they may associate LCCs with high levels of uncertainty. Noticeably, Chinese culture is more conservative in risk decisions than Western culture (Cheng, 2010; Weber & Hsee, 1998), which means Chinese people may have a high preference for avoiding uncertainty (Quintal et al., 2010; Zheng et al., 2015). This study revealed a negative, significant relationship between uncertainty avoidance and the use of LCCs in China. It indicated that, due to the high uncertainty avoidance culture, Chinese consumers can be more sensitive to uncertainties associated with LCCs and have a greater tendency to avoid these uncertainties.

Service quality. Service quality of LCCs played a positive, significant role in passengers' attitudes toward LCCs ($\beta = .68$) and their intentions to use LCCs ($\beta = .30$) in China. As can be seen, the magnitude of the effect is substantial in both relationships. The findings differ from studies in Western countries, but are consistent with studies in Asian markets. In the traditional LCC market, such as Europe, LCCs are often associated with low service quality, and passengers tend to see service elements insignificant in their choice of LCCs (Mikulić & Prebežac, 2011). In some Asian markets, there seems to be a market space for LCCs that offers low prices and a modicum of above average service (Kim & Lee, 2011; Lawton & Solomko, 2005). While still pursuing low fares, passengers in these emerging markets have a higher expectation on LCC services (Chiou & Chen, 2010; Yang et al., 2012). As a result, LCCs that emphasize both low-fares and some service quality can achieve success in these markets (Kim & Lee, 2011; Saha & Theingi, 2009). This study provided new evidence for the positive relationship between service quality and passengers' motivation in choosing LCCs in the Asian market. In this study, service quality was the second most important factor in passengers' intentions to use LCCs, right after price. This study also indicated a strong, positive relationship between service quality and attitudes in the LCC context, which is supported by the literature (Ariffin et al., 2010; Charoensettasilp & Wu, 2013).

The finding of this study is important because it revealed that service quality of LCCs not only shapes the attitude towards LCCs, but also influences consumers' decisions of traveling by LCCs in China. Noticeably, service quality in this study appeared to have a greater impact on the intention to use LCCs in China than in matured LCC markets such as Thailand ($\beta = .22$) (Buaphiban, 2015). Such phenomenon can be attributed to the market characteristics of the two countries. While LCCs are commonplace in Thailand, air transport is still considered a luxury in China (Fu et al., 2012). Due to the dominant influence of FSCs, Chinese consumers often associate air travel with high-level services and would expect some service during a flight, even for LCCs. The finding of this study demonstrated the importance of service quality in the use of LCCs in China. Consumers would seriously consider service quality, along with other important factors such as price, when selecting LCCs as the transportation mode.

Frequency. The relationship between frequency and the intention to use LCCs was not supported in this study. As indicated by the survey data, frequency of LCCs did not influence the respondents' choice of LCCs in China. The insignificant effect of frequency may be associated with the demographics of the respondents. As most survey respondents traveled for non-business purposes, it is likely that they focused on factors more significant to them, such as price, in deciding on the use of LCCs. The literature shows similar results. Flight frequency is an important factor for business passengers to choose LCCs (Fourie & Lubbe, 2006; Mason, 2001), but not important for LCC passengers who planned their trips in advance to obtain low fares (Mikulić & Prebežac, 2011). The finding of this study is in agreement with prior research.

It should be noted that, while LCCs base their operations in uncongested, secondary airports for achieving high frequency flights and improved aircraft productivity (Gillen & Lall, 2004; Tierney & Kuby, 2008), LCCs in China generally find it difficult to achieve high frequencies due to the use of primary, congested airports (Liang & James, 2011). While low flight frequencies are often considered an obstacle to achieving customer satisfaction, the result of this study showed that Chinese consumers do not find frequency of LCCs important. In other words, Chinese consumers would not feel demotivated by low frequencies of LCCs when making decisions of traveling by LCCs.

Access. Airport access demonstrated a moderate, positive effect on passengers' choice of LCCs in China ($\beta = .15$). The result differs slightly from studies in traditional LCC markets in Europe and North America, where LCCs typically utilize far-away, secondary airports in order to save costs and minimize aircraft turnaround times (Gillen & Lall, 2004; Tierney & Kuby, 2008). Passengers in these markets are generally willing to sacrifice convenient airport access in exchange for lower airfares, fewer flight delays, and less congested ground transportation (O'Connell & Williams, 2005; Tierney & Kuby, 2008). The finding, however, is consistent with studies in LCC markets in Asia, where LCCs opt to use primary airports (Kim & Lee, 2011) due to the different operating environment compared to Western countries (Lawton & Solomko, 2005). In these markets, access time is often an influencing factor on passengers' choice of LCCs, especially for business and short-haul travellers (Jung & Yoo, 2014).

In China, LCCs base their operations at primary airports largely due to the lack of secondary airports (Liang & James, 2011). For example, Spring Airlines use Pudong International Airport and Hongqiao International airport, ranked 2nd and 6th domestically by passenger numbers (CAAC, 2015; Spring Airlines Annual Report, 2015), as its main hubs. By doing so, the airline provides their passengers with efficient access to the airport. The ground access, as revealed in this study, has a significant impact on the intention to choose LCCs. It means that Chinese consumers have a higher incentive to choose LCCs when they feel they can easily and quickly access the airport for LCC flights.

Technology self-efficacy. In this study, technology self-efficacy referred to the confidence in passengers' own technology-related ability to search for information and purchase tickets of LCCs. As the result suggested, technology self-efficacy positively influenced passengers' intentions to use LCCs in China ($\beta = .13$).

The finding is consistent with prior studies which indicate positive relationships between consumers' technology self-efficacy and their behavioral intentions (Schreder et al., 2009; Vakilalroaia & Fatorehchi, 2015). The technology competency can be particularly relevant to the LCC context because LCCs typically sell tickets directly through their websites in order to save costs (Escobar-Rodríguez & Carvajal-Trujillo, 2014; Koo et al., 2011), which requires that consumers have the necessary technological knowledge and skills in order to purchase a ticket. For LCC passengers, ticket purchase experience involving the use of technology, such as convenience and simplicity in collecting information about flights and making reservations, can influence service quality perceptions of LCCs (Mikulić & Prebežac, 2011) and the acceptance of LCCs (Chang & Hung, 2013).

The finding of this study showed that, as technology self-efficacy grows, the intention to use LCCs becomes higher. In this study, most survey respondents obtained LCC information and tickets on the internet. As such, technological competence can be a key factor in their use of LCCs. The finding provided important information for LCC market analysis in light of the technological progress in China. Due to the increase of internet users, China has witnessed a widespread adoption of e-commerce in large cities. The dramatic increase in on-line shopping (Jun & Jaafar, 2011) means more consumers will become capable of searching for information about LCCs and purchasing LCC tickets online. Given the positive relationship between technological competence and the motivation in using LCCs, China is likely to see growing LCC passengers in the years to come.

Effect of the TPB. This study used the TPB as the ground theory and included external factors to the model to reflect the LCC context in China. Of the three TPB components, attitudes and subjective norms were significant factors in passengers' intentions to use LCCs, while PBC was found not important. Of the six external factors, price, service quality, access, uncertainty avoidance, and technology self-efficacy were significant determinants of the behavioral intention, while frequency was not an important factor. Overall, the TPB is a suitable ground theory for this study, with two TPB components and five external factors collectively explaining 61% of the variance in the intention to use LCCs in China.

Model Comparison – HSR and LCCs

Both HSR and LCC models used the TPB as the ground theory and included external factors to reflect the research context in China. Table 31 in Chapter IV compares the results of the two models. This section discusses the results in more detail, focusing on the shared factors in the two models. The discussion can provide useful insights into potential competition between HSR and LCCs in China.

Passenger characteristics. The LCC and HSR respondents in this study shared some important demographic characteristics. In both groups, male respondents slightly out-numbered female respondents, and most of them were young (mostly aged 20-40), well-educated (mostly with a bachelor's degree or some college degree), earned moderate to high monthly income (RMB 2000-8000, or USD 290-1161), and worked in the area of business. The two groups differed substantially in their travel experience of using HSR and LCCs. Many HSR respondents used HSR more than three times a year, purchased tickets in the HSR office, and traveled for business purposes. Most LCC respondents, on the other hand, used LCCs less frequently (2-3 times), purchased tickets online, and traveled for non-business purposes. In addition, while most HSR and LCC respondents spent RMB 400-800 (USD 58-116) on their tickets, more LCC respondents purchased more expensive tickets (above RMB 800, or USD 116) than HSR passengers. Overall, HSR and LCCs appear to attract consumers with similar demographics but different travel experiences.

Attitudes. In both HSR and LCC models, attitudes demonstrated a positive impact on the intentions to use HSR and LCCs in China. As explained in Chapter I, HSR and LCCs differ substantially in terms of market position and market share in China, which may result in difference in consumer attitudes toward the two modes. The attitudes toward HSR, most likely to be positive, may derive from the pride of having the world's largest HSR system. In the case of LCCs, the attitudes may not be clear-cut due to the lack of awareness and understanding of low-cost travel in China. It is interesting to note that attitudes were not a strong predictor of behavioral intentions in both HSR ($P = .13$) and LCC models ($p = .11$). It may indicate that, while attitudes influence passengers' behavioral intentions, other factors may play a more significant role in decisions of using HSR and LCCs in China.

Subjective norms. Subjective norms were significant in behavioral intentions in both HSR and LCC models. In other words, when Chinese passengers choose HSR and LCCs for traveling, they consider opinions of those important to them, such as family and friends. For LCC passengers, opinions of their significant others are important in their decisions because low-cost travel is not common, and information regarding LCCs is limited in China. In the case of HSR, passengers also find such opinions necessary, although there is easy access to HSR information in China.

Subjective norms had a similar effect on the use of HSR ($\beta = .19$) and LCCs ($\beta = .20$), despite the different awareness of HSR and LCCs in China. The significant effect of subjective norms in this study could be context-related. As Chinese tradition emphasizes conformity and collectiveness, normative social influence could have some impact on personal decisions.

Price. In both HSR and LCC models, price was a significant predictor of passengers' behavioral intentions. The results are not surprising giving similar findings in prior studies, particularly with respect to the use of LCCs. The magnitude of effect, however, differed in the two models. For the LCC respondents, price was the most important factor in their choice of LCCs (β = .33). The effect of price on HSR passengers was less significant (β = .19).

