

Research Article

The Sense of Travel Deprivation and Its Impact on Travel Decision: A Case Study of China's Rapidly Urbanizing Region

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Under the guidance of regional policy, many regions in China have recently become urbanized at an unprecedented speed. In these rapidly urbanizing regions, urban transport systems have been constructed and implemented to improve efficiency yet fail to consider transport equity. This article studies the transport equity of residents in China's rapidly urbanizing regions and depicts the impacts on travel behavior by promoting equity in transport policies at this current stage. As an area of rapid urbanization, we chose the Chenggong district, Kunming, which was established as a new urban district in 2011. The data on travel and transport equity were collected by designing and conducting a questionnaire survey in this area. To characterize residents' perceptions of transport equity, we defined and developed a method of measuring their sense of travel deprivation so that transport equity describes both their sense of public and private travel deprivation. We then modeled residents' travel decision-making, which was influenced by their sense of travel deprivation. The results demonstrated that in regions of rapid urbanization, the sense of private travel deprivation was stronger than that of public transport, and private travel deprivation had a negative impact on travel frequency. Meanwhile, no significant correlation was found between the sense of public travel deprivation and travel decision-making. We propose that raising residents' income alone will not effectively relieve their sense of travel deprivation. Our research highlights that policymakers should also carefully consider the sense of travel deprivation among the elderly in this region and the welfare of indigenous people. Expansion of private transport in this region should be conducted proactively in accordance with scientific and rational planning and management rather than through reactively increasing private transport as rapid urbanization continues.

1. Introduction

In recent years, China has raised its level of urbanization at an unprecedented rate, which has attracted worldwide attention [1–3]. In 2000, China's urbanization rate was just 36% and reached 63.89% in 2020, higher than the world average of 55.3%. Rapid urbanization means the expansion of urban space, accumulation of resources, and formation of urban morphology and transportation network, in the short term, which is characterized by massive state-led investment into land (re)developments [4]. Affected by external factors such as policy orientation and social investment, the rural areas around the city have been “in situ transformed” in the

transformation to new urban areas. In the process of rapid urbanization, rural residents do not need to move into urban areas but rather migrate into new urban areas in an orderly manner according to urban development planning. In terms of regional spatial types, rapidly urbanizing regions are no longer rural and differ from older urban areas, thus belonging to a new spatial system.

Policies to control the growth of the automobile fleet while also investing in mass public transport have divided city residents into car users and those dependent on public transport [5]. Due to the special land development mode, rapidly urbanizing regions have a small population density and long travel time, which makes low-income people and

other groups unable to buy and use cars, thus facing severe travel challenges. They rely only on public transport for travel. However, most of the transportation infrastructure in the region is in the development period or in the early stages of development. Public transport has problems such as low network coverage, low frequency of departure, long waiting times, and poor accessibility of the site. The public transport system that this group relies on is often unable to meet the daily travel needs, resulting in the unfair phenomenon of “low allocation-high utilization” of public transport resources. Some people in this group will be forced to give up a special purpose of travel, resulting in social members participating in social activities to choose the right to be weakened or even deprived, increasing the social exclusion of vulnerable groups. However, in this process, car users have more choices of travel modes. The above phenomenon is the impact of rapid urbanization on transport equity in a region.

Transportation is an important public resource, and the essence of public resource allocation should be to ensure a balance among different regions and groups. During rapid urbanization, urban transport planning and construction aim to improve efficiency, enhance mobility, and develop urban functions [6–8]. For example, during the last several years, transportation planning in suburban areas of China has focused on improving automobile traffic flow to decrease travel time [9]. Policymakers and many planners are concerned with how much urbanization contributes to the economic development of the area and to what extent the status of the area has improved in the wider region. Few focus their attention on how transport facility resources may fail to meet residents’ needs in an equal sense due to the policy orientation, resource allocation, and other problems in such areas. Accordingly, the accelerated construction of urban transport unavoidably neglects to uphold equity during the process of rapid urbanization.

In summary, because of the characteristics of the stages in social and economic development, urban residents’ living space differences and stratification phenomena will still exist in the future. Therefore, investigating transport equity and residents’ travel decision-making in rapidly urbanizing regions has certain theoretical significance for balancing the level of basic public services in urban areas and promoting sustainable urban development.

