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An FFPT-induced Modal Shift in a Large Tourist Destination in China: Multimodality and Transport Equity Implications

Abstract

The idea of the modal shift has been central to transport policymaking in the past few decades. Fare-free public transport (FFPT) schemes are among the potential policy instruments that are expected to promote modal shifts. After the peak of the COVID-19 outbreak, FFPT schemes have been implemented in large tourist destination areas in China to attract visitors. However, although FFPT has been practiced across the globe, its effect on travel modal shifts and transport equity is still under scrutiny.

This paper, therefore, employs the notion of multimodality and indices for perceived accessibility and equity to investigate whether an FFPT scheme in tourist destination areas encourages a modal shift and promotes transport equity. A two-wave survey was conducted before and after the restoration of within-destination tourist bus tickets in the Mount Yandang Scenic Area, a famous tourist attraction in the Yangtze River delta. Propensity score matching (PSM) was then employed to analyse the treatment effect of the FFPT scheme. Our results indicate that, although the FFPT scheme significantly increased tourists' multimodality, the modal share of within-destination tourist buses was not significantly changed. More surprisingly, we found a modal shift from car-based services such as taxis to informal transportation provided by B&B operators and local residents. Moreover, it is notable that informal transport modes significantly influenced tourists' perceived accessibility and transport equity. Therefore, the tourism industry should encourage the integration of within-destination buses and informal transport modes to encourage multimodal travel, which is more sustainable ecologically and socially.

Keywords: modal shift, FFPT, multimodality, transport equity, informal transport, PSM

1. Introduction

Recent research has put the spotlight on modal shifts in the context of excessively increasing mobility and car dependency in the past few decades. Scholars have sought to understand determinants of modal shifts between cars and more sustainable travel modes (for a review, see Abrahamse et al., 2009; Andersson et al., 2018; Currie & Wallis, 2008; Javaid et al., 2020; Kim et al., 2018; see also Nguyen-Phuoc et al., 2018) and policy interventions that encourage modal shifts (for a review, see Emberger, 2017; Scheepers et al., 2014). Fare-free public transport (FFPT) schemes are among the potential policy instruments that are expected to promote modal shifts. However, the FFPT itself is still under intensive debate: from the utilitarian perspective, such schemes have been widely criticised for their harm to public transport networks, potential to generate unnecessary travel, and questionable likelihood of stimulating a modal shift towards sustainability (e.g., Cervero, 1990; Dai et al., 2021; Kębłowski & Bassens, 2018; Storchmann, 2003), whilst researchers in political and urban studies praised FFPT as an impetus for social change (e.g., Brown et al., 2003; Rambaldini-Gooding et al., 2021). In contrast to the significant attention devoted to the impact of public transport fare changes (mostly fare increases; see e.g., Ma et al., 2017; Miller & Savage, 2017; Zhao & Zhang, 2019), the impact of the abolition of public transport fare on mobility patterns and other social issues such as equity remains largely unexplored, although public transport fares have been abolished in almost one hundred cities globally (Kębłowski, 2020).

At the city level, most researchers focused on shifts in residents' travel modes (e.g., Ebrahimi & Bridgelall, 2021; Idris et al., 2015; Maggi & Vallino, 2021; Wang et al., 2020), but few have discussed the travel mode choices or potential modal shifts towards sustainability of visiting tourists who also influence the urban transport network. Tourists' travel mode choices may differ from the majority of residents' in three respects: (a) tourists may arrive at the destination with a travel plan for the whole journey, having already chosen travel modes without acknowledging the full set of transport alternatives in the destination area; (b) tourists' travel mostly consists of leisure trips; and (c) tourists' travel mode choices may be less influenced by their habits (see also Anderson et al., 2006). Tourists make up a crucial percentage of users of the transport system in many cities, especially the tourist cities (e.g., Le-Klaehn & Hall, 2015; Łapko, 2014). Analysing tourists' modal shifts can also further our understanding of these travellers, who have received much less academic attention in the conventional literature on travel mode choice. Therefore, exploring the impact of policy interventions such as FFPT on tourists' modal shifts can not only develop our understanding of strategies for sustainable transport development in tourist destinations, but also shed new insights into the potential of modal shifts for trips in the tourist cities.

Multimodality refers to "the (flexible) use of various modes of transport within a certain time period" (Molin et al., 2016). Given that passenger cars are the major travel mode in the Global North and increasingly in the Global South, multimodal travel behaviour increases the likelihood that people will choose different travel modes and use sustainable transport options such as public transport, active travel modes, and shared mobility services (e.g., Diana & Mokhtarian, 2009; Tsirimpa et al., 2019). Although the variability of travel behaviour among individuals has historically been overlooked, a growing body of literature on multimodality has emerged (e.g., An et al., 2021; Diana & Mokhtarian, 2009; Heinen & Mattioli, 2019a; Klinger, 2017; McLaren, 2016; Mulley & Moutou, 2015; Olvera et al., 2015; Scheiner et al., 2016). Furthermore, whilst researchers have explored the relationship between multimodality and ecological sustainability (e.g., Heinen & Mattioli, 2019b), in the potential of increased multimodality to promote transport-related social inclusivity requires further study.

Although the conceptualisation of transport equity in the Chinese context is still under debate, in this paper, we use a working definition of transport equity established by Liu et al. (2019, 2021a, 2022a),

that is, a perception of receiving absolutely equal benefits from the transport system among people in the same (anticipated) social stratification. In this case, an equitable transport means that people from the same social stratification should experience the same level of transport service within the scenic area, whilst it is acceptable that people from other social stratifications experience a different level of transport service.

To bridge these gaps, we employ the concept of multimodality to better understand the potential of an FFPT scheme to cause a modal shift and to improve transport-related social equity in the context of a large tourist destination area.

The Mount Yandang Scenic Area (see Figure 1) was selected as the studied case. The scenic area is a specific part of the North Yandang Mountains, which are located in south-eastern Zhejiang Province, covering Pingyang, Ruian, Yongjia, and Yueqing counties in Wenzhou City. It is among the nation's first-tier scenic areas and is renowned for its natural landscape of "the most representative ancient caldera of the huge volcanic belt of [the] Asian continental margin in [the] west Pacific," which provide a record of the geological evolution process, as well as for various cultural heritage attractions dating back to the Song Dynasty[1] (UNESCO, 2001). Although it is one of the most celebrated destinations for vacations in the Yangtze River Delta, its tourism industry has been severely affected by the ongoing Covid-19 outbreak (see also Higgins-Desbiolles, 2020; Lapointe, 2020). To cope with the free-fall decline of public transport use (see Dai et al., 2021; Das et al., 2021) and the scenic area's slow recovery of its appeal to tourists, a FFPT-type policy called a free within-destination tourist bus scheme has been implemented since 1st July 2020. The scheme was initially scheduled to conclude by the end of 2020 but was later extended to 30th April 2021. This scheme abolished fares for tour bus service (40 CNY/day) connecting all major and minor scenic zones within the scenic area. According to Kębłowski's (2020) categorisation, this scheme is a temporary, spatially limited FFPT scheme that serves as a pseudo-natural experiment that offers us a valuable opportunity to evaluate the efficacy of an FFPT scheme in terms of its causal relationship with modal shifts and transport-related social equity.