The mean response values of scales in the questionnaires revealed additional information regarding the price of HSR and LCCs. In the HSR model, the three scales measuring price scored the lowest among all scales, indicating only moderate perceptions of the HSR price. In the LCC model, the mean values of the three items measuring price were among the highest of all scales, indicating satisfaction toward the price of LCCs. These results suggested that, while price is significant in intentions to use HSR and LCCs, Chinese consumers may perceive the price of HSR and LCCs differently. The knowledge could bring important implications for HSR-LCC competition in China.

Access. As the results showed, access was a significant factor in passengers' use of HSR and LCCs. Passengers in China consider accessibility to the train station and airport when making a decision to use HSR and LCCs. In this study, access had a same effect on the use of HSR (β = .15) and LCCs (β = .15).

The perception of access in this study can be related to train station and airport locations. In China, passengers usually find HSR stations easy to access due to their locations in or near the city center. LCCs in China mostly use primary airports for their operations, which also provide convenient airport access to passengers. It is worth noting that, although most HSR respondents in this study traveled for business purposes and LCC respondents for non-business purposes, they both found access important in their mode use intentions.

Service quality. Service quality was a significant determinant of behavioral intentions in both HSR and LCC models. For the HSR respondents, service quality was the most important factor in their use of HSR ($\beta = .32$). For the LCC respondents, it was the second strongest factor, right after price, in explaining the motivation in choosing LCCs ($\beta = .30$). As can be seen, the magnitude of impact of service quality was similar on both HSR and LCC passengers.

In China, HSR is able to provide service quality similar to that of FSCs. LCCs, with their business model focusing on low prices and limited services, are often unable to compete with HSR on service quality. Noticeably, while LCC passengers in traditional LCC markets are usually willing to trade service quality for low prices, this study indicated that passengers in China have a higher expectation of the service provided by LCCs, and they actually make service quality an important consideration when deciding on the use LCCs. The results open up a new perspective in passenger motives in using LCCs in China.

Frequency. In both HSR and LCC models, frequency was not a significant factor in predicting passengers' behavioral intentions. In other words, most HSR and LCC respondents in this study, although traveling for different purposes, did not find frequency important in their decisions to use HSR and LCCs. The finding is interesting because LCCs and HSR are often perceived differently in terms of their frequency services. LCCs in China usually find it difficult to achieve high frequencies due to the use of congested, primary airports (Liang & James, 2011), which is often considered a weakness of LCCs. HSR is able to offer high frequencies, which is often viewed as a competitive advantage of HSR. As this study may suggest, the lack of frequency would not put LCCs in China at a competitive disadvantage, given the insignificant effect of frequency on passengers' decisions to use LCCs.

PBC. In both HSR and LCC models, PBC was not significant in passengers' mode use intentions. In other words, the control on external resources such as time and money did not influence the decision to use HSR and LCCs. The results were largely unexpected, as PBC has often been found important in passenger behaviors in prior studies. Noticeably, another control-related factor in the LCC model, technology self-efficacy, was found important for the respondents to use LCCs, indicating that it could be the internal capacity of the respondents rather than external resources that motivated them to use LCCs in China. The finding regarding the role of control, especially the insignificant effect of PBC on the use of HSR and LCCs, provided a new understanding of HSR and LCC passengers.

The model comparison in this section offers valuable insights into potential competition between HSR and LCCs in China. HSR and LCCs are likely to target passengers with similar demographic characteristics. In terms of the behavioral intention, both HSR and LCC passengers are significantly influenced by some psychological factors (attitudes), social influence (subjective norms), and market attributes of HSR and LCCs (price, service, and access). The impact of these shared factors, especially price and service quality, provides empirical evidence for potential competition between HSR and LCCs in China.

Conclusions

As LCCs have started to expand in China, they are likely to become a competitor of HSR. The potential competition highlights the need for understanding passengers' intentions to use HSR and LCCs, which has remained an understudied area of research. The current study investigated determining factors in the use of HSR and LCCs and compared the results, in order to enhance the understanding of passengers' mode use intentions and potential HSR-LCC competition in China.

The theoretical models for HSR and LCCs were developed based on the TPB, with external factors being added to the model to reflect the context in China. Each model identified nine predicting factors, including three original components of the TPB and six external factors. A survey method was used for collecting data from HSR passengers in South Railway Station in Beijing and Hongqiao Railway Station in Shanghai, and from LCC passengers in Pudong International Airport in Shanghai and Zhengding International Airport in Shijiazhuang.

A SEM approach was employed for data analysis. For the HSR model, 7 out of 10 hypothesized paths were found to be significant. Attitudes, subjective norms, price, access, service quality, and total travel time were significant determinants of passengers' intentions to use HSR, while frequency, trust, and PBC were found insignificant. Of the nine predictors, service quality had the strongest impact on passengers' intentions to use HSR, followed by total travel time. Overall, the model explained 50% of the variance in passengers' intentions to use HSR in China. For the LCC model, 8 out of 10 hypothesized paths were significant. Attitudes, subjective norms, price, access, technology self-efficacy, service quality, and uncertainty avoidance were strong predictors of passengers' use of LCCs, while PBC and frequency were not important factors. Of the nine predictors, price was the most significant determinant of passengers' intentions to use LCCs, followed by service quality. Overall, the model explained 61% of the variance in the intention to use LCCs in China.

The results of the two models were compared for identification of potential competition between HSR and LCCs. Five shared factors – attitudes, subjective norms, price, access, and service quality – were significant predictors in both models. In other words, passengers' decisions to use HSR and LCCs in China were influenced by attitudes toward HSR and LCCs, normative social influence, and price, access, and service quality of HSR and LCCs. Two shared factors, frequency and PBC, were found insignificant for both HSR and LCC passengers. The findings provide important evidence for potential competition between HSR and LCCs in China.

By proposing the theoretical framework for passengers' intentions to use HSR and LCCs, identifying significant factors, and shedding light on HSR-LCC competition, the current study makes important theoretical and practical contributions. The remainder of this section explains these contributions in detail and discusses limitations of this study.

Theoretical contributions. This study contributes to the literature in several ways. First, it broadens the research of passenger motivations in using HSR and LCCs by focusing on China, an important market for both HSR and LCCs. Noticeably, the HSR and LCC markets in China are very different from that in other countries. HSR in China has enjoyed a phenomenal expansion, while the LCC sector has started fast-track development only in recent years. The unique market environment in China means empirical results of passengers' intentions to use HSR and LCCs generated from the local market can contribute significant value to existing knowledge.

Second, this study demonstrates that the extended TPB model, compared to the original TPB model, can provide a means for more comprehensive understanding of passengers' behavioral intentions in the use of HSR and LCCs. For both HSR and LCCs, the original TPB model was extended with service- or culture-related factors that reflected the context of China. The results indicated that, while two TPB components were significant predictors of the intention to use HSR and LCCs, the external factors in the two models provided additional, plausible explanations to the topic under investigation.

Third, this study makes an important contribution to the theory by adding a cultural factor to the TPB model and demonstrating that the addition affected the relationship between predicting factors and the intention to use LCCs. Although the TPB model has been routinely expanded for examining consumer behaviors in the transport domain (Buaphiban, 2015), a cultural specific factor, to the best knowledge of this author, has not been used in the LCC context, especially in China. This study added uncertainty avoidance, one of the five cultural dimensions proposed by Hofstede (1984), to the LCC model and revealed a significant, negative relationship between uncertainty avoidance and passengers' intentions to use LCCs. The new theoretical insight can greatly advance the understanding of the motivation in using LCCs in China.

Finally, by extending the TPB model and comparing the results, this study contributes to the literature of competition between HSR and LCCs. The research of

HSR-LCC competition is limited despite the growing trend of HSR and LCCs in many countries, especially China. In the Chinese market, existing studies comparing the two transportation modes mostly focus on what factors affect passenger choice of one mode to another, instead of how passengers in each mode make their decisions. An important contribution of this study is the focus on factors that influence behavioral intentions of HSR and LCC passengers. The findings provide empirical evidence of HSR-LCC competition from a consumer's perspective.

Practical implications. The current study took measures, such as using random survey samples and surveying LCC and HSR passengers from a wide range of markets, to increase the generalizability of the study. As such, the results of the study can have important practical implications for marketing and consumer behaviors in the HSR and LCC context. Six practical implications are presented below. The discussion focuses on helping LCCs become a stronger competitor of HSR in China.

The first implication derives from the finding that culture-related factors affected passengers' behavioral intentions. The finding pointed to the significant impact of uncertainty avoidance, a cultural factor identified by Hofstede (1984), on passengers' motivation in using LCCs in China. It showed that, due to the high uncertainty avoidance culture of China (Quintal et al., 2010; Zheng et al., 2015), passengers tried to avoid ambiguity when making a decision of traveling by LCCs. The finding is significant because low-cost travel is still a relatively new concept in China, which may be perceived by consumers with high levels of uncertainty. There is a clear implication for LCC policies and strategies in China. In order to attract more passengers, LCCs should focus on market strategies that reduce uncertainties of LCCs and increase the level of trust in LCCs.

The second practical implication comes from the effect of price on passengers' motivation in using LCCs and HSR. In the current study, price was important for both HSR and LCC passengers, but its effect on LCC passengers was much stronger. Interestingly, the mean scores of scales in the questionnaires suggested that LCC passengers were satisfied with the price of LCCs, while HSR passengers appeared to be less satisfied with the price of HSR, though most respondents in the two groups actually reported spending similar amounts of money on their tickets. The different views on HSR and LCC prices may be associated with long-established perceptions of rail and air transport in China, with the latter being perceived as more luxurious and hence reasonably more costly. There is an important implication for LCCs in understanding the role of price in HSR-LCC competition. Price is not only the most significant determinant of passengers' intentions to use LCCs, but likely to be the strongest advantage for LCCs to compete with HSR given different price perceptions of air and rail travel in China. Measures should be taken to strengthen the competitive advantage of the LCC price.

The third practical implication stems from the role of service quality in passengers' intentions to use HSR and LCCs in China. The study revealed strong effects of service quality on passengers' motivation in using HSR and LCCs. While service quality was the most influential factor in the choice of HSR, its effect on LCC passengers should not be underestimated. In fact, the magnitude of impact of service quality on the use of LCCs was only slightly smaller compared to price. The study also suggested a strong, positive effect of service quality on attitudes toward both HSR and LCCs, further highlighting its importance in the use of both modes. For LCCs in China, the results present an implication for using service-related strategies to attract consumers and increase market share. Such strategies are particularly important for competing with HSR, which offers high levels of service that is greatly valued by consumers.