Conceptually, “equity” refers to the fairness of the distribution of resources among populations [10], and the term is widely used in various fields, such as politics, economics, and environmental science. In transportation, equity issues first emerged with the Civil Rights Act of 1964 and were used for transportation resource allocation [11]. Later, some scholars reconceptualized the equitable accessibility distribution mediated by institutional architecture to achieve equality in social opportunities [12].

Recently, the impact of urban transport on social equity has come to be of concern. Researchers have demonstrated that transport equity is related to social exclusion [8]. Accordingly, many scholars have illustrated the transport inequity of specific groups, such as rural residents [13], those with disabilities and of older age [14], and low-income

groups [15], by estimating the mobility and accessibility of transport services for these groups, along with the available infrastructure and other related aspects [16]. Studies also show that inequitable urban transport reduces opportunities for employment, education, and recreation [17], causes social exclusion, and affects the wellbeing of certain groups [18]. With this brought forth, transport equity in social policies has received more attention [19], and many scholars have begun studies on the equity of transport services resulting from transport policy [20] and infrastructure [21].

The transport equity reflected by the transport environment and policies can directly influence residents’ travel decision-making [22]. In previous studies of transport equity, the way in which the equity of the transport environment and related elements affected residents’ travel behavior and decision-making was a critical issue. There are usually several main research paradigms involved in such studies. One is to determine the distribution of residents’ trips based on numerous trip data and mathematical statistics [23, 24] and then submit this for geographical analysis [25]. Another approach is concerned with investigating and describing the correlation or impact mechanism between transport equity factors and travel decision-making behaviors [22]. A further approach is to explore the development and application of a transport equity framework by constructing a new research method [26]. In these paradigms, the variables of transport equity are usually land use, transport infrastructure [21], and residential socioeconomic attributes, including income and family characteristics. The target variables are usually the travel modes, time, purpose, frequency, etc. In addition, traffic emissions and traffic safety are also considered influencing variables [27, 28].

At present, deprivation theory has been well applied in the field of travel research. Based on deprivation theory and accessibility analysis, an evaluation method of public space deprivation was constructed [29]. However, this study only considers the supply of transportation resources. The balance between need and supply is captured by an index of public travel deprivation [30]. The methodology allows identifying (unintended) equity consequences from new transport projects, as it considers not actual travel needs but forecasts. Transport equity is not only related to an objective quantity of resources but also highly linked with an individual’s perception of the transport environment. Of course, some studies use questionnaires to collect actual perceptual data of travelers [31]. The study discovered that due to the differences in traffic resource allocation, residents in different regions of a city have different perceptions of travel deprivation. But their research scale does not focus on a particular area and goes deep into influencing factors.

Transport equity is a complex issue, and the impact of traffic environment fairness on residents’ travel behavior is common. The same measures may help to achieve equity among some groups but a malfunction in others [32]. This article focuses on residents of rapidly urbanizing regions. As mentioned above, the economic situation in their living area is midway between urban and rural regions and similar to that of urban suburbs, but the economic development pattern is quite different. The difference between the

improvement of traffic facilities in this area and the user's perception will cause the travelers to have a sense of travel deprivation. This sense of deprivation is produced by individuals or groups who think that they are in a weak position after social comparison. Therefore, it is necessary to directly describe the residents' perception of transport equity in this region and analyze the impact of perception on travel behavior.

2. Study Framework

Based on the theory of the multidimensional deprivation of social individuals, we modeled and quantitatively described the sense of travel deprivation caused by inequity in China's rapidly urbanizing regions and thus were able to characterize residents' sense of travel deprivation. The structural equation method (SEM) was used to analyze the impact of the sense of travel deprivation on residents' travel behaviors and activity participation. We selected the Chenggong district in Kunming (as shown in Figure 1) as a case of rapid urbanization, and data were gathered from a specially designed questionnaire survey conducted in the area. The conclusions of this article remind policymakers to consider transport equity when urbanization is proceeding at a fast pace; we provide theoretical advice for future transport equity policies and for practice in related areas, and the results can effectively enrich the research field of transport equity.

This article is divided into four parts. The following part describes the research area, data source, and mathematical method. The third part analyzes the statistics and results of the mathematical model. Finally, the fourth part of the article provides a conclusion and further discussion of the topic in question.

3. Data and Methods

3.1. Introduction of the District for Survey. Chenggong New District is located in Kunming City, Yunnan Province, China. It is one of the six main districts of Kunming, a core area of urban construction, and home to the People's Government of Kunming. Large-scale construction began in 2008 in the area, and China's State Council approved an adjustment of the administrative division in 2011. The Kunming Municipal Planning Bureau publicized its controlled planning of the Chenggong New District in 2015, encompassing a total land area of 122.87 square kilometers. The area has now expanded to 461 square kilometers, with a population of 649,500, up from 332,000 in 2015.

