An Empirical Research on the Impact of Passenger Consumption Characteristics on the Supporting Commercial Facilities of Rail Transit Integrated Transfer Hubs: Taking Beijing and Tianjin as an Example

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1. Introduction

With the rapid development of cities, rail transit, as an efficient and convenient way of urban traffic, is also developing rapidly. In recent years, the external passenger transport nodes of major cities in China, such as airports and railway stations, have been supported by urban rail transit, forming a new mode of “external traffic station” + “urban transfer hub” with the main mode of transport as the core. Among them, the role of the transfer hub with urban rail transit as the core is increasingly improving. The huge advantages of passenger flow distribution of these rail transit integrated transfer hubs have brought opportunities for commercial development in and around the hubs, and the combination of commercial service functions and transportation functions has become the basic form of rail transit integrated transfer hub design [1]. The integrated transfer hub will be integrated with the surrounding adjacent urban areas and deeply integrated with urban functions to form a new urban complex, as shown in Figure 1.

With the continuous strengthening of the concept of integrated development of rail transit, the commercial development of rail transit stations has entered a mature development period, the proportion of passengers’ consumption in rail transit hub stations has greatly increased, and the contradiction between the traditional commercial management service mode of rail transit hub stations [2] and passengers’ consumption demand has become increasingly obvious. Therefore, it is necessary to analyze the development direction of rail transit integrated transfer hubs,
especially the commercial service facilities other than railway stations, from the perspective of meeting the consumption needs of passengers. Analyze the consumption behavior characteristics of rail transit transfer passengers in depth and build a reasonable development strategy system oriented by passenger consumption demand, which provides a basis for the commercial integrated development of rail transit integrated transfer hub stations.

The case studies of many foreign rail transit integrated transfer hub stations show that the stations and hubs are not only important nodes for traffic conversion but also the gathering of a large number of passenger flows will also generate business development opportunities, and even become the commercial and public activity centers of cities or regions [3]. With the development and construction of railway passenger transport hubs, many large hubs in Germany, France, and other countries have gradually changed the previous single function mode of stations and gradually updated to a new multifunctional, information-based, and modern station integrating business, public activities, and transportation conversion functions [4]. In Japan, such multifunctional railway passenger stations and hubs are more common in big cities. They have been integrated with urban life, forming a multilevel commercial space and diversified commercial formats [5, 6].

Compared with foreign stations and hubs, the comprehensive utilization level of most rail transit integrated transfer hubs in Chinese Mainland is still in an extensive stage. At this stage, there is still no reliable scale, configuration standard, and prediction method of commercial facilities in the station hub. As a result, the planning and construction of stations and hubs do not fully understand the value of passenger flow, reducing the investment benefits of their construction and operation; or lead to excessive expectation on the value of stations and hubs, leading to idle waste of commercial space built in advance. At the same time, at this stage, the refined utilization of the internal space of stations and hubs and the integration level of traffic space and commercial space are still being explored. These studies need the support of basic research. Especially, it is more important and urgent to study the consumption characteristics of the commercial facility users, that is, passengers in the hub, which is of great significance for the rail transit investment, development and construction in the stage of rapid development. At present, the domestic research on the consumption behavior of railway passengers is in the preliminary stage. In general, the in-station consumption characteristics of rail transit passengers mainly focus on qualitative analysis and are mainly based on the research and summary of the basic attributes and travel characteristics of passengers. The consumption demand is judged by qualitative analysis of their attributes, lacking specific data support.

In this paper, transfer passengers from major rail transit integrated transfer hubs in Beijing and Tianjin are selected as samples to conduct a quantitative analysis of passenger consumption characteristics and study the influence mechanism of passengers’ basic attributes and travel behavior on their consumption characteristics. Through data processing and data analysis, the characteristic key factors affecting passenger consumption and the influencing mechanism are obtained, respectively. The regression model of consumption characteristics is obtained, which lays a foundation for the optimization and improvement of commercial layout of rail transit integrated transfer hub stations in the future.

2. Data Collection and Research Methods

2.1. Case Study Overview. Beijing and Tianjin are, respectively, the first and second cities in China to complete and operate subways. By the end of 2021, Beijing has opened 27 urban rail transit lines with an operating mileage of 783 km. Tianjin has opened 7 urban rail transit lines with an operating mileage of 265 km [7]. The Beijing-Tianjin Intercity Railway, a rail transit line connecting the two cities, is China’s first intercity railway, with an annual two-way passenger capacity of 120 million passengers [8]. The development of the rail transit network in Beijing and Tianjin is complete, and the average daily passenger volume keeps increasing. This study takes the passengers of Beijing south station, Tianjin Station, and Wuqing Station, which are the main stations of the integrated transfer hubs of Beijing and Tianjin rail transit, as samples, and the sample size is large and representative nationwide.