The fourth practical implication derives from the effect of access on passengers' decisions to use HSR and LCCs. In this study, ground access was a significant factor in passengers' choice of HSR and LCCs in China. The finding provides an important implication for LCCs' marketing and operational strategies, particularly regarding the choice of airport for future development. With the government's plan of increasing the number of airports in China (CAAC, 2012; Fu et al., 2012), the choice of using the smaller, secondary airport would become more feasible. LCCs are likely to utilize less congested, secondary airports in addition to their current hubs in primary airports in order to save costs. Acknowledging the importance of ground access in passengers' mode use intentions, LCCs should consider ease of ground access in selecting airports for future expansion.

The fifth practical implication associates with the role of controllability in passengers' intentions to use HSR and LCCs. While the finding suggested that control of external resources (PBC) was insignificant in passenger's use of HSR and LCCs, it revealed the importance of technology self-efficacy (internal-related control) in the use of LCCs. The finding has an important implication for market success of LCCs. To increase competitiveness, LCCs should take measures to reduce technological barriers in using online tools in order for LCC passengers to search information and purchase tickets more easily.

The last practical implication derives from the finding of the importance of total travel time for HSR passengers. As shown in the previous chapters, HSR has a competitive advantage in terms of total travel time, or door to door time, especially in China, due to convenient train station locations and higher average speeds of HSR compared to that in other countries. Although this study did not assess the impact of total travel time on the use of LCCs, the favorable perception of total travel time of HSR provides a useful hint to LCCs in developing business strategies. Measures are needed to reduce total travel time of LCC passengers, which would allow LCCs to better compete with HSR.

Limitations. There are some limitations to this study. These limitations, although putting some constraints on the study results, do not diminish the importance of the findings.

First, there may exist some uncertainty in terms of the representativeness of the survey sample. In China, official statistics of HSR and LCC passengers are not available. As such, there are no well-defined demographics of the HSR and LCC populations that can be compared to the sample characteristics in this study. Due to time and financial constraints, it is also only practical to collect data from selected markets. In addition, the cross-sectional nature of the study means that the survey only captured the population at a single point in time, which could influence its ability to represent the target population. In this study, several measures were taken to increase the generalizability of the survey sample. Particularly, this study used a random sampling technique to choose the survey sample, which can minimize sample bias and improve the reliability and validity of the findings.

Second, as the survey required that participants evaluated the impact of psychological factors, service-related factors, and cultural factors on their behavioral intentions, it is likely that the situation at the time of the survey could influence how participants answered the questions. For example, a passenger facing a long flight delay may view the impact of service quality on the intention to use LCCs in a different way compared to a passenger taking an on-time flight. To minimize such impact, the survey administrator developed a standardized data collection procedure, shown in Figure 8 in Chapter III, and followed a random sampling method for selecting the survey participants. In addition, the survey took place during the days with good weather condition, which can significantly reduce the possibility of flight delay.

Third, the focus on local markets may present some limitations. The findings of this study focus on the Chinese market, which has some distinctive characteristics. The development of HSR and LCCs in China, as introduced in Chapter I, has followed a different path compared to their counterparts in other countries. In addition, this study only examined Chinese passengers, which means some of the results may not easily translate to passengers outside China, especially in Western countries. The findings, however, can still be applicable to some Asian countries, given some similarities between these countries and China, especially in culture and consumer behaviors.

Fourth, the choice of factors to be included in the expanded TPB model could present some limitation. Due to the scope of this study, only a limited number of factors can be added to the model. While the HSR and LCC models in this study were extended with six external factors, there could be more factors that can predict passengers' intentions to use HSR and LCCs in China. This limitation was partially addressed by selecting different types of factors, such as cultural- and service-related factors, for the HSR and LCC models. The combination of diverse factors allows for explanation of passengers' mode use intentions from multiple perspectives.

Fifth, the measuring scales in the questionnaires may present some limitation. The questionnaires were developed in English and then translated into Chinese to be administered to Chinese passengers. The translation could cause subtle changes in the meaning of some questions, and thus could affect the answers. In addition, some questions may not fit the usual way Chinese people make a statement about intentions. For example, while "Those whose opinions I value think that I should use HSR" is a frequently used scale measuring subjective norms, it may sound a little awkward to native Chinese, although the translation may not necessarily affect their understanding of the question. To address the limitation, a back-translation method was employed in this study to evaluate the translation, which significantly reduced differences between the two versions of questionnaires.

Finally, this study developed two separate SEM models for investigating how HSR and LCC passengers made their decisions. As a result, the findings of the study do not provide direct evidence of how passengers would choose between HSR and LCCs in China. This limitation was partially addressed by the in-depth examination of factors that drive the use of HSR and LCCs. By comparing the effects of the shared factors in the two models, the current study provides indirect evidence to potential competition between HSR and LCCs in China.

Recommendations

Based on the discussion of the finding, theoretical contribution, and practical implication, six recommendations are proposed to help policy makers and the industry better understand mode use intentions of HSR and LCC passengers in China. The focus is on providing realistic and implementable measures to HSR and LCC operators and helping them prepare for market competition in China.

Given the moderate perception of the HSR price, HSR providers should re-evaluate fare strategies. For example, a floating fare system with reduced fares during weekdays could increase consumer satisfaction toward HSR prices, which could in turn encourage the use of HSR. For LCCs, price leadership strategies should be strengthened given the decisive role of price in passengers' choice of LCCs in China. Cost saving measures such as increasing aircraft utilization and improving employee productivity through training and career development can be helpful in driving down prices. At the government level, policies are needed to address costs that are beyond airlines' control, such as landing fees and fuel costs, in order to help LCCs achieve lower fares.

Because service quality is the most significant factor in the use of HSR, HSR providers should focus on maintaining and improving services. Particularly important is the development of unified service standards across China given the growing HSR network in the domestic markets. LCCs in China need a mindset change in understanding the role of service quality in passenger motivations of using LCCs. The no-frill strategy, while successful in established LCC markets in Europe and America, may not fit the market in China. The strong effect of service quality on passengers' use of LCCs, as revealed by this study, indicates that LCCs in China should modify the concept of low-cost travel to make it more suitable for the marketplace in China. Some types of service, such as in-flight food and beverage, although adding up costs, would be necessary for LCCs to attract passengers, especially away from HSR which has a reputation for great customer service.

Given the importance of total travel time to HSR passengers, HSR providers should promote the market image of HSR as an efficient and reliable transportation mode. Such a strategy can be effective in attracting airline passengers, especially given frequent flight delays in China. LCCs should be fully aware of the time-saving benefit of HSR, and make efforts to shorten the time LCC passengers would spend on the entire trip. Such effort, however, may present a challenge to LCCs in China. The primary airports used by LCCs are often congested, which slow down airport procedures and cause flight delays. Measures such as using smaller, less congested airports for fast aircraft turnaround and airport procedure and allowing employees to performing multiple tasks can be useful for shortening total travel time for passengers. The government, at the same time, should accelerate the reform of airspace. The reform is essential in opening up more airspace to civil aviation, which can reduce flight delays and save time for passengers.

Because accessibility is important for both HSR and LCC passengers, HSR and LCCs should develop access strategies in order to attract passengers. For HSR, convenient access should become an important strategy to support the growing HSR system in China. The location of the new train station should be able to meet consumer needs for easy access. Similarly, as LCCs continue to expand in the domestic market, it is important for them to consider ground access when adding new airports to their route network. Ease of access to public transportation or HSR can improve passenger convenience, which in turn can encourage the use of LCCs.

Given the importance of subjective norms in passengers' intentions to use HSR and LCCs, HSR and LCCs should use social influence to promote their business images in China. It is especially important for LCCs due to their limited market presence. LCCs can develop computer-based market strategies, such as online reviews and photo sharing, to empower consumers to start conversations and share experiences about low-cost travel. Such market strategy can greatly increase the awareness of LCCs in China, which would increase the intention to travel by LCCs.

Finally, LCCs should recognize the uncertainty avoidance culture of Chinese consumers and develop marketing strategies accordingly. To compete with HSR, LCCs must reduce perceived uncertainties about LCCs. It is important that LCCs increase market awareness of low-cost travel, educate consumers of the LCC concept, and continuously improve safety and reliability of LCCs. The government, at the same time, should foster a favorable environment where LCCs can build a positive market image.

Future Research

This study examined the relationships between a group of predicting factors and the intention to use HSR and LCCs in China. The findings provide valuable insights into the topic under investigation. At the same time, this study points to new directions for future research endeavours.

First, the analytical results suggest some relationships that are not included in the model, which merit further examination. The MI values generated by the SEM models reveal some large values of regression weight between attitudes and subjective norms (87.305), PBC (65.502), trust (47.993), and frequency (31.823) in the HSR model, and between attitudes and price (53.832), PBC (47.881), and uncertainty avoidance (49.857) in the LCC model. These large values may suggest potentially new relationships that are not represented by the current models. Future research of behavioral intentions of HSR and LCC passengers shall examine these relationships in greater depth.

Second, future research should investigate the unsupported relationships in this study involving trust, frequency, and particularly PBC. While PBC is found insignificant in the intentions to use HSR and LCCs, exploring the underlying reasons for this phenomenon is out of the scope of this study. To answer this question, future research can perform separate analysis for the TPB model consisting of attitudes, subjective norms, and PBC and the model containing both TPB components and external factors. By comparing the effects of PBC in the two models, the researcher can determine whether the insignificant effect of PBC in the current study accurately describes the market in China.

Third, future research should continue to increase the predictive power of the research models developed in the current study. While the HSR and LCC models can explain 50% and 61% of the variance in the intention to use HSR and LCCs, there remain unexplained variances in the models. Additional factors could be added to the model to increase the predictive validity of the model.

Fourth, while the current study examined the effect of predicting factors on passengers' intentions to use HSR and LCCs, the relationship between the intention and actual behavior was not the focus of this study. Actual behavior is part of the original

TPB model, as proposed by Ajzen (1991). Future study shall examine the relationship between the intention and actual behavior in the HSR and LCC contexts in China.