Since the construction of the New District, the economy of the area has improved significantly. According to data from the Kunming provincial government portal, the region's GDP in 2020 was 2.8 times that in 2015, and the per capita disposable income of urban and rural residents was 1.4 and 1.5 times those in 2015, respectively.

3.2. Questionnaire Introduction and Descriptive Analysis of the Data. A big data approach has a limited role in pushing forward transport equity research despite the advantages of recording the temporal-spatial details of mobility activities.

A mixed methodology combining qualitative and quantitative is more applicable for unpacking the subtle socio-cultural constraints on daily mobility [12]. Thus, we chose Chenggong district as a representative region of rapid urbanization, and a questionnaire was designed.

Combining the literature and the concerns of this article, our survey mainly includes four parts: basic information, travel behavior, travel perception evaluation, and evaluation of the impact of new urban construction on life, with a total of 30 questions. Among them, the "basic information" mainly collects the residents' age, gender, family circumstances, length of stay in Chenggong district, monthly income, and monthly travel costs. "Travel behavior" collects information such as the frequency, purpose, and mode of transportation of residents going to the main urban area. "Travel perception evaluation" primarily collects the coverage of public transportation around the residence and subjectively evaluates the comfort, convenience, and cost rationality of various transportation modes at five levels. "Evaluation of the impact of new urban construction on life" collects satisfaction with the surrounding traffic environment of the community, changes in travel modes, and evaluation of the degree of improvement of various policies, which are also divided into five levels.

After designing the questionnaire, we conducted a face-to-face survey to ensure the validity, accuracy, and authenticity of the questionnaire. We issued a total of 400 questionnaires, of which 391 were valid, giving a 98% effective rate. The Cronbach's alpha was 0.639, which means that the questionnaire had good reliability. The data used in the mathematical model and statistical analysis were all derived from this survey. The following table provides a basic statistical analysis of the data (Table 1).

3.3. Approach to Measuring the Sense of Travel Deprivation. In the sociological field, deprivation refers to a forced lack of living necessities and may describe a resident's level of poverty [33]. It was applied to this article. Since equity and inequity are in contrast with one another, the sense of travel deprivation also implies a contrast. Deprivation may be linked to a person's inequitable perception of their transport treatment, circumstances, and possession of resources compared to others. In turn, this feeling inevitably affects their travel willingness and decisions and leads to them being unable to participate in activities. We can thus summarize the sense of travel deprivation as manifesting in travel demand inhibition.

We established a method to measure the individual sense of travel deprivation by means of comparison. The model consists of two parts: the deprivation dimension and index system and the measurement of the sense of travel deprivation (Figure 2).

- (1) We separated the sense of travel deprivation into two dimensions—public and private transport—to specifically determine the sense of deprivation relating to each of the two transport systems. The private transport system mainly includes the transport infrastructure and services for private cars, while the