It is generally believed that the consumer behavior of passengers in the transfer process is different from that of ordinary residents. Passenger consumption behavior refers to the behavior that passengers meet their physiological and spiritual consumption needs by purchasing products sold in the station during travel. Because it is a derivative of transfer behavior, it is usually at the lower position of behavior priority. Accordingly, such behavior is more constrained by time and space. It is often more limited in the vicinity of transfer or ride paths, that is, the interior of stations and transfer hub buildings, and less spread to surrounding areas [9]. At the same time, due to various reasons, the current high-speed railway passenger stations and hubs in Chinese Mainland mostly choose nondeveloped areas, resulting in the imperfect development of commercial service facilities in the surrounding areas; or even if it is in a mature area, the station, hub, and surrounding areas have formed a space barrier due to their own superlarge spatial scale plus high-grade roads and green squares, resulting in the lack of close pedestrian connection between the station and the
surrounding areas. The above behavior characteristics and the attributes of facilities and environment form that the current passenger consumption behavior is mainly concentrated in the commercial area inside the station and hub building space. Relevant research on the case area, the research on the 1km around Beijing south railway station and Tianjin railway station, shows the above typical characteristics, as shown in Figure 2 and Figure 3.

2.2. Data Source and Processing. Based on the above understanding of the background characteristics of stations and hubs, the main locations for collecting samples in this study are within the stations and their supporting transport hubs, ignoring the commercial facilities around the stations. The data were collected by random sampling and questionnaire survey, and the questionnaire survey was conducted according to the current passenger flow of the main hub stations in Beijing and Tianjin, so as to strive for the objectivity and comprehensiveness of the sample. From December 5, 2018, to December 11, 2018, including working days and rest days, the research team conducted surveys in the waiting hall in Beijing south railway station, Tianjin railway station and Wuqing station, the midway station between Beijing and Tianjin, and the transfer hall in the hub. A total of 1500 questionnaires were distributed, 1425 samples were collected, 1275 valid samples were screened, and the sample efficiency was 89.5%. As shown in Table 1, the area, time and population covered by the questionnaire can basically represent the consumption characteristics of passengers in rail transit comprehensive transfer hub.

According to the statistics of the questionnaires collected, the analysis was carried out. Taking the analysis of the consumption amount in the passenger consumption characteristics as an example, various characteristic data can be obtained. In terms of the passenger consumption amount, the passenger consumption amount was basically below 200 CNY, and the per capita consumption is 77.8 CNY. Drawing a scatter diagram for the samples with consumption amount below 200 CNY, it can be seen that the consumption density of 100 CNY and 30–50 CNY is higher, as shown in Figure 4.

After sorting out the statistics, the characteristics of all aspects of the whole sample of passengers at the Beijing-Tianjin integrated rail transit transfer hub station are analyzed, including basic attribute characteristics, passenger travel characteristics and passenger consumption characteristics, as shown in Table 2 and Table 3.

2.3. The Research Methods. This paper comprehensively considers the related methods of previous research and adopts a technical route consisting of five parts, i.e., multiple station passenger characteristics collection, information processing analysis, characteristic indicator model establishment, and characteristic influencing factor analysis.

First, the passenger characteristics of multiple stations are collected through questionnaire survey. Second, statistical methods are used to process and analyze the information of passenger characteristics of multiple stations. Third, the main indicator model of passenger consumption characteristics is established. Next, the influencing factors of passenger consumption characteristics in rail transit integrated transfer hub stations are analyzed, and correlation analysis and logistics regression analysis are used to calculate the influencing significance and regression equation of different factors. Finally, the key factors and influencing mechanisms that affect passenger consumption characteristics are obtained.