Fifth, as this study only focused on direct relationships between the predicting variables and outcome variable, future research can include indirect relationships and mediating factors to the SEM study. For example, uncertainty avoidance can be an antecedent of attitudes toward LCCs in the model, having both a direct effect on the intention and an indirect effect via attitudes. A more complex structural model with a network of interrelationships among variables can provide further insights into the behavioral intentions to use HSR and LCCs in China.

Sixth, this study developed separate SEM models for HSR and LCCs and selected different samples from HSR and LCC populations to test the models. While it provides valuable findings of how HSR and LCC passengers made their decisions in using each mode, the model comparison can only provide indirect evidence of the HSR-LCC competition. Future research can focus on HSR-LCC competition by developing a passenger choice model using the five shared-factors identified in this study that influenced the behavioral intentions to use both HSR and LCCs. Data can be collected from passengers who traveled by both HSR and LCCs, which can enhance the understanding of factors influencing passengers' choice between the two modes.

Last, the findings of this study can provide a starting point for new areas of research involving HSR and LCCs. In addition to intermodal competition, future study can investigate how HSR-LCC cooperation would affect consumer intentions to use HSR and LCCs in China. Again, the significant factors identified in this study can be used to develop the theoretical model, which can be tested by empirical data collected in the Chinese market.

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APPENDIX A

Permission to Conduct Research

中央财经大学

地址：北京市海淀区学院南路39号 邮编：100081
Add:39 South College Rd,Haidian District Beijing,China
Post Code:100081

August 1st, 2016

To whom it may concern:

I have reviewed the survey questionnaires used in the research titled Investigation of Passengers' Intentions to Use High-Speed Rail and Low-Cost Carriers in China, which is conducted by Jing Yu Pan, a student of the College of Aviation at Embry Riddle Aeronautical University, Daytona Beach, Florida, USA. I have considered the research meaningful, and the outcome will benefit the transport industry.

I believe that the questionnaires do not affect social security. I believe that the questionnaires pose no harm to the dignity, health, rights and welfare of participants, and they do not affect the privacy and identity of participants.

If you have any question or need more information, Please feel free to contact me.

Sincerely,

Chen Bo

Chen Bo (PH.D.)
Dean/Professor
Institute of Defence Economics and Management
Central University of Finance and Economics
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APPENDIX B

Data Collection Device

Questionnaire for the LCC Model

<u>STUDY LEADERSHIP AND TOPIC</u>. DataSea invites you to participate in a survey, which is part of a research project that examines passengers' motivation in choosing high-speed rail (HSR) and low-cost carriers (LCCs) in China. The topic of the study is ***Investigation of Passengers' Intentions to Use High-speed Rail and Low-cost Carriers in China.***

<u>PURPOSE.</u> The survey conducted at this location is to learn about passengers' viewpoints related to LCCs use and the factors influencing their intentions to use LCCs in China.

<u>ELIGIBILITY.</u> To be in this study, you must be 18 years or older, a resident of People's Republic of China, and an LCC passenger.

<u>PROCEDURES.</u> A survey administrator will provide you with a questionnaire to be filled in. You are free to seek clarification before participating in the survey. The questionnaire will include your travel experience and demographic questions such as your age and occupation. It will also seek your opinions on factors influencing your intention to use LCCs. The questionnaire will take less than ten minutes to complete.

<u>VOLUNTARY PARTICIPATION.</u> Your participation in this project is completely voluntary and you are free to decline to participate, without consequence, at any time prior to or during the survey. You are also free to skip any question in the questionnaire that you feel unease to give an answer to.

<u>RISKS AND BENEFITS.</u> There are no known risks to you as a person taking this survey, beyond those risks experienced in everyday life. One possible inconvenience to you is that you may spend less time on other activities because of participating in the survey. After completing the questionnaire, you will be given a luggage tag as a token of appreciation. There are no known direct benefits to you personally in participating in the survey. Your participation will promote the understanding of passengers' motivation in choosing LCCs in China.

SAFEGUARDING PRIVACY. The participation is anonymous. No personal information will be collected other than basic demographic descriptors. The questions are designed such that no personal identification will be included. All information collected from you will be maintained in a secure manner. If you choose to "opt-out" during the research, the data collected from you will not be used in this research and will be destroyed in a safe manner.

FURTHER INFORMATION. If you have any questions or would like additional information about this study, please contact Jing Yu Pan at panj@my.erau.edu. Embry-Riddle Aeronautical University Institutional Review Board (IRB) has approved this project. You may contact Dr. M.B. McLatchey from IRB with any questions or issues at MCLATCHM@erau.edu.

CONSENT. Please tick "Yes" below to indicate that you understand the information on this form, that any questions you have about this study have been answered, and that you agree to participate in this survey.

☐ Yes, I like to participate in the survey. (Thank you and please start the survey)

Section 1. Filter Questions

1.1 Are you Chinese?
( ) Yes (Please continue the survey) ( ) No (Please withdraw this survey)

1.2 Are you eighteen years or older?
( ) Yes (Please continue survey) ( ) No (Please withdraw this survey)

1.3 Are you Departing Shanghai (or Shijiazhuang) using a low cost carrier (LCC)?
( ) Yes (Please continue survey) ( ) No (Please withdraw this survey)

Section 2. Demographics

2.1 Gender
( ) Male ( ) Female

2.2 Age
( ) Less than 20 ( ) 20-30 years
( ) 31 - 40 years ( ) 41 – 50 years
( ) 51-60 years ( ) Older than 60 years

2.3 Education level
( ) Lower than high school ( ) High school
( ) Voc/Tech school ( ) Bachelor's degree
( ) Master's degree ( ) Doctoral degree

2.4 Monthly income
( ) Less than 2000 RMB ( ) 2000 – 4000 RMB
( ) 4001 – 6000 RMB ( ) 6001 – 8000 RMB
( ) 8001 - 12000 RMB ( ) 12001 - 15000 RMB
( ) Over 15000 RMB

2.5 Occupation
( ) Student ( ) Non-government employee
( ) Business owner ( ) Government employee
( ) Others, please specify________

2.6 City where you live in
Please indicate which city you live in ___________________

Section 3. Travel Experience

3.1 How often do you travel by an LCC?

( ) Less than once per year ( ) Once per year

( ) 2-3 times per year ( ) More than 3 times per year

3.2 How do you get information about an LCC?
( ) LCC website ( ) Advertising
( ) Family and friends ( ) Online search engine
( ) Travel website ( ) Travel agent
( ) Others, please specify ______________

3.3 What is the main purpose of this trip?
( ) Leisure/Vacation ( ) Business
( ) Seminar/Conference/Training ( ) Study

( ) Visiting family/friends ( ) Others, please specify_______

3.4 What is your destination city for this trip?
Please indicate ______________________

3.5 Are you traveling alone?
( ) Yes ( ) No

3.6 How do you purchase your LCC ticket?
( ) LCC office ( ) At the airport
( ) Tourist website ( ) LCC website
( ) Travel agent ( ) Others

3.7 How much did you pay for the LCC ticket (one way)?
( ) under 200 Yuan ( ) 200 – 400 Yuan
( ) 401-600 Yuan ( ) 601- 800 Yuan
( ) 801 -1000 Yuan ( ) over 1000 Yuan

Section 4. Factors affecting passengers' intentions to use low cost carriers (LCCs)

Item Number	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
AT1	I think traveling by LCCs is a good idea					
AT2	I think traveling by LCCs would be pleasant					
AT3	I think traveling by LCCs would be relaxing					
AT4	I have a good perception toward LCCs					
SN1	My family and friends want me to choose LCCs					
SN2	I feel I should choose LCCs because my family/ friends recommend it					
SN3	Those close to me approve that I choose LCCs					
SN4	Those whose opinions I value think I should choose LCCs					
PB1	It's mainly up to me whether I choose LCCs or not					
PB2	I have entire control on using LCCs					
PB3	If I want, I can travel by LCCs soon					

PB4	If I want to, I can obtain a LCCs ticket soon					
PB5	For me, traveling by LCCs is easy to achieve					
PR1	I think the price of LCCs is affordable					
PR2	I think the price of LCCs is fair and reasonable					
PR3	I think the price of LCC matches my consumption level					
PR4	I am satisfied with the price of LCCs					
UA1	If I perceived uncertainty of LCCs' future growth in the Chinese market, I will seek clear information in this regard before choosing an LCC					
UA2	If I perceived uncertainty of LCC's safety, I will seek clear information of LCCs' safety before choosing an LCC					
UA3	If I perceived uncertainty of LCC's on-time performance, I will seek unambiguous information of LCCs' on-time performance before choosing an LCC					
AC1	The airport used by an LCC is conveniently located					
AC2	The airport used by an LCC is easy to access					
AC3	Transportation to the airport used by an LCC is easy					
AC4	The access time to the airport used by LCCs is reasonable					
AC5	There are multiple transportation options to get to the airport used by an LCC					

FR1	The number of flights provided by an LCC is adequate					
FR2	LCCs operates with high frequency					
FR3	LCCs offer convenient frequencies					
FR4	The time interval between LCC flights is satisfactory					
SE1	If I wanted to, I could easily search for LCC information on the internet on my own					
SE2	If I wanted to, I could easily purchase an LCC ticket on the internet on my own					
SE3	I would be able to purchase an LCC ticket on the internet even if there is no one around to show me how to do it					
SE4	If I wanted to, I could search/compare prices of airlines online					
SQ1	LCCs provide a quite cabin environment					
SQ2	LCCs provide a clean cabin environment					
SQ3	Seats are comfortable on an LCC flight					
SQ4	Onboard facilities of LCCs are complete					
BI1	I intent to buy an LCC ticket					
BI2	It's likely that I use LCCs again in the future					
BI3	Even if other transportation options are recommended, I still like to choose LCCs					
BI4	LCCs are likely to be my first choice					
BI5	I intent to travel by LCCs frequently					

BI6	It's likely I will recommend LCCs to others					

Questionnaire for the HSR Model

STUDY LEADERSHIP AND TOPIC. DataSea invites you to participate in a survey, which is part of a research project that examines passengers' motivation in choosing high-speed rail (HSR) and low-cost carriers (LCCs) in China. The topic of the study is ***Investigation of Passengers' Intentions to Use High-speed Rail and Low-cost Carriers in China.***

PURPOSE. The survey conducted at this location is to learn about passengers' viewpoints related to HSR use and the factors influencing their intentions to use HSR in China.

ELIGIBILITY. To be in this study, you must be 18 years or older, a resident of People's Republic of China, and an HSR passenger.