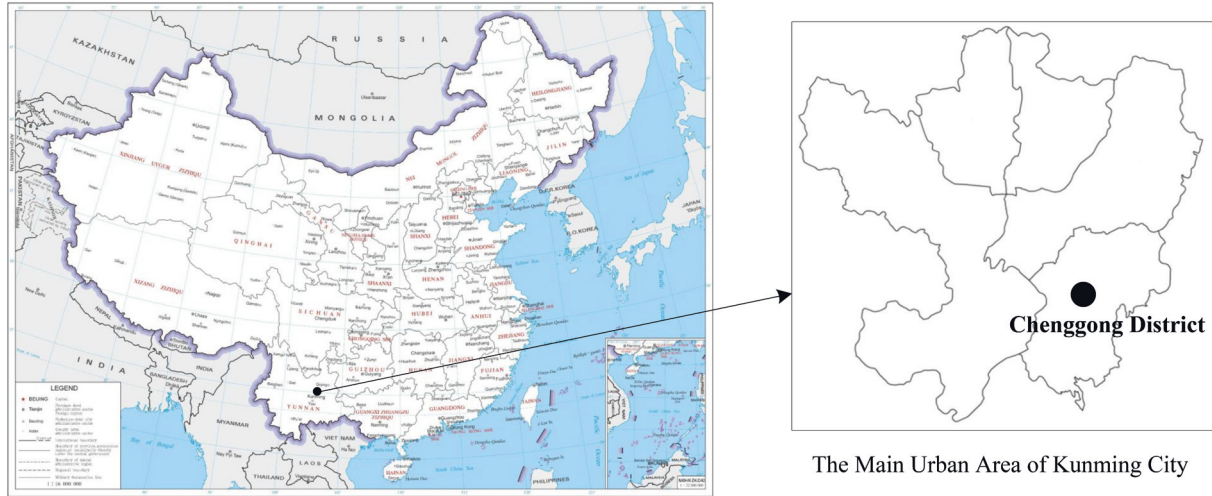


FIGURE 1: Location of Chengong in China.

TABLE 1: Descriptive statistics of the total sample residents.

Variable	Interpretation	Proportion (%)
Year of settling here	Before 2006	28.97
	During 2006–2008	4.36
	During 2008–2011	13.33
	After 2011	53.33
Age	Younger than 20 years old	6.92
	20–40 years old	61.28
	40–60 years old	21.03
	Older than 60 years old	10.77
Gender	Male	57.44
	Female	42.56
Monthly income	Less than 2000 yuan	27.44
	2000–4000 yuan	34.62
	4000–8000 yuan	18.46
	8000–10,000 yuan	8.72
	More than 10,000 yuan	10.77
Family structure	Three generations or even more	17.95
	Two generations	16.15
	Only husband and wife	43.33
	Living alone	22.56
Available transport modes	Marking the available transport modes on a scale of 1–5, according to accessibility and mobility	2.56
		11.54
		37.44
		43.33

public transport system refers to buses and subways. The division is based on the results of the respondents' choice of their main travel mode in the questionnaire. Compared with public transport, private transport usually occupies more transportation resources, so the sense of deprivation of private transportation may be caused by imperfect transportation configurations, such as roads and parking. At the same time, private transport can sometimes separate individuals by social status as wealthier residents tend to purchase more expensive cars; thus, the sense of deprivation of private

transport may also come from the perception of their own social status. The price of public transport is low, so the difference in service and accessibility caused by the allocation of public transport resources is the main reason for the sense of deprivation of public transport.

- (2) A series of studies have found that transport accessibility is sensitive to travel costs, and travel costs have a more significant impact on suburban accessibility [34]. Travel comfort plays a significant role in the choice of transportation mode, which can be defined as the usability of facilities, riding comfort,

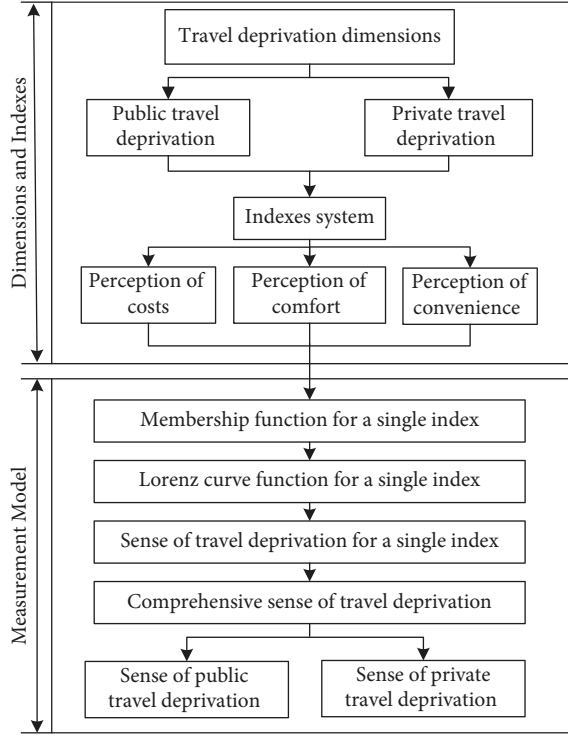


FIGURE 2: Flowchart used to measure the sense of travel deprivation.

ambient conditions, complementary facilities, and ergonomic conditions [35]. Convenience can be seen as a mix of travel distance (including walking distance) and travel time [36]; the convenience of transfer and the convenience of reaching the bus station are also primary factors affecting the travel choices of low-income groups [37]. Therefore, we selected the three evaluation elements of cost, comfort, and convenience that individuals are most likely to perceive when traveling as the basic perception indicators of traffic deprivation. The basic data are derived from the ranking evaluation results of the respondents' travel perceptions in the questionnaire. Finally, a sense of traffic deprivation model is used in the measure.