In conducting such an evaluation, this paper contributes to the literature in the following respects: (a) contextually, as it examines FFPT and multimodality in a tourist setting, which have not yet been sufficiently explored in the literature; (b) theoretically, as it enriches our understanding of the impact of FFPT on mobility patterns and transport equity; (c) methodologically, as this study is based on a pseudo-natural experiment and PSM that minimise the self-selection bias by addressing the problem of unknown unobserved confounders; and (d) practically, as it offers policy implications and practical recommendations that will enable policymakers and tourism industry operators to develop more competitive and inclusive multimodal transport and support progress towards sustainability in the tourism sector and beyond.

This study will begin with a literature review on travel multimodality and the equity implications of changes to public transport fares. In the next section, the propensity score matching (PSM) methodology and the variables used in this study will be introduced. Analysis results will be presented and discussed in section 4, and the conclusions and extensions will summarise the study's main research findings and discuss limitations and future research directions.

2. Literature Review

As the free within-destination tourist bus scheme is anticipated to have effects on both modal shifts towards more sustainable travel modes and transport equity, the literature review consists of two parts: multimodality as the indicator for modal shifts, and the equity effects of public transport fare changes.

[1] The Song Dynasty is a Chinese imperial dynasty (960 AD–1279 AD), famous for its economic superiority, its vibrant social life, and a flourishing of technology, science, philosophy, and engineering unmatched in Ancient China.

Although most of the studies on the equity implications of public transport fare changes focus on the effects of increasing the fare (e.g., Ma et al., 2017; Miller & Savage, 2017; Zhao & Zhang, 2019), they are included in this review because the equity effects of fare-free schemes have received limited attention.

2.1 Multimodality

Multimodality, a new concept that describes the variability of individuals' travel behaviour, has increasingly emerged as a promising indicator for potential progress toward sustainability in the transport sector (e.g., Heinen, 2018; Hunecke et al., 2020; Klinger, 2017; Nobis, 2007). This is because multimodal travellers are more willing to shift travel modes (e.g., de Kruijf et al., 2018; Heinen & Ogilvie, 2016; Kroesen, 2014), although Heinen & Mattioli (2019) have argued that a high level of multimodality may not translate into less individual car use.

The limited but growing literature about multimodality mainly focuses on four issues: (a) sketching the trends of multimodal travel and multimodal behaviour for different population groups (e.g., An et al., 2021; Blumenberg & Pierce, 2014; Buehler & Hamre, 2016; Kroesen & van Cranenburgh, 2016; Lee et al., 2020; Molin et al., 2016; Rietveld, 2000; Schuppan et al., 2014; Uteng et al., 2019); discussing the measurement of multimodality (e.g., Diana & Pirra, 2016; Heinen & Chatterjee, 2015; Susilo & Axhausen, 2014); (c) exploring the theoretical basis of multimodality (e.g., Chorus et al., 2007; Clauss & Döppe, 2016; Heinen, 2018; Heinen & Mattioli, 2019b); and (d) evaluating the nexus between multimodality and ecological sustainability outcomes (e.g., Heinen & Mattioli, 2019).

In their investigation of these issues, researchers have emphasised that multimodality is a behavioural phenomenon. For example, evidence indicated that travellers have been increasingly multimodal in the Global North (e.g., Kuhnimhof et al., 2012; Buehler & Hamre, 2016). Multimodal behaviour varies across population groups both socio-demographically and spatially—young people, women, high-income people, residents in urban areas, and those who are incapable of using cars have been found more likely to be multimodal travellers (e.g., Diana & Mokhtarian, 2009; Mehdizadeh & Ermagun, 2020; Scheiner et al., 2016). An et al. (2021) revealed a cohort effect on multimodality: due to the early life experience of baby boomers, they have the lowest level of multimodality.

It worth noting that all of the aforementioned studies are based on areas in the Global North, where the driving culture developed in the post-war era. In recent decades, car dependency has declined in this part of the world, whereas people in other parts of the world have started getting used to individual car ownership much more recently. Thus, multimodal behaviour and factors influencing multimodal behaviour in other societies may deviate from existing empirical evidence. However, to the best of our knowledge, multimodality in emerging economies remains underexplored. More importantly, previous empirical findings, while interesting in themselves, cannot shape the development of sustainable transport policy without a further exploration of the mechanisms that encourage multimodal travel.

2.2 Equity Implications of Public Transport Fare Change

Although the theorisation of transport-related social equity has been historically neglected by both researchers in social justice and transport researchers (Martens & Lucas, 2018), it has been an increasing focus in the transport domain. Drawing on the debate about social exclusion, forerunners in conceptualising transport-related social equity viewed transport as a prerequisite for people to access a variety of opportunities, and it is therefore essential to social inclusion (e.g., Farrington, 2007; Lucas, 2006, 2012). More recently, transport researchers started to apply philosophies of social justice to challenge the conventional utilitarian underpinning of transport policy and practice more directly. For example, several

researchers referred to Rawlsian theory (e.g., Pereira et al., 2017; van Wee & Geurs, 2011), arguing that transport services should be delivered in a way that enables people to "pursue a wide range of life plans" (Martens, 2016, p. 82). Those who applied Sen and Nussbaum's capability approach argued that the relevance of transport to social equity should be concerned not only with achievements, but also with freedom to achieve (see Beyazit, 2011; Hananel & Berechman, 2016). To date, most of the theoretical debates have been based on ethics in Euro-American liberal philosophy (Verlinghieri & Schwanen, 2020). Given the institutional and cultural differences, it is highly questionable whether these conceptualisations may make the same sense outside the Anglophone world. However, paralleled with Chinese researchers' increasing contributions to the empirical evidence base on transport inequalities and inequities by using Western-based theorisations, few have looked at the conceptualisation of transport equity in the Chinese context (for early theorising attempts, see Liu et al., 2019, 2021a, 2022a).

Previous studies on the equity implications of public transport fare changes targeted two main dimensions of transport equity: (a) affordability, or whether disadvantaged populations are able to pay for the transport (e.g., Falavigna & Hernandez, 2016; Serebrisky et al., 2009; Wang et al., 2020; Zhao & Yang, 2019), and (b) accessibility, or the extent to which the transport enables users to participate in desired activities (e.g., Bocarejo & Urrego, 2020; Guzman & Oviedo, 2018; Hananel & Berechman, 2016). As aforementioned, although some previous studies considered the equity effects of pro-poor public transport fare structure changes through subsidies (see Guzman & Oviedo, 2018; Venter et al., 2018), the equity implications of the abolition of public transport fares have received little attention.