It should be noted in particular that correlation analysis is a statistical analysis method to measure the relationship between two kinds of things. There are many methods, such as Pearson simple correlation, Spearman rank correlation, Kendall correlation and contingency correlation [10]. This paper mainly studies whether the attributes and travel characteristics of passengers have an impact on their choice of consumption behavior. The variables are mostly nominal level variables, so the chi-square test of contingency
correlation is selected to conduct correlation analysis. Chi-square test was carried out for the two groups of nominal level variables by using Crosstab function in SPSS software. The correlation degree between variables was usually measured by Pearson chi-square bilateral test probability value $p$: the significance level $\alpha$ is required to be 0.05, that is $\alpha < 0.05$, when the $p$ value is greater than 0.05, it indicates that there is no correlation between the two variables. When the $p$ value is less than 0.05, it indicates that there is a relationship between the two variables and the correlation is significant. Through this method, the influence of factor variables on passenger consumption choice variables is investigated, so as to find the key variables and lay a foundation for the analysis of passenger consumption characteristics model of rail transit integrated transfer hubs.

Since correlation analysis is mainly used to demonstrate the correlation between two variables, in order to further study the correlation degree and influence trend between the two, multiclassification logistics regression analysis should be adopted to focus on extracting the correlation factors that have significant influence on the dependent variables and analyze their influence trend on the dependent variables. According to the different attributes of the dependent variable, it can be divided into ordered multiclassification logistics regression analysis and disordered multiclassification logistics regression analysis [11].

(1) When there are more than two categories of dependent variables in the research variables, and the categories can represent ordered variables such as degree and level, an ordered multiclassification logistics regression analysis is used, and the cumulative logit model is mainly used. Taking the response variable with a level number of 3 as an example, when the value of the response variable $Y$ is 1, 2, and 3, the corresponding probabilities of the corresponding level variables are $p_1$, $p_2$, and $p_3$, respectively. The result of the ordered Logistics regression model is:

$$
\ln \left( \frac{P_1}{1 - P_1} \right) = \ln \left( \frac{P_1}{P_2 + P_3} \right) = a_1 - (\beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3),
$$

(1)

$$
\ln \left( \frac{P_1 + P_2}{1 - (P_1 + P_2)} \right) = \ln \left( \frac{P_1 + P_2}{P_3} \right) = a_2 - (\beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3),
$$

(2)
| Basic attribute characteristics | Classification | Proportion (%) | Passenger travel characteristics | Classification | Proportion (%) |
|---------------------------------|----------------|---------------|---------------------------------|----------------|---------------|
| Gender                          | Male           | 60            | Official business, business trip, work, etc. | 54             |
|                                 | Female         | 40            | Return to working place (nonroutine) | 2              |
|                                 | Under 18,      | 1             | Go home (to one's usual place, everyday) | 6              |
|                                 | 18 to 24       | 21            | Return to school from holiday (not daily) | 2              |
| Age                             | 25 to 44       | 62            | Travel on holiday | 10             |
|                                 | 45 to 54       | 13            | Going to work (part-time daily) | 5              |
|                                 | Over 55        | 4             | Going to work (full-time daily) | 10             |
| Civil servants                  | 4              |               | Going to school (daily) | 2              |
| Company employees               | 41             |               | Visiting relatives | 7              |
| Doctor and teacher              | 9              |               | Working days | 64             |
| Professional and technical personnel | 17         |               | Legal holiday | 4              |
| Occupation                      | Students       | 11            | Vacation time | 17             |
|                                 | Business owners | 4             | Over the weekend | 15             |
|                                 | Freelancer     | 10            | Occasionally or rarely | 18             |
|                                 | Retired        | 2             | Several times a year | 31             |
| Migrant workers                 | 3              |               | Every two or three or five days | 7              |
|                                 | Part-time      | 0             | Basically once a week | 14             |
|                                 | <3000          | 11            | Once or twice a month | 24             |
|                                 | 3000–5000      | 20            | Working day, basically everyday | 6              |
| Monthly income (CNY/month)      | 5000–8000      | 28            | Below 10 minutes | 3              |
|                                 | 8000–10000     | 16            | 10–30 minutes | 22             |
|                                 | 10000–15000    | 10            | 30–60 minutes | 48             |
|                                 | 15000–25000    | 8             | 60–120 minutes | 24             |
|                                 | >25000         | 7             | Over 120 minutes | 4              |