- (3) We developed a measurement model according to the theory (this theory is developed on the basis of fuzzy set theory) of the multidimensional deprivation of social individuals [38]. The key point of this model is to reasonably choose the membership function. Then, the membership function was constructed to express the travel deprivation status of individuals, and we defined the membership degree as a function $F(x)$ that followed a normal distribution. The maximum membership degree was 1, and the minimum membership was 0. According to the Totally Fuzzy and Relative approach [39], we considered both the proportion of people who are less deprived and the actual value of the index to obtain the individual membership function:

$$\mu_{ij} = (1 - F_{ij})^\alpha = \left(\frac{\sum_k \omega_{kj} |x_{kj} > x_{ij}}{\sum_k \omega_{kj} |x_{kj} > x_{1j}} \right)^\alpha, \quad (1)$$

where ω_{kj} is the sample weight of individual k on dimension j , x_{kj} is the index value of individual k on dimension j . $(\omega_{kj} |x_{kj} > x_{ij})$ is a conditional symbol indicating the value of ω_{kj} under the condition of $x_{kj} > x_{ij}$, and $(\omega_{kj} |x_{kj} > x_{1j})$ indicates the value of ω_{kj} under the condition of $x_{kj} > x_{1j}$. F_{ij} is the distribution function of a certain index, which can show individual positions in the group. $1 - F_{ij}$ represents the share of residents who are in a better position than the object. Parameter α can correct the proportion in the population. The weight of vulnerable individuals can be promoted by increasing the value of α ; thus, the sensitivity of the distribution of vulnerable individuals is improved.

The Lorenz curve function was introduced to acquire the position of individual travel deprivation in the Lorenz curve, which shows the inequitable distribution of an index in the population. In this article, we use the Lorenz cumulative percentage to reflect the travel deprivation distribution in the population. Formally, we define Fuzzy Indicator (FI) as

$$\mu_{ij} = FI_{ij} = (1 - L_{ij})^\alpha = \frac{\sum_k \omega_{kj} x_{kj} |x_{kj} > x_{ij}^\alpha}{\sum_k \omega_{kj} x_{kj} |x_{kj} > x_{1j}}, \quad (2)$$

where L_{ij} is an individual position on the Lorenz curve and $1 - L_{ij}$ is the share of the residents who are in better positions. $1 - L_{ij}$ is more sensitive than the normal distribution function $1 - F_{ij}$.

We introduced the Integrated Fuzzy and Relative theory [39] to integrate the above equations. To facilitate calculation, we set $\alpha = 1$. Then, the individual sense of travel deprivation on an index can be obtained based on equation (3). Formally,

$$\begin{aligned} \mu_{ij} &= (1 - F_{ij}) \cdot (1 - L_{ij}) \\ &= \left(\frac{\sum_k \omega_{kj} |x_{kj} > x_{ij}}{\sum_k \omega_{kj} |x_{kj} > x_{1j}} \right) = \left(\frac{\sum_k \omega_{kj} x_{kj} |x_{kj} > x_{ij}}{\sum_k \omega_{kj} x_{kj} |x_{kj} > x_{1j}} \right). \end{aligned} \quad (3)$$

Finally, we attained the individual sense of travel deprivation on a dimension by weighted averaging of the results of all indices.

$$\mu_i = \left(\frac{\sum_j \lambda_j \mu_{ij}^\beta}{\sum_j \lambda_j} \right)^{\frac{1}{\beta}}. \quad (4)$$

The parameter β can change the type of index average. When $\beta = 1$, the result is an arithmetic mean. The weight parameter λ reflects the sample redundancy and the degree of deviation. Sets λ^a and λ^b represent the sample redundancy and degree of deviation, respectively, so $\lambda = \frac{a}{\lambda} \cdot \frac{b}{\lambda}$.

$$\lambda_j^a = \left(\frac{1}{1 + \sum_{j'=1}^{m-1} \rho_{j,j'} | \rho_{j,j'} < \rho_T} \right) \cdot \left(\frac{1}{\sum_{j'=1}^{m-1} \rho_{j,j'} | \rho_{j,j'} \geq \rho_T} \right)$$

$$\lambda_j^b = \frac{\sum_{i=1}^n P_i \ln(P_i)}{\ln n}$$

$$= -\frac{1}{\ln n} \sum_{i=1}^n \frac{x_{ij}}{\sum_{i=1}^n x_{ij}} \ln \left(\frac{x_{ij}}{\sum_{i=1}^n x_{ij}} \right).$$
(5)

3.4. SEM of Travel Decision-Making. In the process of rapid urbanization, the urban center district is still the main area to agglomerate urban resources. The separation of jobs and residences is often unavoidable in rapidly urbanizing regions, so the activities of residents in rapidly urbanizing regions continue to depend on the urban center district. With this understanding, travel toward the urban center district gradually becomes a typical travel activity, which reveals the significance of realistic planning considering the sense of travel deprivation. For that reason, we chose this travel process as the main research object.