Among the small number of researchers who have investigated the equity implications of FFPT schemes, abolishing public transport fares is regarded as a socially beneficial measure that will increase public transport accessibility, alleviating transport equity issues such as transport poverty and transport-related social exclusion (Larrabure, 2016). However, little evidence has arisen to support this optimistic account. Whilst Cats et al. (2017) found that the introduction of an FFPT scheme in Tallinn increased both access to job opportunities and public transport for shopping and leisure purposes for disadvantaged populations (for the effect of increasing job opportunity, see also Bull et al., 2021; and Franklin, 2018), other dimensions of transport equity have yet to be discussed.

Such one-dimensional accounts of FFPT and related measures are problematic because, as we found in our previous study (Liu et al., 2021b), the equity impacts of fare-free public transport services can be quite complex and difficult to trace through simple, objectively measured indicators such as accumulated travel distance by public transport. Elderly people, who are exempted from public transport fares, experienced most excruciating transport-related social exclusion during the early phase of the Covid-19 pandemic because younger populations perceived that they excessively used public transport for frivolous travel. It has been argued that transport-related social equity is a subjective evaluation of existing inequalities, but that these can be quite different from objective inequalities (Liu et al., 2019, 2021a, 2021b, 2022a). Therefore, in this study, we measure transport equity by perceived accessibility (see Lättman et al., 2016, 2018, 2020) and individuals' assessments of their own perceptions and experience of their travel compared to their own anticipated "average."

3. Method and Data

3.1 Propensity Score Matching

The evaluation studies presented in this paper were designed to estimate the effects of the free within-destination tourist bus scheme. The randomised trial is generally held to be the most scientifically rigorous research design because subjects in the treatment and control groups are randomly assigned, which

minimises systematic bias (see Glasziou et al., 2007). However, such experimental approaches require close monitoring and are difficult to conduct in practice, especially in the social sciences. Therefore, a number of quasi-experimental evaluations have been carried out to assess programme effects (e.g., Hoang-Tung et al., 2021; Reinhard et al., 2018: Song et al., 2017). PSM has achieved popularity as a useful analytical technique for quasi-experimental studies in the past few decades (e.g., Ding et al., 2021; Tørnblad et al., 2014; Tyndall, 2018) due to its advantage of replacing high-dimensional matches that significantly increase the chances of unmatched participants with single index matches (Rosenbaum & Rubin, 1983).

Suppose there are two groups of tourists *P*=1/0, where 1/0 indicates tourists who did/did not visit the Mount Yandang Scenic Area when the within-destination tourist bus service was free to use. Y_i^1 and Y_i^0 are the potential outcomes conditional on the counterfactual situations of treatment (with free within-destination tourist bus service) and control (without free within-destination tourist bus service). To answer the question "To what extent did tourists benefit from the free within-destination tourist bus scheme compared to those who visited the scenic area without free within-destination buses?" the average effect of treatment on the treated (ATT) was estimated as:

$$ATT = E[Y_i^1 | P_i = 1] - E\left[Y_i^0 | P_i = 1\right]$$

3.2 Data and Variables

Our data were collected from tourists of the Mount Yandang Scenic Area (shown in Figure 1) in 2021. The within-destination tourist bus service normally connects the three main destinations in the scenic area (the spiritual peaks, the spiritual rocks, and the big dragon waterfall scenic zone) but may also go to smaller destinations occasionally. Hard copies of the questionnaire were randomly distributed at the entrances of the aforementioned three most popular tourist destinations, resting areas inside all parks, and restaurants and B&Bs within the scenic area. The first round of data collection took place from 17th to 30th April, before the cancellation of the free within-destination tourist bus scheme. A total of 536 valid respondents comprised the treatment group. Although the programme was called off on 1st May, the second round of data collection did not start until 15th May because of the five-day International Workers' Day national holiday and the subsequent make-up days, which may have significantly changed tourist behaviour. After two weeks of data collection, a sample of 791 tourists who completed the survey was obtained.

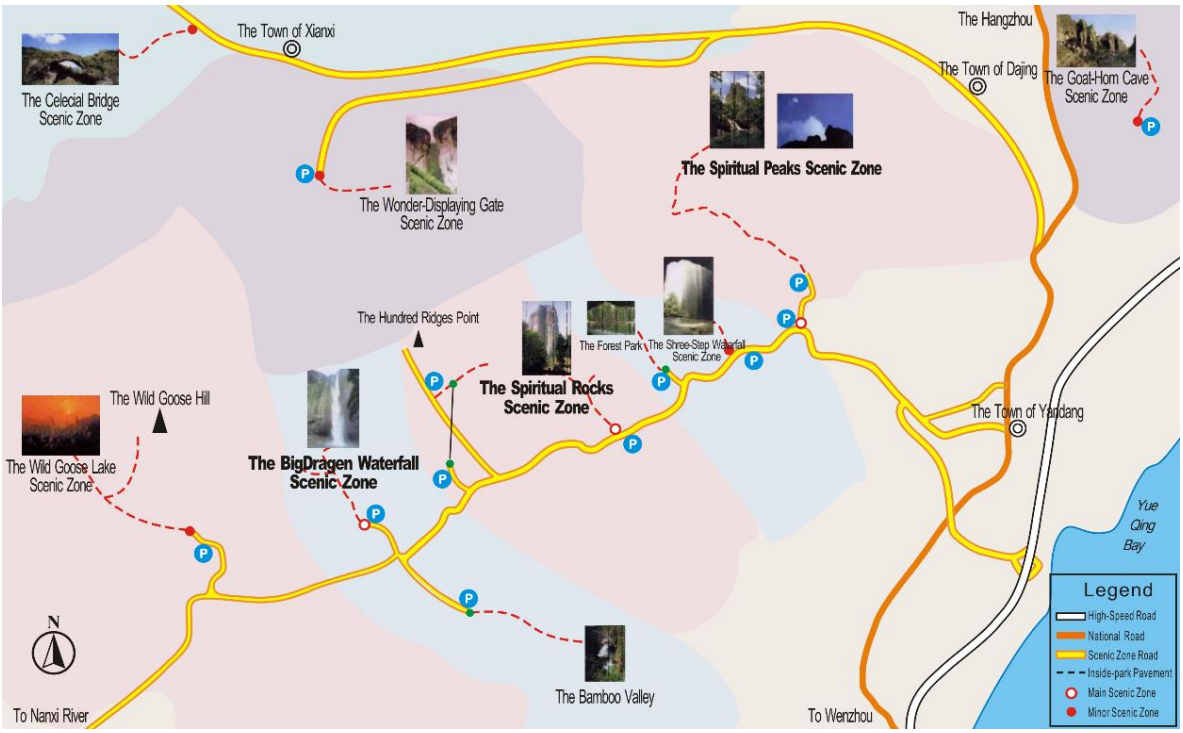

Figure 1. The Mount Yandang Scenic Area

Confounders in this study are the basic characteristics of respondents listed in Table 1, including socio-demographics and travel habit variables. The treatment indicator is the abolition of the free within-destination tourist bus scheme. The dummy variable is set equal to one for those who visited the Mount Yandang Scenic Area during the free within-destination tourist bus period, whilst for data collected after 15th May, the dummy variable is set to zero.