PROCEDURES. A survey administrator will provide you with a questionnaire to be filled in. You are free to seek clarification before participating in the survey. The questionnaire will include your travel experience and demographic questions such as your age and occupation. It will also seek your opinions on factors influencing your intention to use HSR. The questionnaire will take less than ten minutes to complete.

VOLUNTARY PARTICIPATION. Your participation in this project is completely voluntary and you are free to decline to participate, without consequence, at any time prior to or during the survey. You are also free to skip any question in the questionnaire that you feel unease to give an answer to.

RISKS AND BENEFITS. There are no known risks to you as a person taking this survey, beyond those risks experienced in everyday life. One possible inconvenience to you is that you may spend less time on other activities because of participating in the survey. After completing the questionnaire, you will be given a luggage tag as a token of appreciation. There are no known direct benefits to you personally in participating in the survey. Your participation will promote the understanding of passengers' motivation in choosing HSR in China.

SAFEGUARDING PRIVACY. The participation is anonymous. No personal information will be collected other than basic demographic descriptors. The questions are designed such that no personal identification will be included. All information collected from you will be maintained in a secure manner. If you choose to "opt-out" during the research, the data collected from you will not be used in this research and will be destroyed in a safe manner.

FURTHER INFORMATION. If you have any questions or would like additional information about this study, please contact Jing Yu Pan at panj@my.erau.edu. Embry-Riddle Aeronautical University Institutional Review Board (IRB) has approved this project. You may contact Dr. M.B. McLatchey from IRB with any questions or issues at MCLATCHM@erau.edu.

CONSENT. Please tick "Yes" below to indicate that you understand the information on this form, that any questions you have about this study have been answered, and that you agree to participate in this survey.

☐ Yes, I like to participate in the survey. (Thank you and please start the survey)

Section 1. Filter Questions

1.1 Are you Chinese?

( ) Yes (Please continue the survey) ( ) No (Please withdraw this survey)

1.2 Are you eighteen years or older?

( ) Yes (Please continue survey) ( ) No (Please withdraw this survey)

1.3 Are you Departing Beijing (or Shanghai) using HSR?
( ) Yes (Please continue survey) ( ) No (Please withdraw this survey)

Section 2. Demographics

2.1 Gender
( ) Male ( ) Female
2.2 Age
( ) Under 20 ( ) 20-30 years
( ) 31 - 40 years ( ) 41 – 50 years
( ) 51-60 years ( ) Older than 60 years
2.3 Education level
( ) Lower than high school ( ) High school
( ) Voc/Tech school ( ) Bachelor's degree
( ) Master's degree ( ) Doctoral degree

2.4 Monthly income

( ) Less than 2000 RMB ( ) 2000 – 4000 RMB
( ) 4001 – 6000 RMB ( ) 6001 – 8000 RMB
( ) 8001 - 12000 RMB ( ) 12001 - 15000 RMB
( ) Over 15000 RMB

2.5 Occupation

( ) Student ( ) Non-government employee
( ) Business owner ( ) Government employee
( ) Government official ( ) Others
2.6 City where you live in

Please indicate which city you live in __________________

Section 3. Travel Experience

3.1 How often do you travel by HSR?

( ) Less than once per year ( ) Once per year

( ) 2-3 times per year ( ) More than 3 times per year

3.2 How do you get information about HSR?

( ) HSR website ( ) Advertising
( ) Family and friends ( ) Online search engine
( ) Travel website ( ) Newspaper
( ) Travel agent ( ) Others

3.3 What is the main purpose of this trip?

( ) Leisure/Vacation
( ) Business
( ) Seminar/Conference/Training
( ) Study
( ) Visiting family/friends
( ) Others, please specify________

3.4 Are you traveling alone?

( ) Yes
( ) No

3.5 What is your destination city for this trip?
Please indicate ______________________

3.6 How do you purchase your HSR ticket?

( ) HSR office
( ) At the station
( ) Tourist website
( ) HSR website
( ) Travel agent
( ) Others

3.7 How much did you pay for the HSR ticket (one way)?

( ) under 200 Yuan
( ) 200 – 400 Yuan
( ) 401-600 Yuan
( ) 601- 800 Yuan
( ) 801 -1000 Yuan
( ) over 1000 Yuan

Section 4. Factors affecting passengers' intentions to use HSR.

Item Number	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
AT1	I think traveling by HSR would be a good idea					
AT2	I think traveling by HSR would be pleasant					
AT3	I think traveling by HSR would be relaxed					
SN1	My family and friends hope that I choose HSR					
SN2	I feel I should choose HSR because my family/ friends recommend it					
SN3	Those close to me approve that I choose HSR					

SN4	Those whose opinions I value think I should choose HSR					
PB1	It's mainly up to me whether I choose HSR or not					
PB2	I have entire control on using HSR					
PB3	For me, traveling by HSR is easy to achieve					
PB4	If I want to, I can travel by HSR soon					
PR1	I think the price of HSR is affordable					
PR2	I think the price of HSR is fair and reasonable					
PR3	I think the price of HSR matches my consumption level					
PR4	I am satisfied with the price of HSR					
TR1	I expect that HSR operates in a safe manner					
TR2	I expect that HSR operates in a reliable manner					
TR3	I expect that HSR is technologically advanced					
TR4	HSR pays attention to the interest of consumers					
TR5	I expect that HSR is trustworthy					
AC1	HSR station is conveniently located					
AC2	HSR station is easy to access					
AC3	Transportation to HSR station is easy					

AC4	I can quickly access HSR station					
FR1	The number of trains provided by HSR is adequate					
FR2	HSR operates with high frequency					
FR3	HSR trains depart at convenient times					
FR4	The time interval between trains is satisfactory					
TT1	I think the total travel time of HSR is easy to manage					
TT2	I think total travel time of HSR is assured					
TT3	I think the total travel time of HSR is satisfactory					
TT4	I think the total travel time meets my needs					
SQ1	HSR provides a quiet cabin environment					
SQ2	HSR provides a clean cabin environment					
SQ3	Seats are comfortable on HSR trains					
SQ4	HSR provides complete onboard facilities					
SQ5	HSR provides satisfactory food choices					
BI1	I intent to buy an HSR ticket					
BI2	It's likely I will choose HSR again in the future					
BI3	HSR is likely to be my first choice					

BI4	Even if other transportation options were recommended, I still like to choose HSR					
BI5	I intent to travel by HSR frequently					

APPENDIX C

Tables

Table C1

Construct Items and Sources for the HSR Model

Variable	Statement	Source
Attitudes	AT1. I think traveling by HSR would be a good idea	Al Ziadat, 2015; Hsiao & Yang (2010); Liu et al. (2013); Taylor & Todd (1995)
	AT2. I think traveling by HSR would be pleasant.	
	AT3. I think traveling by HSR would be relaxed.	
Subjective Norms	SN1. My family and friends hope that I choose HSR	Liu et al. (2013); Jalilvand & Samiei (2012); Jing et al. (2014);Taylor & Todd (1995)
	SN2. I feel I should choose HSR because my family/ friends recommend it.	
	SN3. Those close to me approve that I choose HSR	
	SN4. Those whose opinions I value think I should choose HSR	
PBC	PBC1. It's mainly up to me whether I choose HSR or not.	Hsiao & Yang (2010); Jing et al. (2014); Liu et al. (2013)
	PBC2. I have entire control on using HSR	
	PBC3. For me, traveling by HSR is easy to achieve	
	PBC4. If I want to, I can travel by HSR soon.	
Price	PR1. I think the price of HSR is affordable	Chou & Yeh (2013); Kuo et al. (2013); Self-designed
	PR2. I think the price of HSR is fair and reasonable	

Table C1 *(continued)*

Variable	Statement	Source
	PR3. I think the price of HSR matches my consumption level. PR4. I am satisfied with the price of HSR	
Trust	TR2. I expect that HSR operates in a reliable manner. TR3. I expect that HSR is technologically advanced TR5. I expect that HSR is trustworthy	Hsiao & Yang (2010); Forgas et al. (2010);Fang et al. (2009); Tsai et al. (2010), Self-designed
Access	AC1. HSR station is conveniently located AC2. HSR station is easy to access. AC3. Transportation to HSR station is easy AC4. I can quickly access HSR station	Chou & Kim (2009); Self-designed
Frequency	FR1. The number of trains provided by HSR is adequate. FR2. HSR operates with high frequency FR3. HSR trains depart at convenient times FR4. The time interval between trains is satisfactory	Park et al. (2006); Self-designed
Total Travel Time	TT1. I think the total travel time of HSR is easy to manage. TT2. I think total travel time of HSR is assured TT3. I think the total travel time of HSR is satisfactory	Harvey et al. (2014); Kuo et al (2013), self-designed

Table C1 *(continued)*

Variable	Statement	Source
	TT4. I think the total travel time meets my needs	
Service Quality	SQ1. HSR provides a quiet cabin environment	Chou & Kim (2009); Wen, Lan, & Cheng (2005); Harvey et al. (2014), Self-designed
	SQ2. HSR provides a clean cabin environment	
	SQ3. seats are comfortable on HSR trains	
	SQ5. HSR provides satisfactory food choices.	
Behavioral Intention	BI2. It's likely I will choose HSR again in the future	Al Ziadat, 2015; Chou & Kim (2009); Kuo & Tang (2011); Taylor & Todd (1995)
	BI3. HSR is likely to be my first choice	
	BI4. Even if other transportation options were recommended, I still like to choose HSR	
	BI5. I intend to travel by HSR frequently	

Table C2

Construct Items and Sources for the LCC Model

Variable	Statement	Source
Attitudes	AT2. I think traveling by LCCs would be pleasant	Al Ziadat, 2015; Liu et al. (2013); Taylor & Todd (1995)
	AT3. I think traveling by LCCs would be relaxing	
	AT4. I have a good perception toward LCCs	
Subjective Norms	SN1. My family and friends want me to choose LCCs	Liu et al. (2013); Taylor & Todd (1995); Jing et al. (2014); Jalilvand & Samiei (2012)
	SN2. I feel I should choose LCCs because my family/ friends recommend it	
	SN3. Those close to me approve that I choose LCCs	
	SN4. Those whose opinions I value think I should choose LCCs	
PBC	PBC1. It's mainly up to me whether I choose LCCs or not	Hsiao & Yang (2010); Liu et al. (2013); Jing et al. (2014)
	PBC4. If I want to, I can obtain a LCCs ticket soon	
	PBC5. For me, traveling by LCCs is easy to achieve	
Price	PR1. I think the price of LCCs is affordable	Liu & Lee (2016); Park et al. (2006); Self-designed
	PR2. I think the price of LCCs is fair and reasonable	
	PR3. I think the price of LCC matches my consumption level	
	PR4. I am satisfied with the price of LCCs	