A structural equation model is a favorable approach to establishing a travel decision-making model for residents affected by multiple factors in rapidly urbanizing regions. It is a metrological model containing a set of independent variables and one or more dependent variables, explaining the causal relationship between multiple variables. In the model, the sense of travel deprivation is affected by individual social attributes, the transport location (quality of developing transportation in rapidly urbanizing regions by geographical factors), travel capacity (conditions and levels of travel activities for residents in rapidly urbanizing regions), and travel environment (the most direct spatial carrier related to the rapidly urbanizing region residents, including the urban environment, living environment, public space). Thus, the social attributes of an individual can be understood to determine their perceived individual status in social relations. Travel is regarded as a derivative demand based on social relationships; therefore, individual attributes play an important role in the process of travel decision-making and the sense-forming of travel deprivation. On this basis, as mentioned earlier, we built a conceptual model of travel decision-making for residents living in rapidly urbanizing regions and traveling toward an urban center district (Figure 3).

4. Results

4.1. Measurement Results of the Sense of Travel Deprivation. We distinguished the respondents' sense of travel deprivation based on the method of measurement and quantity of available data and determined the mean and standard deviation values of the sense of travel deprivation in different groups to reveal fine distinctions (Table 2).

It can be seen from the results in Table 2 that in rapidly urbanizing regions, the overall sense of private travel

deprivation of residents is higher than that of public transport, and the divergence of private travel deprivation is larger than that of public transport. According to the results, the development of private versus public transport is perceived to be unbalanced in the area. When constructing a new district such as this one, improvement of the public transport system is usually relatively slow, resulting in a significant advantage to private transport. Furthermore, inequitable allocation of private transport resources is perceived to have led to increased deprivation in the new district.

Elderly residents have an intense sense of public travel deprivation. As shown in the results, with increasing age, the sense of public travel deprivation gradually increases, indicating that public transport services for the elderly are not perfect in alleviating their deprivation. On the one hand, the limited physical condition of the elderly reduces their ability to navigate the public transport system and participate smoothly in activities, meaning they might be more prone to be socially isolated. However, for the most part, elderly residents have lived in the area over the long term, which intimates to some extent that the construction in the new district has failed to improve the original residents' satisfaction with available transport options.

Males' sense of travel deprivation is slightly higher than that of females, and males' sense of deprivation is more obvious for private travel than for public transport. Transportation is important both in going to and from work and in maintaining interpersonal relationships. Correspondingly, females' sense of public travel deprivation is relatively strong.

The residents with a strong ability to choose from varied modes of transport have only a slight sense of public travel deprivation. The ability to choose from a variety of transport modes means a high level of mobility; residents who enjoy this are usually private car users. We can interpret that the trend of a person's mobility level is opposite to their sense of public travel deprivation, which means that those who travel by private car usually have only a weak sense of public travel deprivation. We can further infer that the improvement of residents' mobility will help eliminate their sense of public travel deprivation.

4.2. Impacts of the Sense of Travel Deprivation on Travel Decision-Making Using SEM. A typical structural equation model can identify the relationships between observed and potential variables and among potential variables. Moreover, the model has many derivation and deformation applications for a multicausal relationship. The path model we used is part of the structural equation model family. The non-weighted least squares method was chosen to estimate the model parameters in IBM's AMOS software. With our research objective in mind, we adjusted the path of the model continuously until the optimal model was obtained, with the goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), comparative fit index (CFI), and root mean square error of approximation (RMSEA) being 0.981, 0.960, 0.962, and 0.033, respectively.

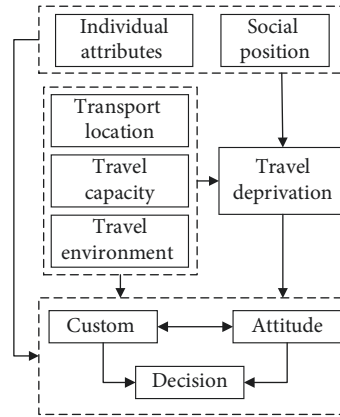


FIGURE 3: Conceptual model of travel decision-making of residents traveling to the urban center from the rapidly urbanizing regions.