Table 1. Confounders and descriptions

Confounder	Description
Age	Age in years
Gender	Gender: male (1) or female (0)
Household disposable income	Household disposable income measures the income of the respondent's household considering net interest, dividends, and mandatory charges.
Occupation	Four categories: employed (including self-employed), unemployed, retired, and student
Car ownership	Household car ownership: number of cars owned by the respondent's household
Car use habit	Number of days the respondent uses car in a normal week
Public transport use habit	Number of days the respondent uses public transport in a normal week

Outcome variables consist of two groups: multimodality variables and travel preferences and attitudes. In this study, multimodality was measured by three variables: (a) a multimodality index OM_PI (Diana & Mokhtarian, 2009), (b) the percentage of within-destination tourist bus trips within one day, and (c) the percentage of trips via informal transit modes within one day. The multimodality index OM_PI was selected from various widely used multimodality indicators (Diana & Pirra, 2016; Heinen & Chatterjee, 2015) because it is easy to interpret. OM_PI is calculated as:

$$OM\_PI = \sum_{i=1}^{n}\left[\frac{f_i}{\sum_{j=1}^{n} f_j}\ln\left(\frac{\sum_{j=1}^{n} f_j}{f_i}\right)\frac{1}{\ln n}\right]$$

where f_i represents the intensity of the travel mode *i*, and n stands for the total number of transport modes one individual used within one day. OM_PI=0 indicates that the individual is a monomodal user of one particular travel mode in the Mount Yandang Scenic Area, whereas OM_PI=1 indicates that the individual uses all the potential transport modes with the same intensity. Eleven potential transport modes were considered in this study, including individual cars, within-destination tourist buses, buses operated by tourist agencies, walking, cycling, taxis, ride hailing, electric mini shuttle buses, electric three-wheelers, minivans that can carry 1-2 people, and cable cars. Among these, electric mini shuttle buses, electric three-wheelers, and minivans were regarded as informal transport modes (shown in Figure 2), as they were provided by locals and B&B operators. Since this study was designed to explore the impacts of free within-destination tourist bus schemes, the percentage of within-destination tourist bus trips, informal transport mode trips, active mode trips, private car trips, and other car-based mode trips are of special interest in terms of modal shift.

Figure 2. Informal Transport Modes

To identify travel preferences and attitudes, respondents were asked to rate their agreements with 40 statements on a six-point Likert Scale (for a detailed discussion of the use of six-point scales, see Liu et al., 2020), ranging from 1 (strongly disagree) to 6 (strongly agree). These statements were selected from quotes of some visitors, B&B managers, restaurant owners, and staff of several parks in the scenic area who were interviewed prior to the survey. For the sake of brevity, we only discuss the quantitative analysis of the study. The principal axis factor analysis identified ten latent factors: perceived travel convenience, perception of within-destination tourist buses, availability of transport alternatives in the scenic area, perceived parking convenience, attitude towards car-based travel, attitude towards informal transport modes, perception of walking between destinations, perceived destination accessibility, perceived transport equity, and overall satisfaction (shown in Table 2).

In this study, perceived accessibility refers to perceptions of how easily one can reach venues that provide essential aspects of tourist trips—sightseeing, food, and accommodation. It only reflects one aspect of Lättman et al.'s (2016, 2018, 2020) Perceived Accessibility Scale, which also considers three other key aspects of perceived accessibility—perceived opportunities to travel, attitude towards a certain transport mode, and satisfactory access to preferred activities. This is because (a) in the Chinese language, the satisfactory level of access to preferred activities may be subject to widely varying interpretations by

different people, whereas the ease of reaching activities is much more straightforward (see also Liu et al., 2021a); (b) perceived opportunities to travel may be represented by the factor "availability of transport alternatives in the scenic area"; and (c) four factors reflect respondents' travel attitudes, including individual cars, within-destination tourist buses, informal transport modes, and walking.

Transport equity is measured by comparing respondents with their socioeconomic counterparts in terms of experiences of travel between tourist destinations in the scenic area. Social equity, which implies an evaluation of fairness and justice (Nalbandian, 1989), includes not only objective inequalities, but also people's perceptions or recognitions of such inequalities, which, according to Hobbes (1660), are essential to a peaceful and just society. As discussed in Liu et al. (2019), the sense of social inequity in the Chinese context is engendered by perennial comparison between people who occupy the same position in the social hierarchy. Therefore, the perception of whether other people have benefited from the transport system would arguably be the best indicator for transport equity in the Chinese context.

Table 2. Variables loading on travel attitudes

Factor	Statement (factor loadings)
Perceived travel convenience	Within-destination transport is convenient (0.866); I will not cancel my visit to a certain scenic point because of inconvenient transport (0.758); I can visit each one of the destinations if I want (0.792); Transport is not a factor influencing my trip arrangements inside the scenic area (0.805).
Perception of within-destination tourist buses	I prefer to use within-destination tourist buses (0.736); Within-destination tourist buses are convenient to use (0.680); The waiting time for within-destination tourist buses is acceptable (0.744); The service quality of within-destination tourist buses is good (0.727); Considering time cost, within-destination tourist buses are cost effective (0.709).
Availability of transport alternatives in the scenic area	There are multiple transport modes available to me (0.837); Depending on my preference, I can choose relatively cheap/convenient/efficient travel modes between destinations (0.812); I cannot visit may destinations without a car (0.649).
Perceived parking convenience	It is convenient to find parking spaces near main destinations (0.551); It is convenient to find parking spaces near minor destinations (0.648); I hoped there would be more parking spaces (0.683).
Attitude towards car-based travel	I prefer using cars in the scenic area if I can (0.811); I will use a car even if the within-destination tourist bus service is of high quality (0.846); I will use a car even if within-destination tourist buses are free to use (0.790); I will use a car even if other modes are as convenient as cars (0.712); I will use a car for this trip even if I do not really need to (0.825).
Attitude towards informal transport	Informal transport modes helped me a lot when travelling between destinations in the scenic area (0.838); I like using electric mini shuttle buses (0.617); Electric three-wheelers are convenient to use (0.529); Informal transport provided by the locals made my tour here more convenient (0.843); Informal transport provided by the locals made my tour here more comfortable (0.761).
Perception of walking between destinations	I can move from one destination to another by walking (0.577); It is convenient to walk between destinations (0.642); It is not difficult to walk around destinations (0.703).
Perceived destination accessibility	I have sufficient access to all of the main destinations (0.854); I have sufficient access to minor destinations that I am interested in (0.740); I have sufficient access to B&Bs inside the scenic area (0.762); I can easily find preferred restaurants in the scenic area (0.776).
Transport inequity	Compared to other people, it is less convenient for me to travel in the scenic area because they have better transport (0.856); Compared to other people, I am less comfortable traveling in the scenic area because they have better transport (0.879); Other people can visit more destinations than myself because they have better transport (0.833); Other people have more freedom to choose accommodations than myself because they have better transport (0.874); Other people would have a more pleasant travel experience than myself because they have better transport (0.826).