| Passenger consumption characteristics | Classification | Proportion (%) | Passenger consumption characteristics | Classification | Proportion (%) |
|---------------------------------------|----------------|---------------|--------------------------------------|----------------|---------------|
| Consumption frequency                 | No, basically not | 21            | Newspapers and magazines | 8              |
|                                      | Yes, basically every time | 8            | More formal dining | 3              |
|                                      | Yes, occasionally or rarely | 41          | Fast food, coffee, tea and other casual meals | 29             |
|                                      | Yes, sometimes | 29            | Specialties and gifts | 2              |
|                                      | Basement one | 21            | Clothing, apparel or other everyday items | 4              |
| Consumption place                     | Waiting hall on the second-floor | 58          | Beverages, food, fruit | 45             |
|                                      | Outside the station | 22          | Leisure and entertainment | 9              |
|                                      | 1–19 | 15            | Other | 1              |
|                                      | 20–39 | 26.6        | Bad shopping environment | 9              |
|                                      | 40–49 | 6.9          | High price | 49             |
|                                      | 50–69 | 23.7         | Do not have time | 9              |
|                                      | 70–99 | 5.6          | Nothing I need | 5              |
|                                      | 100–149 | 14.6        | Crowded | 19             |
|                                      | 150–199 | 1.2         | Unreasonable business layout | 7              |
|                                      | 200 and above | 6.4        | Other | 2              |
It can be seen from the above model that the ordered multiclassification logistics model divides the different values of the dependent variable into two levels in sequence and establishes a dichotomous regression model for it at the same time. Therefore, no matter where the segmentation point of the dependent variable is chosen, the independent variable parameter \( \beta \) in the model remains unchanged, and only the constant term is changed.

(2) If the level number of reflection variables is greater than 2, and the classifications exist independently and do not represent the magnitude relationship of the degree, or the parallel line test \( p \) of ordered multiclassification regression for ordered variables is less than 0.05, the disordered multiclassification Logistics regression model is adopted. First of all, a certain level of the reflection variable should be defined as a reference, and the regression equation of the other k-1 level values should be obtained.

Taking the response variable with a level number of 3 as an example, when the value of the response variable \( Y \) is 1, 2, and 3, the system will take the variable with the largest level number as the reference by default, and the corresponding probabilities of the corresponding level variables are \( p_1 \), \( p_2 \), and \( p_3 \), respectively. The results of the disorderly Logistics regression model are as follows:

\[
\ln \left( \frac{P_1}{P_3} \right) = a_1 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3, \tag{3}
\]

\[
\ln \left( \frac{P_2}{P_3} \right) = a_2 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3, \tag{4}
\]

\( p_1 + p_2 + p_3 = 1 \). In essence, the classification of variables with a level number of 3 can be obtained through two two-dimensional logistic regression equations. To compare groups 1 and 2, the corresponding function can be obtained by subtracting the above two equations.

3. Establishment of the Passenger Consumption Characteristic Indicator Model in the Rail Transit Integrated Transfer Hub Stations

There are five main characteristic indicators of passengers’ consumption characteristics: consumption frequency, consumption place, consumption content, consumption amount, and factors affecting consumption willingness [12, 13]. Establish the passenger consumption characteristic indicator model, conduct a deeper analysis of the influencing factors of different consumption characteristics, and explore how the relevant influencing factors affect the consumption characteristics in the passenger station. In order to facilitate the calculation, the variables are assigned values, as shown in Table 4.

4. Research on the Influencing Factors of Passenger Consumption Characteristics in Rail Transit Comprehensive Transfer Hub Stations

4.1. Analysis of the Key Influencing Factors of Passenger Consumption Amount

4.1.1. Correlation Analysis. According to the correlation analysis results of the chi-square test, the variable of passenger waiting time will have a significant impact on the consumption amount, as listed in Table 5.

4.1.2. Regression Analysis. The consumption amount of passengers is an ordered multiclassification variable. Taking the consumption amount of passengers as the dependent variable and the waiting time attribute factor as the independent variable, an ordered multiclassification logistic regression analysis model is established. The analysis results are shown in Table 6.

\[
\ln \left( \frac{P_4}{1 - P_4} \right) = -0.922 + 0.904X_{t1} + 0.482X_{t2}
\]

\[- 0.513X_{t3} - 0.396X_{t4}, \tag{5}\]

\( P_4 \) indicates the probability of “consumption amount = 1”, that is, the probability of the event that the consumption amount is less than 20 CNY. \( X_{t1} \) indicates “waiting time = 1”, that is, the waiting time is less than 10 minutes. \( X_{t2} \) indicates “waiting time = 2”, that is, the waiting time is 10–30 minutes. \( X_{t3} \) indicates “waiting time = 3”, that is, the waiting time is 30–60 minutes. \( X_{t4} \) indicates “waiting time = 4”, that is, the waiting time is 1–2 hours.