Table C2 (*continued*)

Variable	Statement	Source
Uncertainty Avoidance	UA1. If I perceived uncertainty of LCCs' future growth in the Chinese market, I will seek clear information in this regard before choosing an LCC UA2. If I perceived uncertainty of LCC's safety, I will seek clear information of LCCs' safety before choosing an LCC UA3. If I perceived uncertainty of LCC's on-time performance, I will seek unambiguous information of LCCs' on-time performance before choosing an LCC	Quintal et al. (2010); Self-designed
Access	AC1. The airport used by an LCC is conveniently located AC2. The airport used by an LCC is easy to access AC3. Transportation to the airport used by an LCC is easy AC5. There are multiple transportation options to get to the airport used by an LCC	Chou & Kim (2009); Self-designed
Frequency	FR1. The number of flights provided by an LCC is adequate FR2. LCCs operate with high frequency FR4. The time interval between LCC flights is satisfactory	Park et al. (2006); Self-designed
Technology Self-efficacy	SE1. If I wanted to, I could easily search for LCC information on the internet on my own SE2. If I wanted to, I could easily purchase an LCC ticket on the internet on my own SE3. I would be able to purchase an LCC ticket on the internet even if there is no one around to show me how to do it SE4. If I wanted to, I could search/compare prices of airlines online	Taylor & Todd (1995)
Service Quality	SQ2. LCCs provide a clean cabin environment	Park et al. (2006), Self-designed

Table C2 (*continued*)

Variable	Statement	Source
	SQ3. Seats are comfortable on an LCC flight SQ4. Onboard facilities of LCCs are complete	
Behavioral Intention	BI1. I intend to buy an LCC ticket BI5. I intend to travel by LCCs frequently BI6. It’s likely I will recommend LCCs to others	Al Ziadat, 2015; Chou & Kim (2009); Kuo & Tang (2011); Taylor & Todd (1995)

APPENDIX D

Figures

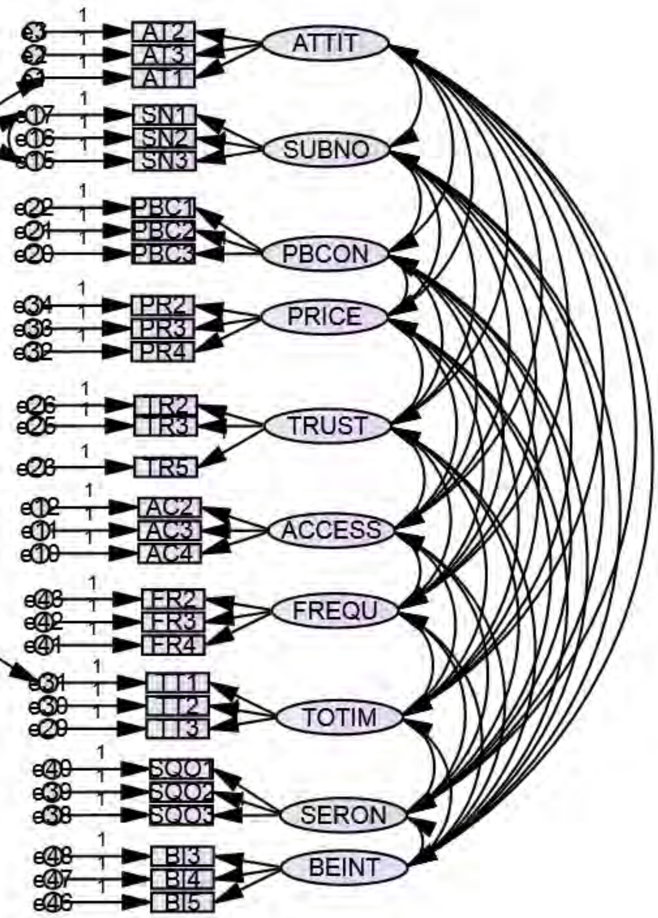

Figure D1. Final CFA model – HSR.

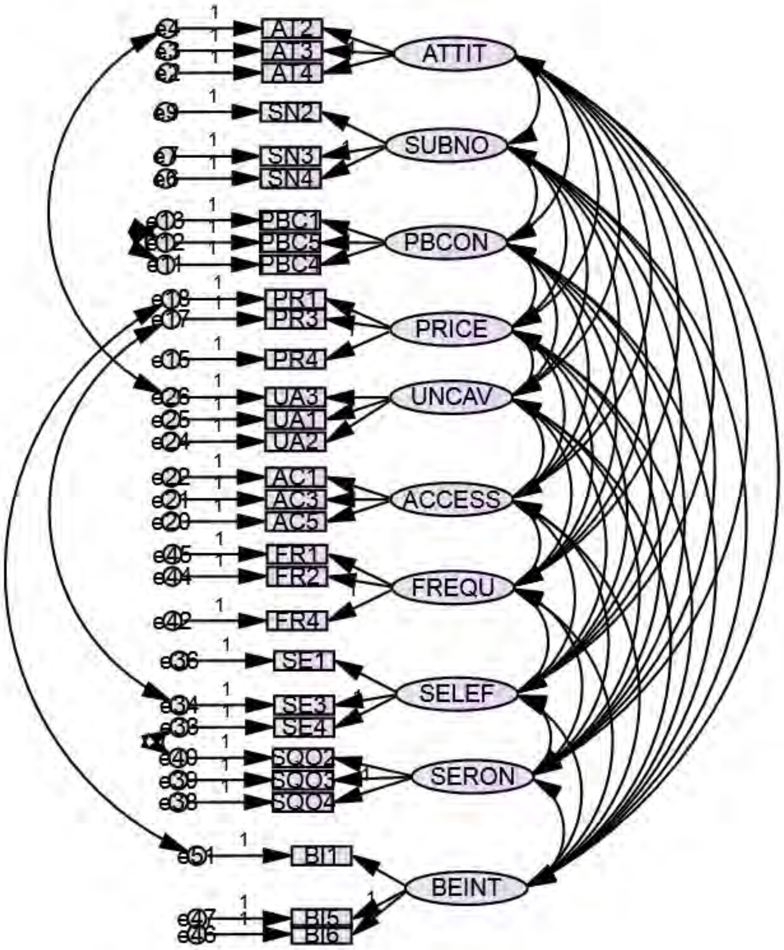

Figure D2. Final CFA model – LCCs.

APPENDIX E

IRB Approval Exempt Determination

Embry-Riddle Aeronautical University
Application for IRB Approval
Exempt Determination

Principle Investigator: Jing Yu Pan **Other Investigators:** Dr. Dothang Truong **Role:** Student **Campus:** Daytona Beach **College:** COA

Project Title: Investigation of Passengers' Intentions to Use High-speed Rail and Low-cost Carriers in China

Submission Date: 11/16/2016 **Determination Date:** 12/7/2016

Review Board Use Only

Initial Reviewer: Haydee M. Cuevas

Exempt: Yes

Approved:

Haydee M. Cuevas	M.B. McLatchey	December 12, 2016 Expires: December 11, 2017
Pre-Reviewer Signature	Chair of the IRB Signature	Date of Approval / Expiration Date

Brief Description: The purpose of this study is to identify which devices are the easiest to use, where the issues in their use are, and possible ways to improve the usability of these devices.

This research falls under the **exempt** category as per 45 CFR 46.101(b) under:

☐(1) Research conducted in established or commonly accepted educational settings, involving normal educational practices, such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

☒(2) Research involving **only** the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures (of adults), interview procedures (of adults) or observation of public behavior. Participant information obtained will remain anonymous or confidential.

☐(3) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under paragraph (b)(2) of this section if: (i) the human subjects are elected or appointed public officials or candidates for public office; or (ii) federal statute(s) require(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.

☐(4) Research involving the collection or study of **existing** data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects.

☐(5) Research and demonstration projects which are conducted by or subject to the approval of department or agency heads, and which are designed to study, evaluate, or otherwise examine: (i) Public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs.

☐(6) Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the Food and Drug Administration or approved by the Environmental Protection Agency or the Food Safety and Inspection Service of the U.S. Department of Agriculture.

An exempt research project does not require ongoing review by the IRB, unless the project is amended in such a way that it no longer meets the exemption criteria.

EMBRY-RIDDLE
Aeronautical University
FLORIDA | ARIZONA | WORLDWIDE

29 November 2016

Human Subject Protocol Application

Campus:	Daytona Beach	College:	COA
Other Institution Name & Address:			
Applicant:	Jing Yu Pan	Degree Level:	PhD
ERAU ID:	2105426	ERAU Affiliation:	Student
Project Title:	Investigation of Passengers' Intentions to Use High-speed Rail and Low-cost Carriers in China		
Principal Investigator:	Dr. Dothang Truong		
Other Investigators:			
Submission Date:	11/16/2016		
Beginning Date:	12/03/2016	Expected End Date:	01/31/2017
Type of Project:	Research		
Type of Funding Support (if any):	Self-funding		

Questions:

1. Background and Purpose: Briefly describe the background and purpose of the research.

High-speed rail (HSR) and low-cost carriers (LCCs) have increasingly become worldwide phenomenon. In China, HSR has achieved rapid growth because of government support, while LCCs have gained only limited success due to regulatory constraints. The situation is expected to change with Chinese authority's new policies to promote the development of LCCs. As LCCs continue to grow, they are likely to become a serious competitor for HSR. The potential competition between HSR and LCCs calls for an in-depth investigation of passengers' intentions to use these modes, which remain an understudied area of research.
This study will examine factors that affect passengers' intentions to choose LCCs and HSR in the current Chinese market, and compare the magnitude of their impact. The results of this study will provide empirical evidence of passengers' mode use intentions and potential HSR-LCC competition in China.

2. Design, Procedures, Materials and Methods: Describe the details of the procedure to be used and the type of daa that will be collected.