Overall satisfaction	In general, the travel experience is good (0.738); I am satisfied with my visit to the Mount Yandang (0.690); I will recommend this place to others (0.665).

4. Analysis Results and Discussions

4.1 Propensity Scores and Matching

The propensity score was computed using a binary logit model (see Appendix 1) in which the implementation of the free within-destination tourist bus scheme was employed as the dependent variable, whilst the confounders shown in Table 1 were independent variables. The algorithm of greedy nearest neighbour matching without replacement was applied (for a comparison between different matching algorithms, see Austin, 2014). The pseudo-R square of the model is 0.216, which is acceptable in social science settings. Matching can be considered successful if covariates of the treatment group are no longer significantly different from those of the control group (e.g., Linden & Yarnold, 2016). Unadjusted and adjusted mean differences of covariates between tourists who visited the Mount Yandang Scenic Area with and without free within-destination tourist bus service are reported in Table 3.

Table 3. Balancing properties of covariates in treated and control groups

	Treatments	Pre-matched Controls	Matched Controls
Age	42.304	**45.779**	42.615
Gender	0.487	**0.436**	0.485
Household disposable income (kCNY/month)	3.216	**3.325**	3.223
Car ownership	0.590	**0.628**	0.592
Car use habit	2.102	**2.173**	2.009
Public transport use habit	1.321	**1.267**	1.317
Dummy employed	0.567	**0.626**	0.571
Dummy unemployed	0.065	**0.053**	0.062
Dummy retired	0.179	**0.162**	0.183
Dummy student	0.188	**0.159**	0.185
Number of observations	536	**791**	536

Note: numbers in bold indicate that the mean values of observation from the potential (selected) treatment group are significantly different at the 5% level from those of observation from the potential (selected) control group in a t-test.

As Table 3 shows, tourists who visited the Mount Yandang Scenic Area before the restoration of within-destination tourist bus fares significantly differ from those who visited the scenic area after the restoration with respect to all socio-demographic and travel habit variables before the matching analysis. A comparison between the unmatched treatment and control groups shows that the unmatched control group was significantly older and richer, with more females and car owners. The unmatched control group is also characterised by more frequent car use and less frequent public transport use. After the matching, the differences between the treatment and control groups became smaller and not significantly different from 0 at the 5% level. Therefore, differences in means between the treatment and control groups have been removed through the matching analysis.

4.2 Test for Balancing Property

Following Becker and Ichino (2002), we split the sample into 5 equally spaced intervals of the propensity score. To check the balancing property, we estimated t-test for the equality of means of covariates within estimated propensity score blocks for the sample. As t-statistics from the estimations show (Table 4), the null hypothesis of equality of means in the covariates of the propensity score is accepted in most of the cases, which in addition to the test show a good balancing within each block. This indicates that, in general, treatment and control groups within each block have similar socio-demographic characteristics and travel

habits, except for the fact that the treatment group visited the scenic area when the fare-free public transport scheme was active whilst the control group did not. Although there were unobserved factors that might influence tourists' travel mode choices, these should not be considered problematic because socio-demographics such as educational level can be somehow reflected in occupation and income and the environmental conditions such as weather and temperature were roughly the same between the two wave of data collection.

Table 4. T-statistics for the equality of the means of covariates within estimated propensity score blocks

	Block1	Block2	Block3	Block4	Block5
Age	-0.47	0.31	0.07	**2.15**	0.58
Gender	-0.94	0.54	-0.01	1.52	0.59
Household disposable income (kCNY/month)	1.12	1.43	0.79	1.22	1.40
Car ownership	0.09	0.23	1.44	-0.27	0.00
Car use habit	0.20	0.87	0.16	-0.04	0.25
Public transport use habit	1.02	0.60	-0.52	0.53	-0.74
Dummy employed	0.81	0.17	-1.61	0.02	0.09
Dummy unemployed		-0.03	**-2.98**	0.84	0.07
Dummy retired	-0.83	0.55	0.15	-0.04	-1.59
Dummy student	1.35	0.51	-0.74	0.41	0.27

Note: numbers in bold indicate that the mean values of observation from the potential (selected) treatment group are significantly different at the 5% level from those of observation from the potential (selected) control group in a t-test.

4.3 Treatment Effect

The ATT presents the causal effects of the free within-destination tourist bus scheme. A positive ATT value indicates an increase in visitors' multimodality or a change in certain travel attitudes due to the introduction of the free within-destination tourist bus scheme.

Table 5. Impacts (ATT) of the free within-destination tourist bus scheme

	Treatment	Control	ATT	t-value
Multimodality				
OM_PI	0.274	0.258	0.016	1.81*
Percentage of within-destination tourist bus trips	0.045	0.044	0.001	0.25
Percentage of informal transport mode trips	0.155	0.106	0.049	5.48***
Percentage of active mode trips	0.082	0.091	-0.009	-1.75
Percentage of private car trips	0.428	0.433	-0.005	-0.36
Percentage of other car-based mode trips	0.139	0.176	-0.037	-4.69***
Preferences & Attitudes				
Perceived travel convenience	4.437	4.452	-0.015	0.89
Perception of within-destination tourist buses	2.384	2.360	0.024	1.26
Availability of transport alternatives in the scenic area	3.608	3.024	0.584	4.37***
Perceived parking convenience	3.126	3.135	-0.009	-0.08
Attitude towards car-based travel	3.512	4.088	-0.576	-3.75***
Attitude towards informal transport	3.741	3.119	0.622	4.12***
Perception of walking between destinations	2.469	2.257	0.212	3.03***
Perceived destination accessibility	4.822	4.641	0.181	2.64**
Transport inequity	2.940	2.309	0.631	7.57***
Overall satisfaction	4.673	4.534	0.139	2.20**

Note: *, **, and *** denote significance at $p<0.1$, $p<0.05$, and $p<0.01$, respectively.