4.2. Analysis of the Key Influencing Factors of Passenger Consumption Frequency, Passenger Consumption place, Consumption Content, and Main Factors Affecting Passenger Consumption Willingness. According to the above correlation analysis and regression analysis methods, the key influencing factors such as passenger consumption frequency, passenger consumption place, consumption content, and main factors affecting passenger consumption willingness are analyzed respectively, and the key influencing factors of passenger consumption frequency, passenger consumption place, consumption content, and main factors influencing passenger consumption willingness can be obtained.
4.2.1. Passenger Consumption Frequency. The correlation analysis is carried out on the consumption frequency of passengers in the rail transit integrated transfer hubs with personal attribute variables and travel behavior variables. The analysis results show that only the monthly income variable of passengers has a significant impact on the consumption frequency. According to the output results of the regression model, the higher the income of passengers, the occurrence ratio of nonconsumption in the station will decrease accordingly; the specific calculation shows that for every 1,000 CNY increase in the monthly income of passengers, the occurrence ratio of nonconsumption in the station will decrease by 1%, that is, the occurrence ratio of consumption will increase by 1%.

4.2.2. Passenger Consumption Place. From the correlation analysis of passenger consumption places, personal attribute variables, and travel characteristic variables in the rail transit.
integrated transfer hubs, it can be seen from the results of sig. value that the passengers’ travel frequency and travel date will have a significant impact on their choice of consumption places.

From the output results of the regression model, it can be seen that compared with the consumption at the underground hub layer, the passengers who travel on vacation prefer to consume outside the station, and the daily passengers are more inclined to consume at the underground hub layer. In terms of consumption choices at the waiting layer and the underground hub layer, compared with weekend travelers, vacation travelers are more inclined to consume at the second-floor waiting hall. Compared with daily travel, annual travel, monthly travel, and weekly travel are more inclined to consume at the waiting floor, while daily travel passengers are more inclined to consume at the underground hub layer.

4.2.3. Passenger Consumption Content. Based on the chi-square test analysis of passenger consumption content and personal attribute variables and travel characteristic variables in the rail transit integrated transfer hubs, the factors that affect passenger consumption content include a total of six factors such as age, income, travel frequency, travel purpose, travel date, and waiting time.

From the output results of the regression model, it can be seen that compared with casual fast food, passengers with higher travel frequency are more inclined to consume newspapers and magazines. In addition, passengers who travel on vacation are more inclined to consume casual food and beverages in the consumption choices of newspapers and fast food. Daily travel and weekly travel passengers are more inclined to consume meals between fast food and meals. In terms of leisure fast food and specialty gift consumption choices, the higher the travel frequency of passengers, the greater the probability of choosing specialty gifts. When comparing the consumption of beverage, food and fruit with the consumption of leisure food such as fast food, coffee, and tea, passengers who travel on working days prefer the latter.

4.2.4. The Main Factors Affecting Passengers’ Willingness to Consume. Reclassify the factors that affect passengers’ willingness to consume and divide them into three categories. The first category is the reasons for the commodity itself such as high commodity prices and commodity categories that do not meet the demand. The second category is the reasons such as unreasonable commercial layout, unfriendly commercial environment and the pressing crowd inside the station. The third category is that passengers have no time for consuming. According to the correlation analysis results, the three variables of passengers’ income, travel frequency, and travel purpose will have a significant impact on the factors that affect passengers’ willingness to consume.

From the output results of the regression model, the following conclusions can be drawn. In terms of commodity factors and commercial layout factors, compared with daily travel passengers, the consumption willingness of passengers whose travel frequency is an annual trip is more likely to be affected by commodity factors, such as the high commercial prices inside the station, and the types of goods do not meet the demand. Compared with the lack of consumption time and commodity reasons, the consumption willingness of
annual and monthly passengers is more likely to be affected by commodity reasons than daily passengers.

5. Conclusion

Through the statistics of the data obtained from the research on the abovementioned influencing factors of passenger consumption characteristics, the weight frequency of the influencing factors of passenger consumption characteristics is obtained, as shown in Table 8.

It can be seen from the above table that the basic attributes of passenger gender, age, and occupation have no significant impact on the five main characteristic indicators of passenger consumption characteristics; passenger income and travel frequency mainly affect consumption frequency and consumption characteristics in passenger consumption characteristic indicators and affects consumption willingness; travel purpose, travel date, and travel frequency more intensively affect the consumption location and consumption content in the passenger consumption characteristic indicator; while the waiting time affects the consumption amount.