This study will follow a cross-sectional, survey design. The researcher will develop two structured questionnaires for data collection. For the HSR survey, this researcher will randomly select passengers at the boarding gate areas at Beijing South Railway Station and Shanghai Hongqiao Railway Station. Similarly, for the LCC survey, LCC passengers waiting for boarding will be randomly chosen from Shanghai Pudong International Airport and Shijiazhuang Zhengding International Airport. Beijing and Shanghai are selected for the HSR survey because they are the key markets for HSR operations in China. Similarly, Shanghai and Shijiazhuang are selected because they have the most LCC operations in China. Small-scale pilot studies will be conducted to test the validity and reliability of the questionnaires, followed by large-scale surveys.
As this study aims to identify factors affecting passengers' mode use intentions through numerical evidence and generalize the results to a larger population, it is quantitative in nature. This study will employ a structural equation modeling (SEM) method. Empirical data will be used to test the SEM models developed for HSR and LCCs, respectively.

3. Measures and Observations: What measures or observations will be taken in the study?

The questionnaire will be used as the research instrument.

3b. If any questionnaires, tests, or other instruments are used, provide a brief description.

Two questionnaires containing demographic questions, travel experience questions, and a series of Five Likert scale questions will be distributed by the survey administrator at the selected railway stations in Beijing and Shanghai, and the selected airports in Shanghai and Shijiazhuang. The questionnaires will assess the impact of two sets of constructs on passengers' intentions to use HSR and LCCs. In the HSR questionnaire, constructs of attitude, subjective norms, perceived behavioral control, price, trust, frequency, accessibility, service quality, and total travel time will be assessed. In the LCC questionnaire, constructs of attitude, subjective norms, perceived behavioral control, price, uncertainty avoidance, frequency, accessibility, technology self-efficacy, and service quality will be assessed. These constructs are borrowed from the theory of planned behavior (TPB) and existing literature. The question items that measure these constructs are adopted and modified from previous research studies to better reflect the HSR and LCC context in China. The surveys will follow a face-to-face mode, which allows the survey administrator to provide clarification when needed. The researcher will translate the questionnaires from English to Chinese using a back-translation method. Participants will be provided with the questionnaire written in their native language.

4. Risks and Benefits: Describe any potential risks to the dignity, rights, health or welfare of the human subjects. Assess the potential benefits to be gained by the subjects as well as to society in general as a result of this project. Briefly assess the risk-benefit ratio.

This study will use the survey questionnaire to collect data about passengers' opinions on choosing HSR and LCCs in China. The risk a passenger may encounter by taking part in this study is minimal, no more than that in everyday life. The questionnaire can be completed within about ten minutes, which is a reasonable timeframe. Participation of this study is voluntary and participants can skip any question they feel uncomfortable with or withdraw from the survey even after they have started.

The participants will not likely receive any personal benefit. The findings of the study will help identify passengers' motivation in choosing HSR and LCCs in China. This will fill the gap in the literature and help the airline industry better prepare for the future competition.

5. Informed Consent: Describe the procedures you will use to obtain informed consent of the subjects and the debrief/feedback that will be provided to participants. See Informed Consent Guidelines for more information on Informed Consent requirements.

Potential respondents will need complete and clear information of this study in order to decide whether they want to participate. The informed consent that contains information such as a brief introduction of the research, eligibility requirements, and estimated time involved will be used to facilitate the decision making. The survey administrator will invite passengers to read the consent and ask questions. A point of contact for additional information will be provided. If the passenger agrees to participate, he (she) will select "Yes" in the consent, which will be taken as the willingness to participate in the study. He (she) will then be provided with the survey questionnaire. If the passenger does not wish to participate, he (she) can simply decline the invitation and return the consent form to the survey administrator. The researcher will translate the consent form from English to Chinese using a back-translation method. Participants will be provided with the form written in their native language. See the informed consent document as an attachment of this application.

6. Anonymity: Will participant information be anonymous (not even the researcher can match data with names), confidential (Names or any other identifying demographics can be matched, but only members of the research team will have access to that information. Publication of the data will not include any identifying information.), or public (Names and data will be matched and individuals outside of the research team will have either direct or indirect access. Publication of the data will allow either directly or indirectly, identification of the participants.)?

Anonymous

6b. Justify the classification and describe how privacy will be ensured/protected.

Because the researcher cannot match data with names in this study, the level of privacy of this study will be anonymous. No personal identifiers will be required during the data collection process. The questionnaires will only collect general demographic information. This researcher will ensure that respondents' identifiers will not be identified through these characteristics. Results of data analysis will be reported in summary format only.

7. Privacy: Describe the safeguards (including confidentiality safeguards) you will use to minimize the risks. Indicate what will happen to data collected from participants that choose to "opt out" during the research process. If video/audio recordsings are part of the research, please describe how that data will be stored or destroyed.

In this research, potential respondents will be fully informed about the research, have the opportunity to ask questions, and provide explicit consent to participate in the survey. Only after that, data collection can start. Participants will have the option of not participating even after they have started. If the participant chooses to opt-out during the research process, the incomplete data collected from this participant will not be used in this research and will be destroyed in a safe manner.

After the data collection completes, the researcher will keep the data as confidential information in password-protected computer system. The data will not be shared with anyone.

8. Participant Population and Recruitment Procedures: Who will be recruited to be participants and how will they be recruited. Note that participants must be at least 18 years of age to participate. Participants under 18 years of age much have a parent or guardian sign the informed consent document.

A local marketing firm will be hired to collect data on my behalf. The English name of the firm is DataSea and it will be the survey administrator for my research. DataSea, established in 1996, is one of the largest marketing research groups providing data collection service, marketing analysis and marketing solutions in China. It has over 200 employees. In 2014, its revenue exceeded 60 million RMB (8.7 million USD). Some Key customers of DataSea include Siemens, Samsung, Walmart, Johnson-Johnson, Michelin, Intel, UNICEF, Haier, Industrial and Commercial Bank of China, and Hainan Airlines. DataSea is chosen for this research because of its good reputation in China. Another important reason is its partnership with airports and professional experience in airport surveys across China. For example, it has been involved in many large-scale studies of Beijing Capital International Airport (BCIA), such as Investigation of Passenger Composition and Behaviors at BCIA, Evaluation of Services after Flight Delays at BCIA, and ACI Global Airport Satisfaction Survey (with 6000 questionnaires).

The role of DataSea in this research is limited to data collection. Full communication has been conducted with DataSea about this task. This researcher will ensure that 1) DataSea fully understands the research and the purpose of the survey so its survey administrators are able to provide accurate clarification at the survey locations, 2) it fully understands the required survey procedures and will strictly follow the procedures, and, 3) while DataSea has its ethical training system in place and it attaches great importance to ethical and professional conducts in marketing research, this researcher will communicate with it on the CITI training materials and emphasize on the professional standards and ethical conducts established by CITI. Based on the contract, DataSea is responsible for obtaining permits from Pudong International Airport, Zhengding International Airport, Beijing South Railway Station and Shanghai Hongqiao Railway Station for conducting surveys at these locations.

Passengers waiting for boarding at Beijing South Railway Station and Shanghai Hongqiao Railway Station will be randomly selected for the HSR survey. Passengers waiting for boarding at Shanghai Pudong International Airport and Shijiazhuang Zhengding International Airport will be randomly selected for the LCC survey. To be eligible to participate in the survey, the passenger must be Chinese, 18 years or older, and leaving Beijing or Shanghai by HSR or leaving Shanghai or Shijiazhuang by LCCs. For each passenger being selected, the survey administrator will provide him (her) the informed consent and answer any question from the passenger. The questionnaires will be short and clear and they will be printed in Chinese to be used by the Chinese passenger. The passenger will inform the survey administrator whether he (she) agrees to participate in the survey. If he (she) declines to participate, the survey administrator will ask if he (she) wants to answer three simple demographic questions, including What is the purpose of your trip, What is your occupation, and How often do you use HSR(LCCs) each year. The information is collected for assessing non-response bias. This will be done by talking to the passenger, which will take less than one minute. After the passenger provides the information, or if he (she) does not wish to do so, the survey administrator will thank him (her) and leave.

9. Economic Considerations: Are participants going to be paid for their participation?

No

9b. If yes, describe your policy for dealing with participants who 1) Show up for research, but refuse informed consent; 2) Start but fail to complete research.

Participants will not be paid for their participation. After the participants complete the survey they will be given a luggage tag as a token of appreciation.

10. Time: Approximately how much time will be required of each participant?

The questionnaire can be completed within ten minutes.

By submitting this application, you are signing that the Principal Investigator and any other investigators certify the following:
1. The information in this application is accurate and complete
2. All procedures performed during this project will be conducted by individuals legally and responsibly entitled to do so
3. I/we will comply with all federal, state, and institutional policies and procedures to protect human subjects in research
4. I/we will assure that the consent process and research procedures as described herein are followed with every participant in the research
5. That any significant systematic deviation from the submitted protocol (for example, a change in the principal investigator, sponsorship, research purposes, participant recruitment procedures, research methodology, risks and benefits, or consent procedures) will be submitted to the IRB for approval prior to its implementation
6. I/we will promptly report any adverse events to the IRB

Electronic Signature:

Jing Yu Pan

中央财经大学
地址：北京市海淀区学院南路39号 邮编：100081
Add:39 South College Rd.Haidian District Beijing,China
Post Code:100081

August 1st, 2016

To whom it may concern:

I have reviewed the survey questionnaires used in the research titled Investigation of Passengers' Intentions to Use High-Speed Rail and Low-Cost Carriers in China, which is conducted by Jing Yu Pan, a student of the College of Aviation at Embry Riddle Aeronautical University, Daytona Beach, Florida, USA. I have considered the research meaningful, and the outcome will benefit the transport industry.

I believe that the questionnaires do not affect social security. I believe that the questionnaires pose no harm to the dignity, health, rights and welfare of participants, and they do not affect the privacy and identity of participants.

If you have any question or need more information, Please feel free to contact me.

Sincerely,

Chen Bo

Chen Bo (Ph.D.)
Dean/Professor
Institute of Defence Economics and Management
Central University of Finance and Economics
39 South College Road, Haidian District
Beijing, China
Email: chb0081@sina.com.cn
Tel: +86-10-62288567
Fax: +86-10-62288950

Informed Consent Form (Low-cost Carrier Passenger Survey)

STUDY LEADERSHIP AND TOPIC. DataSea invites you to participate in a survey, which is part of a research project that examines passengers' motivation in choosing high-speed rail (HSR) and low-cost carriers (LCCs) in China. The topic of the study is ***Investigation of Passengers' Intentions to Use High-speed Rail and Low-cost Carriers in China.***

PURPOSE. The survey conducted at this location is to learn about passengers' viewpoints related to the LCC use and the factors influencing their intentions to use LCCs in China.