As shown in Table 5, the free within-destination tourist bus scheme had a significantly positive causal effect on tourists' multimodality in the scenic area. The difference in OM_PI (ATT=0.016) between

tourists who visited the Mount Yandang Scenic Area before and after the cancellation of the free within-destination tourist bus scheme is different from zero at the 0.1 level of significance. However, there was no significant difference between the percentage of within-destination tourist bus trips before and after the cancellation of the scheme; instead, the percentage of informal transport mode trips was 46.2% higher when within-destination tourist bus service was free to use. In other words, although the free within-destination tourist bus scheme encouraged multimodal travel in the scenic area, this increase in multimodality had nothing to do with within-destination tourist buses themselves, but led to a significant increase in informal transport usage.

This result was unexpected in light of previous studies that found that changes in public transport fares would inevitably influence the ridership of public transport (e.g., Hickey, 2005; Miller & Savage, 2017; Verbich & El-Geneidy, 2017). Although Wang et al. (2018) argued that public transport users' responses to fare changes might be considerably exaggerated by stated preference surveys, public transport fare changes would undoubtedly impact passengers' choices of travel modes. More specifically, researchers found that eliminating public transport fares could substantially increase public transport use and improve mobility for low-income people's, at least in the early stages of such a scheme (e.g., Cats et al., 2017; Fearnley, 2013; Thøgersen, 2009).

The insignificant impact of the free within-destination tourist bus scheme has three possible causes. (a) The survey was conducted just one year after the outbreak of Covid-19. As much empirical evidence has shown (e.g., Liu et al., 2022b; Vickerman, 2021), the pandemic has a long-term impact on travel behaviour and modal choice, especially regarding the decrease in the preference of traveling using collective transport modes such as buses. In the era of Covid-19, fares are probably less important if preferences regarding safety and health are highly considered by travellers. (b) The impact of free public transport schemes on different travel purposes and destinations varies. Storchmann (2003) found that passengers are not sensitive to public transport price change when they travel for leisure purposes. (c) Most previous studies on FFPT schemes investigate how local residents respond to such schemes (e.g., Bull et al., 2021; Cats et al., 2014; Dai et al., 2021; see also, for an overview of FFPT schemes globally, Kębłowski, 2020), whereas few studies focused specifically on tourists, who might differ from residents in the following respects. Firstly, tourists are less familiar with FFPT schemes than locals, so they may not be aware of the free within-destination tourist bus scheme in the scenic area. Secondly, tourists may value convenience and relaxation over the price of transport. Although previous studies found that tourists (especially Chinese ones) are highly price sensitive (e.g., Pritchard, 2003; Schiff & Becken, 2011), their travel behaviours were not compared with local residents. So, it is likely that tourists are more price-demand inelastic than local residents. Also, since monetary costs are just one of the components of the generalised cost of transport, changes in fares would have minimal impact on travel behaviour if time costs and transaction costs are very high. Thirdly, there was no significant difference in attitude towards within-destination tourist buses between the treatment and control group, which implies that within-destination tourist bus service did not appear more attractive to tourists when it was fare-free. This is mainly due to the perceived low service quality, long waiting time, and cost-ineffectiveness of within-destination tourist bus services. It is noteworthy that these may have been preconceived ideas, as most respondents did not use tourist buses in the scenic area. Fourthly, decisions are usually made prior to the trip—tourists would be much less likely to use other travel modes between destinations in the scenic area once they have arrived at the scenic area by car or a bus provided by tourist agencies, whereas residents have more flexibility to choose non-car modes depending on their travel purpose even if they typically use private cars. Consequently, the free within-destination tourist bus scheme may not necessarily increase the use of within-destination tourist buses.

A modal shift occurs from other car-based modes (taxi and car hailing) to informal transport modes. A significant increase in the percentage of informal transport mode trips was paralleled by a decrease in the percentage of other car-based mode trips. The surface of the phenomena can be explained quite straightforwardly by significant increases in perceived availability of transport alternatives in the scenic area and attitude towards informal transport, as well as a significant decrease in attitude towards car-based travel. Many researchers have noted that informal transport can offer transport alternatives that provide on-demand mobility, especially in the Global South (e.g., Cervero & Golub, 2007; Ehebrecht et al., 2018; Sunio et al., 2021). In this case, various informal transport modes provided by B&B managers and local residents had the potential to be chosen by the tourists, which may have reduced the share of other car-based modes. Further, although it is still under debate to what extent intentions are likely to get translated into behaviour (see Carrington et al., 2014; Sheeran & Webb, 2016), preference is widely considered to have an important impact on travel mode choice (for a review, see De Vos et al., 2021; Hoffmann et al., 2017). Given that the impact of habit has been removed by the matching, the modal shift from other car-based modes to informal transport seems to be explained by the increased attitude towards informal transport and decreased attitude towards other car-based modes. However, these factors do not answer the questions of why an FFPT scheme only increased informal transport usage or why a modal shift occurred.

To explain the limited impact of the FFPT scheme, it is important to understand the underlying causes of the modal shift. As previously mentioned, tourists usually do plan their travel before visiting the destinations (e.g., McKercher et al., 2006). Therefore, tourists' decisions with respect to travel mode choice are made prior to the travel, to wit—once they had planned to travel by private car, there would be little opportunity left for them to choose other modes during the trip. Those who did not drive their own cars, although they were more open to other opportunities, tended to use other car-based services such as taxis (which had the second largest share of other car-based modes in the control group) when the within-destination tourist bus service, the only other formal transport option, cost 40CNY/day. In such circumstances, informal transport modes were not feasible transport alternatives for many tourists, as they had made the decision to use car-based services without considering the option of using informal transport modes. The free within-destination tourist bus scheme reintroduced not only tourist buses but also various informal transport modes provided by B&B managers and local residents, as potential options for tourists. Because those who planned to use the free within-destination tourist bus service needed to be aware of other alternatives due to the uncertainty surrounding wait times (see Dell'Olio et al., 2011) and other anticipated problems with tourist bus services, tourists now seek informal transport modes that are cheaper and more flexible and sometimes offer better accessibility to some specific scenic spots. Moreover, the free within-destination tourist bus scheme made tourists' decision-making about travel mode choice more fragmented because tourists considering taking buses during the fare-free period needed to make decisions on each individual outing. This may also have increased the tourists' likelihood of using informal transport modes.

The equity impacts of public transport fare changes are widely discussed in the literature (e.g., Nahmias-Biran et al., 2014; Nuworsoo et al., 2009; Zhou et al., 2019). This study did not investigate the affordability dimension (see for example Falavigna & Hernandez, 2016; Ojekunle, 2014) because the change under consideration was a fare-free scheme. Other transport equity implications (Lucas, 2012, 2019) of this scheme, such as its impacts on perceived accessibility and perceived transport-related social equity, were investigated in this study. Our results indicate that perceived destination accessibility and perceived transport equity significantly increased due to the free within-destination tourist bus scheme. The modal shift from other car-based modes to informal transport indicates that informal transport significantly contributed to these perceived increases. Although providers, and perhaps users, of such modes often subjectified informal

transport as chaotic and backward (Schwanen, 2020), this study's findings suggest that informal transport could be an effective way to improve transport-related social equity in such large tourist destinations.