TABLE 2: Results of measurement of the sense of travel deprivation.

Variable	Interpretation	Sense of public travel deprivation		Sense of private travel deprivation	
		Mean	Standard deviation	Mean	Standard deviation
Year of settling here	Before 2006	214.9	172.2	204.5	190.1
	During 2006–2008	200.7	150.1	222.2	174.4
	During 2008–2011	192.7	148.5	240.5	206.1
	After 2011	195.0	166.3	208.5	176.1
Age	Younger than 20 years old	180.2	155.7	192.4	181.9
	20–40 years old	180.3	156.4	215.1	186.0
	40–60 years old	241.5	186.5	221.3	182.6
	Older than 60	250.5	151.3	191.1	181.0
Gender	Male	204.7	177.1	218.9	190.6
	Female	195.4	147.9	203.2	176.1
Monthly income	Less than 2000 yuan	211.3	159.3	152.1	167.3
	2000–4000 yuan	206.1	222.4	177.6	184.4
	4000–8000 yuan	175.4	236.2	146.6	166.2
	8000–10,000 yuan	161.3	236.7	153.0	203.6
	More than 10,000 yuan	232.0	253.2	184.6	211.7
Family structure	Three generations or more	154.5	159.6	208.4	185.7
	Two generations	243.6	170.0	221.1	196.5
	Only husband and wife	210.6	171.0	218.0	180.7
	Living alone	187.8	144.0	197.8	182.0
Available transport modes	Score of 1	236.1	156.4	116.5	126.5
	Score of 2	204.3	193.9	214.3	197.3
	Score of 3	204.5	163.8	179.9	162.8
	Score of 4	188.0	142.6	316.8	184.4
	Score of 5	196.0	161.0	232.9	193.3
Overall		200.7	165.4	212.2	184.8

In the following table, trip chain pattern is a combination of modes of transportation needed to complete a trip, such as using buses after standing out from the subway. Companion is the companion of the survey object when completing travel activities. Both indicators are available from the second part of the questionnaire. β is the coefficient of the result, t is the value of the T -test, and - means the result is unavailable (Table 3). We can see that income, age, and transport fares significantly impact the sense of travel deprivation, while the sense of travel deprivation clearly affects travel decision-making.

4.2.1. *The Sense of Travel Deprivation and Travel Decision-Making.* The sense of private travel deprivation had a negative impact on travel frequency. A sense of deprivation caused by private transport accessibility, services, costs, and other factors affected the travel frequency, while a high satisfaction with car usage strengthened residents' contact with the urban center district. Meanwhile, the results showed that a sense of public travel deprivation had no significant impact on travel decision-making. We understand the result in this way: traveling by public transport is a relatively rigid demand, so even if someone

TABLE 3: Impacts of the sense of travel deprivation on travel decision-making.

		Sense of public travel deprivation	Sense of private travel deprivation	Travel frequency	Purpose of travel	Trip chain pattern	Companion
Income	β	—	0.155	-0.203	—	0.104	—
	t	—	3.103	-3.899	—	1.910	—
Age	β	0.156	—	—	0.116	—	—
	t	3.477	—	—	2.295	—	—
Transport fare	β	-0.161	—	-0.219	—	0.134	0.160
	t	-3.566	—	-4.261	—	2.458	3.197
Family structure	β	—	—	—	—	-0.092	—
	t	—	—	—	—	-1.860	—
Sense of public travel deprivation	β	—	—	—	—	-0.079	—
	t	—	—	—	—	-1.587	—
Sense of private travel deprivation	β	0.418	—	-0.095	—	—	—
	t	9.285	—	-2.009	—	—	—

has a strong sense of deprivation, their travel decisions cannot change.

4.2.2. Individual Attributes and the Sense of Travel Deprivation. Similar to the previous conclusions, the impact of a person's income on their private travel deprivation was found to be remarkable, and the individual's age also strongly affected their sense of public travel deprivation. We have highlighted that private transport use can become a symbol of social status to a certain extent in the context of economic constraints. Therefore, the impact of a person's income on their sense of private travel deprivation is essentially a reflection of their levels of social status deprivation. Meanwhile, we can further understand the relationship between the deprivation of public transportation and age as follows: travel costs less on public transport, while comfort, speed, and other service attributes become more important factors for residents in their travel demands when they are traveling without economic constraints. Thus, age proves to be a significant factor affecting the sense of public travel deprivation since the perception of public transport service varies greatly across different age groups.