ELIGIBILITY. To be in this study, you must be 18 years or older, a resident of People's Republic of China, and an LCC passenger.

PROCEDURES. A survey administrator will provide you with a questionnaire to be filled in. You are free to seek clarification before participating in the survey. The questionnaire will include your travel experience and demographic questions such as your age and occupation. It will also seek your opinions on factors influencing your intention to use LCCs. The questionnaire can be completed within ten minutes.

VOLUNTARY PARTICIPATION. Your participation in this project is completely voluntary and you are free to decline to participate, without consequence, at any time prior to or during the survey. You are also free to skip any question in the questionnaire that you feel unease to give an answer to.

RISKS AND BENEFITS. There are no known risks to you as a person taking this survey, beyond those risks experienced in everyday life. One possible inconvenience to you is that you may spend less time on other activities because of participating in the survey. After completing the questionnaire, you will be given a luggage tag as a token of appreciation. There are no known direct benefits to you personally in participating in the survey. Your participation will promote the understanding of passengers' motivation in choosing LCCs in China.

<u>**SAFEGUARDING PRIVACY.**</u> The participation is anonymous. No personal information will be collected other than basic demographic descriptors. The questions are designed such that no personal identification will be included. All information collected from you will be maintained in a secure manner. If you choose to "opt-out" during the research, the data collected from you will not be used in this research and will be destroyed in a safe manner.

<u>**FURTHER INFORMATION.**</u> If you have any questions or would like additional information about this study, please contact Pan Jing Yu at jane_panjy@yahoo.com. Embry-Riddle Aeronautical University Institutional Review Board (IRB) has approved this project. You may contact Dr. M.B. McLatchey from IRB with any questions or issues at MCLATCHM@erau.edu.

<u>**CONSENT.**</u> Please tick "Yes" below to indicate that you understand the information on this form, that any questions you have about this study have been answered, and that you agree to participate in this survey.

☐ Yes, I like to participate in the survey. (Thank you and please start the survey)

Informed Consent Form (High-speed Rail Passenger Survey)

STUDY LEADERSHIP AND TOPIC. DataSea invites you to participate in a survey, which is part of a research project that examines passengers' motivation in choosing high-speed rail (HSR) and low-cost carriers (LCCs) in China. The topic of the study is ***Investigation of Passengers' Intentions to Use High-speed Rail and Low-cost Carriers in China.***

PURPOSE. The survey conducted at this location is to learn about passengers' viewpoints related to the HSR use and the factors influencing their intentions to use HSR in China.

ELIGIBILITY. To be in this study, you must be 18 years or older, a resident of People's Republic of China, and an HSR passenger.

PROCEDURES. A survey administrator will provide you with a questionnaire to be filled in. You are free to seek clarification before participating in the survey. The questionnaire will include your travel experience and demographic questions such as your age and occupation. It will also seek your opinions on factors influencing your intention to use HSR. The questionnaire can be completed within ten minutes.

VOLUNTARY PARTICIPATION. Your participation in this project is completely voluntary and you are free to decline to participate, without consequence, at any time prior to or during the survey. You are also free to skip any question in the questionnaire that you feel unease to give an answer to.

RISKS AND BENEFITS. There are no known risks to you as a person taking this survey, beyond those risks experienced in everyday life. One possible inconvenience to you is that you may spend less time on other activities because of participating in the survey. After completing the questionnaire, you will be given a luggage tag as a token of appreciation. There are no known direct benefits to you personally in participating in the survey. Your participation will promote the understanding of passengers' motivation in choosing HSR in China.

SAFEGUARDING PRIVACY. The participation is anonymous. No personal information will be collected other than basic demographic descriptors. The questions are designed such that no personal identification will be included. All information collected from you will be maintained in a secure manner. If you choose to "opt-out" during the research, the data collected from you will not be used in this research and will be destroyed in a safe manner.

FURTHER INFORMATION. If you have any questions or would like additional information about this study, please contact Pan Jing Yu at jane_panjy@yahoo.com. Embry-Riddle Aeronautical University Institutional Review Board (IRB) has approved this project. You may contact Dr. M.B. McLatchey from IRB with any questions or issues at MCLATCHM@erau.edu.

CONSENT. Please tick "Yes" below to indicate that you understand the information on this form, that any questions you have about this study have been answered, and that you agree to participate in this survey.

☐ Yes, I like to participate in the survey. (Thank you and please start the survey)

Questionnaire for the LCC Survey

Section 1. Filter Questions

1.1 Are you Chinese?

( ) Yes (Please continue the survey)   ( ) No (Please withdraw this survey)

1.2 Are you eighteen years or older?

( ) Yes (Please continue survey)   ( ) No (Please withdraw this survey)

1.3 Are you Departing Shanghai (or Shijiazhuang) using a low cost carrier (LCC)?

( ) Yes (Please continue survey)   ( ) No (Please withdraw this survey)

Section 2. Demographics

2.1 Gender

( ) Male   ( ) Female

2.2 Age

( ) 20 or younger   ( ) 21-30 years

( ) 31 - 40 years   ( ) 41 – 50 years

( ) 51-60 years   ( ) Older than 60 years

2.3 Education level

( ) Lower than Bachelor's degree   ( ) Bachelor's degree

( ) Master's degree   ( ) Higher than Master's degree

2.4 Monthly income

( ) 5000 RMB or less   ( ) 5001 – 10000 RMB

( ) 10001 – 15000 RMB   ( ) 15001 – 20000 RMB

( ) More than 20000 RMB

2.5 Occupation

( ) Student   ( ) State enterprise employee

( ) Private company employee   ( ) Government officer

( ) self-employed   ( ) Business owner

( ) Others, please specify________

2.6 City where you live in

Please indicate which city you live in __________________

Section 3. Travel Experience

3.1 How often do you travel by an LCC?

( ) Less than once per year   ( ) Once per year

( ) 2-3 times per year   ( ) More than 3 times per year

3.2 How do you get information about an LCC?

( ) Company website   ( ) Advertising

( ) Family and friends   ( ) Search engine

( ) Others, please specify _____________

3.3 What is the main purpose of traveling by an LCC?

( ) Leisure/Vacation   ( ) Business

( ) Seminar/Conference/Training   ( ) Study

( ) Visiting family   ( ) Others, please specify_______

3.4 What is your destination city for this trip?

Please indicate ______________________

3.5 Are you traveling alone?
( ) Yes ( ) No

3.6 How do you purchase your LCC ticket?
( ) LCC office ( ) At the station
( ) Travel Agency ( ) LCC website
Others, please specify_______________

3.7 How much did you pay for the LCC ticket (one way)?
( ) under 200 Yuan ( ) 201 – 400 Yuan
( ) 401-600 Yuan ( ) 601- 800 Yuan
( ) 801 -1000 Yuan ( ) over 1000 Yuan

Section 4. Factors affecting passengers' intentions to use low cost carriers (LCCs).

Statements	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
AT1. I think traveling by an LCC would be a good idea					
AT2. I think traveling by an LCC would be pleasant.					
AT3. I like traveling by an LCC.					
SN1. Most people important to me (family/friends) think I should choose an LCC					
SN2.I feel I should choose an LCC because my family and friends recommend it.					
SN3. People whose opinion I value prefer that I use an LCC					
PB1. It's mainly up to me whether I choose an LCC or not.					
PB2. There is adequate information that I can use to decide on the choice of an LCC.					
PB3.I have enough money to buy an LCC ticket.					
PR1. I am satisfied with the price of an LCC.					
PR2. The price is important for me to choose a transportation mode					
PR3. I think the price of an LCC is reasonable.					

UA1. If I perceived uncertainty of LCCs' future growth in the Chinese market, I will seek clear information in this regard before choosing an LCC.					
UA2. If I perceived uncertainty of LCC's safety, I will seek clear information of LCCs' safety before choosing an LCC .					
UA3. If I perceived uncertainty of LCC's on-time performance, I will seek unambiguous information of LCCs' on-time performance before choosing an LCC .					
UA4. If I perceived uncertainty of LCCs' restrictive rules, I would seek explicit information of LCCs' rules before choosing an LCC .					
AC1. The airport an LCC uses is easy to access.					
AC2. There are convenient transportation options to and from the airport used by an LCC.					
AC3. The airport access time for an LCC flight is reasonable.					
FR1. The number of flights provided by LCCs is adequate.					
FR2. I am satisfied with the number of flights provided by LCCs .					
FR3. LCC flights are operated at convenient times during the day					
FR4. The number of flights provided by LCCs meets my need.					
SE1. If I wanted to, I could easily search for LCC information on the internet on my own.					
SE2. If I wanted to, I could easily purchase an LCC ticket on the internet on my own.					

SE3. I would be able to purchase an LCC ticket on the internet even if there is no one around to show me how to do it.					
SQ1. I think the seat on an LCC flight is comfortable.					
SQ2. I think an LCC provides adequate legroom space.					
SQ3. I think an LCC provides satisfactory food choices.					
SQ4. I think an LCC has good in-flight entertainment services (movies, magazines etc.)					
SQ5.LCC employees are willing to help passengers					
SQ6. LCC employees are courteous					
SQ7. LCC employees have the knowledge to answer passengers questions					
SQ8. LCC employees can quickly and efficiently solve the problem with passengers					

Section 5: Behavioral Intention.

Statements	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
BI1. I intent to buy an LCC ticket.					
BI2. It's likely I will choose an LCC again in the future					
BI3. I will recommend LCCs to others.					

Section 6: Actual Behavior.

Statements	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
AB1. I am a regular passenger of LCCs.					
AB2. I will continue to buy LCC ticket in the future.					
AB3. I use LCCs more than other types of airlines.					

APPENDIX F

Approval from UIC for Using UIC's Online Map

IU Info UIC <UIC@uic.org>
周一 5/29, 9:05
Pan, Jane

你已在 2017/5/29 14:38 答复。

Dear Ms Pan,

Thank you very for your interest in UIC activities. I have the pleasure to inform you that you are allowed to reproduce the high speed rail in China map provided the source (UIC) is acknowledged.

Best regards

Emmanuelle Boudier
Head of the Documentation Centre

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