Given this, the free within-destination tourist bus scheme improved the multimodality and inclusivity of the scenic area by increasing the use of informal transport.

4.4 Robustness Check

First, the other four matching methods of PSM (kernel matching, k-nearest neighbours matching, stratification matching, and radius matching) were performed to check the robustness of the results. As Table 6 shows, the results of the four matching methods were consistent with the main results reported above.

Table 6. The treatment effects of the other four matching methods

Matching Methods		Treatment	Control	ATT	t-value
Kernel matching (bandwidth = 0.05)	OM_PI	0.274	0.252	0.022	2.24**
	Percentage of within-destination tourist bus trips	0.045	0.044	0.001	0.25
	Percentage of informal transport mode trips	0.155	0.101	0.054	6.43***
	Percentage of active mode trips	0.082	0.088	-0.006	-0.80
	Percentage of private car trips	0.428	0.432	-0.004	-0.28
	Percentage of other car-based mode trips	0.139	0.184	-0.045	-5.22***
	Perceived travel convenience	4.437	4.444	-0.007	0.31
	Perception of within-destination tourist buses	2.384	2.365	0.019	0.85
	Availability of transport alternatives	3.608	3.157	0.451	3.26***
	Perceived parking convenience	3.126	3.130	-0.004	-0.01
	Attitude towards car-based travel	3.512	3.834	-0.322	-2.62**
	Attitude towards informal transport	3.741	3.246	0.495	3.37***
	Perception of walking between destinations	2.469	2.263	0.206	2.92***
	Perceived destination accessibility	4.822	4.645	0.177	2.48**
	Transport inequity	2.940	2.315	0.625	7.40***
	Overall satisfaction	4.673	4.539	0.134	2.11**
k-nearest neighbours matching (k=2)	OM_PI	0.274	0.257	0.017	1.87*
	Percentage of within-destination tourist bus trips	0.045	0.045	0.000	0.00
	Percentage of informal transport mode trips	0.155	0.108	0.047	5.06***
	Percentage of active mode trips	0.082	0.090	-0.008	-1.58
	Percentage of private car trips	0.428	0.434	-0.006	-0.61
	Percentage of other car-based mode trips	0.139	0.179	-0.040	-4.92***
	Perceived travel convenience	4.437	4.450	-0.013	0.76
	Perception of within-destination tourist buses	2.384	2.360	0.024	1.26
	Availability of transport alternatives	3.608	3.031	0.577	4.23***
	Perceived parking convenience	3.126	3.133	-0.007	-0.07
	Attitude towards car-based travel	3.512	4.112	-0.600	-5.64***
	Attitude towards informal transport	3.741	3.103	0.638	4.55***
	Perception of walking between destinations	2.469	2.245	0.224	3.86***
	Perceived destination accessibility	4.822	4.634	0.188	3.07***
	Transport inequity	2.940	2.257	0.683	8.83***
	Overall satisfaction	4.673	4.506	0.167	2.70**
Stratification matching	OM_PI	0.274	0.258	0.016	1.81*
	Percentage of within-destination tourist bus trips	0.045	0.043	0.002	0.33
	Percentage of informal transport mode trips	0.155	0.104	0.051	5.79***
	Percentage of active mode trips	0.082	0.091	-0.009	-1.75
	Percentage of private car trips	0.428	0.435	-0.007	-0.67
	Percentage of other car-based mode trips	0.139	0.177	-0.038	-4.77***
	Perceived travel convenience	4.437	4.449	-0.012	0.68
	Perception of within-destination tourist buses	2.384	2.358	0.026	1.44
	Availability of transport alternatives	3.608	3.010	0.598	5.25***
	Perceived parking convenience	3.126	3.133	-0.007	-0.07

	Attitude towards car-based travel	3.512	4.016	-0.503	-4.58***
	Attitude towards informal transport	3.741	3.125	0.616	3.95***
	Perception of walking between destinations	2.469	2.259	0.210	2.98***
	Perceived destination accessibility	4.822	4.636	0.186	2.81**
	Transport inequity	2.940	2.307	0.633	7.52***
	Overall satisfaction	4.673	4.533	0.140	2.36**
Radius matching (caliper = 0.05)	OM_PI	0.274	0.247	0.027	3.11***
	Percentage of within-destination tourist bus trips	0.045	0.045	0.000	0.00
	Percentage of informal transport mode trips	0.155	0.102	0.053	6.31***
	Percentage of active mode trips	0.082	0.091	-0.009	-1.69
	Percentage of private car trips	0.428	0.430	-0.002	-0.12
	Percentage of other car-based mode trips	0.139	0.187	-0.048	-5.57***
	Perceived travel convenience	4.437	4.447	-0.010	0.52
	Perception of within-destination tourist buses	2.384	2.363	0.022	1.09
	Availability of transport alternatives	3.608	2.983	0.625	5.88***
	Perceived parking convenience	3.126	3.134	-0.008	-0.08
	Attitude towards car-based travel	3.512	4.147	-0.635	-5.32***
	Attitude towards informal transport	3.741	3.016	0.725	6.46***
	Perception of walking between destinations	2.469	2.254	0.215	3.25***
	Perceived destination accessibility	4.822	4.510	0.312	4.03***
	Transport inequity	2.940	2.231	0.709	8.94***
	Overall satisfaction	4.673	4.508	0.165	2.59**

Note: *, **, and *** denote significance at p<0.1, p<0.05, and p<0.01, respectively.

Second, we separated those who lived inside and outside the scenic area to check whether the location of tourists' accommodations influence the results. As Table 7 shows, the results of the two groups were consistent with the main results reported above but the FFPT scheme derived more informal transport mode trips, more positive attitudes towards informal transport modes, and less positive attitudes towards car-based travel modes for those who lived inside the scenic area. This may indicate unobserved heterogeneities between those who live inside and outside the scenic area. Since many people who live inside the scenic area live in B&Bs, they are more likely to use informal transport modes provided by the B&B operators, and they may have more information about alternatives within the scenic area. Also, tourists' travel mode choice may be influenced by the time they plan to stay within the scenic area. Those who have to finish their tour within one day should be more time sensitive and less likely to try alternative transport modes that they may perceive as less convenient. Moreover, there may be differences between those who travel by themselves and those who travel with a tour group, because those who travel with a tour group can hardly choose any other modes of transport between destinations. Other unobserved heterogeneities such as tourists' environmental attitudes might also influence their travel mode choices.