4.2.3. Income Increase and the Sense of Travel Deprivation. The model results also infer that raising someone's income alone will not lessen their sense of travel deprivation. In contrast, income has a positive relationship with private travel deprivation and an indirect positive relationship with public travel deprivation. That is, with increasing income, the individual's sense of travel deprivation also gradually increases. Thus, while raising a person's income is one of the acknowledged ways to eliminate their sense of social deprivation, this result shows that their sense of travel deprivation will still increase in such a situation. What we can infer from this is that in the process of rapid urbanization, the improvement rate of transport facilities in the new district lags behind the improvement of the living standard of residents, which leaves them feeling they are unable to access travel services matching their income level. In addition, the higher the income, the higher the demand for travel services, which

presents a further reason why raising a person's income will not effectively alleviate their sense of travel deprivation.

4.2.4. Family Structure, Transport Fares, and Travel Decision-Making. Transport fares can restrict travel activities, and in relation to this, the family structure was found to be slightly related to the trip chain pattern. The model results showed that the number of activity companions was significantly associated with the transport fare, meaning the more companions that travel, the more money is spent. In this way, the family structure, in our model, was linked with having a possible impact on trip chain patterns.

4.3. Inspirations of Measurement Results. Our research highlights that the public transport environment for elderly people needs improvement. Policymakers should carefully consider the circumstances of the elderly with regard to travel deprivation and the welfare of indigenous residents. Our results also show that the sense of public travel deprivation has no significant effect on residents' travel decision-making. We understand this as a reflection of how travel by public transport is relatively rigid based on the need for residents to travel. Thus, even if there is a strong sense of public travel deprivation, travel plans will not change. However, on a more specific level, the sense of private travel deprivation can affect residents' travel decisions. We revealed that an increase in income alone cannot effectively alleviate this sense of deprivation because the higher the income is, the more a person requires transportation services. Therefore, possible ways of expanding private transport include conducting rational, scientific planning and management in this area instead of increasing the amount of private transport reactively during the process of construction.

At the same time, we believe that transport equity should be included in the transportation planning and evaluation of transportation projects in rapidly urbanizing regions, and the "baseline equality" of residents' public transport in rapidly urbanizing regions should be guaranteed. However, the "baseline equality" is not to determine the standard line with high or low fairness but to emphasize the baseline of government responsibility. A baseline should be set between

differentiated and nondifferentiated protection of residents' public transport travel demand.

5. Conclusion and Discussion

Our research was conducted based on China's rapid urbanization. In rapidly urbanizing regions, urban transport systems are quickly developed under the guidance of policies, and residents experience rapid urbanization. Nevertheless, few scholars have thus far paid attention to transport equity in these regions. In this article, we measured the sense of public and private travel deprivation in a rapidly urbanizing region by taking the Chenggong New District of Kunming, China, as a representative example. The impact of the sense of travel deprivation on travel decision-making was thoroughly analyzed using a structural equation method.

By surveying residents living in a rapidly urbanizing region, this research on the sense of travel deprivation found that residents' sense of private travel deprivation is stronger than that of public transport, males' sense of travel deprivation is slightly stronger than that of females, and the sense of public travel deprivation is remarkable for the elderly. Considering individual attributes, we also found a significant impact of a person's income on their sense of private travel deprivation, while age was another important factor affecting perceived public travel deprivation. Moreover, our travel behavior model of residents in rapidly urbanizing regions traveling to the urban center showed that transport fares can restrict trips made with activity companions and that people with more options for transport modes have less sense of public travel deprivation than others.

In addition, we concede that we are lacking in the selection of some other indicators in the method of measuring the sense of travel deprivation. For example, only the residents' perception of monetary cost is considered, but travel costs often include time costs. As such, the article should be seen more as an exploration of the travel deprivation approach and its relevance for policymakers who are interested in the development of interventions. Future research directions include the contrast of the speed of urban expansion with that of the improvement of transport facilities and services, the impact of urban planning policies on residents' travel habits in the transition process, and the identification of transport-disadvantaged groups and families, all of which require attention and research as China's urbanization continues. These studies can further depict the impact of urban expansion policy on transport equity.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare no conflicts of interest.

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