(1) In terms of the basic attributes of passengers, only the monthly income variable of passengers will have a significant impact on the consumption behavior of passengers, which is mainly reflected in the impact on the frequency of consumption and the factors affecting the willingness of passengers to consume.

(2) In terms of passenger travel characteristics, the travel frequency characteristics of passengers will have a significant impact on the three variables of their consumption place, the choice of consumption content, and the factors that affect their willingness to consume. The travel date of passengers will have a significant impact on the choice of the two variables of their consumption places and consumption content. In addition, the passenger’s waiting time has a significant impact on the passenger’s consumption content and consumption amount.

In general, compared with the basic attribute variables of passengers, the influence of passengers’ travel behavior variables on their consumption characteristics will be more significant.

6. Discussion

6.1. Recommendations for the Scale of Commercial Facilities.

As an important development strategy of the country, with the guidance of national policies, the integration of regional economies, and the complementarity of industries, the pace of Beijing-Tianjin-Hebei integration is accelerating. Transportation integration is an important support for the integrated development of Beijing-Tianjin-Hebei. It is estimated that by 2030, 24 rail transit integrated transfer hubs will be built between Beijing, Tianjin, and Hebei, and the operating mileage will reach more than 3,400 km, gradually forming “Beijing-Tianjin-Hebei on the rail” [14]. It can be predicted that with the improvement of economic and social development level in the Beijing-Tianjin-Hebei region, the income level and travel frequency of passengers will continue to rise. The regression analysis results in this paper show that passengers’ willingness to consume and consumption frequency are significantly positively affected by passengers’ income level and travel frequency. Therefore, regional economic and social development and the improvement of regional integration level will inevitably be transmitted to passenger consumption frequency and willingness to consume and are then transmitted to the demand for the scale of commercial facilities through income and travel frequency.

However, different from general urban commercial buildings, rail transit integrated transfer hub buildings are often superimposed with rail engineering, and the engineering is complex, so it is difficult to expand and increase the capacity of stations, hubs, and its internal functions. This characteristic is more obvious in the large-scale rail hub with highly intensive functions and land use and highly integrated station. This means that there must be a contradiction between the rigidity of facilities and the continuity of demand [15]. This phenomenon has been reflected in the integrated transfer hub stations of Beijing-Tianjin rail transit, such as Beijing south railway station. Therefore, in the planning and design of large-scale rail transit integrated transfer hub stations, it is necessary to make a certain scale of static or dynamic reservation on the basis of conforming to the relevant design quotas of the current national standards and regulations, so as to leave the possibility of commercial space expansion.

6.2. Recommendations for the Format and Layout of Commercial Facilities.

Business and office travel between urban agglomerations will increase with the strengthening of economic activities between cities, and the newly emerging cross-city commuting has gradually become one of the important types of rail transit passenger flow, which will significantly increase the proportion of travel on weekdays, and also significantly increase the travel frequency of passengers. The regression analysis results in this paper show that passengers’ consumption content and consumption place are significantly and positively affected by travel purpose and travel frequency [16]. Therefore, the strengthening of the connection between economic and social activities in urban agglomerations may also be transmitted to the format and layout of commercial facilities through changes in the purpose and frequency of travel.

In addition, in the new generation of TOD-oriented integrated rail transit transfer hubs, the deep integration of stations and cities has become a trend. The integrated rail transit transfer hub in the city center is being transformed into a transportation complex with surrounding service capabilities to some extent [17]. This will make it possible to further break the boundaries of space and management between inside and outside the station, inside and outside the red line. In these transportation and urban spaces without clear boundaries, supporting commerce inside the stations will have dual service functions for the city and
passengers, and even become places for purposeful consumption, which will make them more flexible, more diversified, and with higher environmental quality. Obviously, this will be a brand-new model with more development potential. This aspect is the best means to solve the contradiction between demand growth and facility rigidity and provides a strong guarantee to balance and meet the total amount, structure, and distribution of commercial demand in the station.

Although the data collected in this paper have investigated the passengers on weekends and peacetime, it cannot cover all typical periods. For example, the data collection of passenger flow on holidays is still lacking, which will affect the reliability of the model analysis conclusion to some extent. In addition, the research of this paper mainly focuses on the transfer hub outside the station building. What is the relationship between the commerce here and the commerce in the station, and what is the interaction and difference between the two in terms of scale, format, and demand satisfaction objects need to be further studied.

Data Availability
The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of Interest
The authors declare that they have no conflicts of interest.

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