Table 7. The treatment effects of two groups with different locations of accommodation

Subgroups		Treatment	Control	ATT	t-value
Living inside the scenic area	OM_PI	0.285	0.270	0.015	1.77*
	Percentage of within-destination tourist bus trips	0.084	0.080	0.004	0.41
	Percentage of informal transport mode trips	0.196	0.112	0.084	9.15***
	Percentage of active mode trips	0.083	0.089	-0.006	-1.22
	Percentage of private car trips	0.421	0.429	-0.007	-0.72
	Percentage of other car-based mode trips	0.126	0.170	-0.044	-5.05***
	Perceived travel convenience	4.433	4.445	-0.012	0.55
	Perception of within-destination tourist buses	2.391	2.372	0.019	0.78
	Availability of transport alternatives	3.639	3.041	0.598	5.19***
	Perceived parking convenience	3.095	3.104	-0.009	-0.10
	Attitude towards car-based travel	3.458	4.052	-0.594	-4.91**
	Attitude towards informal transport	3.867	3.262	0.605	5.22***

	Perception of walking between destinations	2.461	2.243	0.218	2.98***
	Perceived destination accessibility	4.805	4.608	0.197	2.96***
	Transport inequity	2.932	2.278	0.654	7.20***
	Overall satisfaction	4.667	4.526	0.141	2.12**
Living outside the scenic area	OM_PI	0.268	0.252	0.016	1.85*
	Percentage of within-destination tourist bus trips	0.025	0.033	-0.008	1.23
	Percentage of informal transport mode trips	0.134	0.103	0.031	3.57***
	Percentage of active mode trips	0.081	0.092	-0.011	-1.71
	Percentage of private car trips	0.432	0.435	-0.003	-0.16
	Percentage of other car-based mode trips	0.146	0.179	-0.033	-4.04***
	Perceived travel convenience	4.439	4.456	-0.017	0.92
	Perception of within-destination tourist buses	2.380	2.354	0.026	1.31
	Availability of transport alternatives	3.592	3.015	0.577	4.10***
	Perceived parking convenience	3.142	3.151	-0.009	-0.06
	Attitude towards car-based travel	3.540	4.107	-0.567	-4.73***
	Attitude towards informal transport	3.676	3.045	0.631	4.69***
	Perception of walking between destinations	2.473	2.264	0.209	2.91***
	Perceived destination accessibility	4.831	4.658	0.173	2.48**
	Transport inequity	2.944	2.325	0.619	5.74***
	Overall satisfaction	4.676	4.538	0.138	2.25**

Note: *, **, and *** denote significance at $p<0.1$, $p<0.05$, and $p<0.01$, respectively.

5. Conclusions and extensions

Encouraging modal shifts toward sustainability is among the highest policy priorities in the transport arena. However, the evaluation of interventions such as the FFPT policy, which has already been widely practiced in the Global North and South, faces several challenges. Firstly, the impacts of FFPT interventions and multimodal behaviour have been mostly investigated in residential settings, leading studies to overlook other travellers' potential for modal shifts. Secondly, few have discussed the impact of FFPT or multimodality on transport-related equity issues. Thirdly, the impact of public transport fare changes is conventionally estimated through regression analyses whose results may have been distorted due to selection bias.

This paper addresses these issues by applying a PSM approach to investigate the effects of a FFPT policy within tourist destinations in the Mount Yandang Scenic Area. Specifically, we investigate the impact of the free within-destination tourist bus scheme on multimodality, the modal share of various car-based modes and less unsustainable alternatives, perceptions of different travel modes, and perceived transport equity. The results indicate that this FFPT scheme significantly promoted tourists' multimodality in the scenic area, but not by increasing their use of public transport. A notable modal shift occurs from other car-based travel modes such as taxis to informal transport provided by B&B operators and local residents. We identified a twofold potential cause of this unexpected modal shift from other car-based services to informal transport due to a FFPT scheme. That is, this shift took place because of two derivations of the scheme: (a) the abolition of fares increased the attractiveness of tourist buses while also introducing informal transport modes as appealing options; and (b) the intention to use tourist buses fragmentised decision making about travel mode choice, thereby increasing tourists' likelihood of choosing on-demand informal transport. In terms of transport equity, the results suggest that this scheme significantly increases tourists' accessibility to destinations and their perceptions of how equitable the transport system in the scenic area was. These increases are also largely owing to informal transport alternatives.

According to the results, we offer three managerial suggestions to large tourist destination areas in China and beyond. First, without improving the service quality of within-destination tourist bus services, the FFPT policy instrument should not be expected to attract tourists to use such sustainable travel modes.

Second, local villagers could use self-organised associations to regulate and improve the delivery of the informal transport service. Since most informal transport services are not suitable for long-distance travel, informal transport providers could find ways to cooperate with tourist bus operators, making them efficient shuttle services. Third, convenient and customised within-destination transport could be an attractive service that B&B operators offer to their customers. Such service is not necessarily provided by one B&B operator alone because Chinese rural communities are largely organised by lineage and acquaintance relationships.

Important aspects of this modal shift phenomenon require further investigation in future research. First and foremost, although we proposed an interesting hypothesis of the underlying mechanism of the modal shift, it requires further verifications. Second, it would be interesting to see different types of decision making about travel modes and how pre-planned mode choice be altered. Third, it was difficult to distinguish travel modes that were actually adopted from those that were planned to be used in the survey. Therefore, a comparison between pre-planned travel modes and actual mode choices during travel, as well as interviews aiming to reveal the underlying causes of differences between the two, would be very helpful to understand tourists' travel mode decision-making. Fourth, the study lacked a comprehensive overview of informal transport provided in the scenic area before conducting the survey. Although the pilot interviews addressed the potential role played by informal transport, more modes cropped up over the course of the survey. It would be very interesting to explore how informal transport is organised, what strategies operators adopt to deliver such services, how different modes of informal transport cooperate and compete with each other, and how integration among different forms of informal transport, and between informal and public transport, can better promote modal shifts and transport equity. Fifth, it would be very interesting to see whether there were differences between questionnaires collected near different attractions, but unfortunately, we mixed all the hard-copies collected from different locations so we cannot trace where the questionnaires were collected. It may matter as some destinations may be generally visited later so people answered mostly their actual travel modes used whilst other destinations may be visited earlier so people answered some of their anticipated travel modes. Finally, since multimodality is normally improved by using other transport alternatives (informal transport in this case) that tend to be more accessible to relatively disadvantaged people, multimodality itself might have equity implications, but this possibility requires further scrutiny. Nonetheless, this paper provides reasonably solid evidence of a modal shift from car-based services to informal transport due to a FFPT scheme and explores how such a scheme may promote multimodal travel and transport equity without necessarily increasing the use of public transport.

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