Transport Poverty in Chinese Cities

Subjects: Transportation

Contributor: Weichang Kong

The widening income gap in post-reform China has given rise to social inequality. Among those, transport poverty and inequality have significantly affected the daily life of low-income groups. It was found that the most common causes of transport poverty include: a lack of access to private vehicles; uneven access to alternative transport options; inadequate public transport provision; jobs-housing imbalance; and the hukou system (a system of household registration which aims to regulate population distribution and rural-to-urban migration). The main impacts of transport poverty include: curtailed mobility and longer travel times; higher household expenditures on travel; reduced access to jobs and essential services; higher household expenditures on travel; and health and environmental issues.

Keywords: China ; transport poverty ; inequality ; systematic review

1. Introduction

China's impressive economic growth since the 1979 'reform and opening-up' (*gaige kaifang*) policy has led to much higher incomes for its population. However, averages conceal the uneven distribution of wealth under 'capitalism with Chinese characteristics.' While a growing economy has helped lift millions out of poverty, many others find themselves at the bottom of the income ladder with little hope of moving up [1]. From a classless nation in the Maoist era, China has become one of the most unequal countries in the world, with a Gini index of 0.5 [2]. By way of comparison, a GI of 0.4 represents severe income inequality. The higher echelons of society have benefited the most from economic reforms and are poised to become wealthier [3]. By the national standard in 2020, poverty is defined as residents with an annual income lower than RMB 4000 (approximately USD 600) in China.

Inequality presents a major obstacle for economic, social and environmentally sustainable development [4]. The gap between rich and poor is undermining the Chinese idea of 'social harmony' [4]. Inequality has also affected transport—the focus of this paper—notwithstanding vast investments in urban road and rail transport infrastructure since *gaige kaifang* [5].

There have been numerous studies on general transport issues in China [6] but transport inequality among socioeconomically disadvantaged groups is an under-researched topic. More attention to urban transport inequality needs to be paid to developing countries because of its increasing importance, especially in China [7], which has witnessed enormous increases in urban expansion and motorization over recent decades. In most Chinese cities, transportation strategies give priority to the use of private vehicles, while other transport modes, including active and public transportation, have lower priority. The disproportionate investment in transport infrastructure is creating a divide between residents of different socioeconomic backgrounds [7]. The urban poor suffer disproportionately from a limited transport options and disadvantageous housing locations [8]. As a result, widening income gaps in China are increasing social inequalities of low-income workers [7].

Due to the complex urban structure and transport system in China, daily commuting and traveling in China can be affected by many factors including institutional, economic, spatial and individual variables [9]. Ta et al. [9] explain that these factors are interrelated and play a significant role in urban commuting because the spatial mismatch and accessibility issues associated with these factors often lead to longer travel distances and time. However, the detail of how each factor affects transport poverty and how it impacts on social exclusion for low-income Chinese households has yet to be researched. Therefore, to provide a comprehensive understanding on how income impacts transport poverty in China, we conducted a systematic review of studies on transport poverty, set in Chinese cities. We did not merely count the number of studies, but also conducted a qualitative analysis of text to identify key themes found in the literature. We sought to examine both the causes and effects of transport poverty in China's metropolitan areas. Additionally, this study aims to explore the similarities and differences in transport poverty issues between China and the West by comparing the findings with Lucas' transport poverty framework [10].

2. Causes of Transport Poverty in Chinese Cities

Most publications in our dataset focused on the reasons why low-income groups in Chinese cities were suffering from transport poverty, disadvantage and exclusion. Common 'causes' included: a lack of access to private vehicles; uneven access to alternative transport options; inadequate public transport provision, job-housing imbalance and *hukou* system, all of which fall into three of the four factors (spatial factors, institutional factors and individual factors) identified by Ta et al. [9], with economic factors barely discussed in any of the studies. Therefore, this section will discuss the causes by categorizing them into individual, spatial and institutional factors. An overview of the studies addressing the causes of transport poverty in Chinese cities is shown in Table 1.

2.1. Individual Factors

2.1.1. Lack of Access to Private Vehicles

The lack of access to private vehicles (cars in particular) due to low incomes is underscored in most studies as the driver of transport poverty and disadvantage. Numerous studies showed that high-income commuters were more likely to own and use private automobiles, whereas low-income groups were less likely to own cars and therefore could not easily move around [7][11][12][13][14][15][16][17][18][19][20][21][22][23][24]. Longitudinal studies also suggested that as a result of gradually increasing household incomes, there was a rapid growth in car use among high-income groups, which led to an increasing gap in car ownership between the rich and poor [14][25]. However, increases in income for those in low-income groups were often also accompanied by car purchases to a certain extent [26]. A close relationship between income and leisure car trips was also identified [27]. Another study showed that there might be a threshold where the use of private vehicles decreased with increasing income level, and that might be caused by considerably shorter distance to employment for high income residents and non-motorized modes were prioritized [28].

While incomes have increased for all groups in China, the cost of purchasing a car is still too high for the poor. A study in Nanjing found that between 2008 and 2011, car ownership had decreased among low-income workers, and the gap in private car use between the rich and poor had increased for both commuting and leisure travel [29]. Public transport could be generally less favored by the urban wealthy due to the inconvenience associated with bus and train ridership, and because of the low symbolic value of public transport vis-à-vis cars [30].

The lack of access to car-based travel also produces transport poverty among children from low-income households. Children from high-income families were more likely to travel to school by car than public transport, whereas children from low-income families tended to walk [31][32]. Children from higher income families sometimes did walk too—especially if mothers were in charge of the school run (cars were more often used by fathers or paid chauffeurs) [32]. While walking was positive in terms of physical activity, it exposed children to adverse weather, which could be problematic during Beijing's cold winters and hot summers, and to accident risk [31].

The situation of internal migrants is more complex. Car ownership and use was lower among younger migrants (aged under 31) even when their incomes were high [20]. This was because people in this cohort tended to rent rather than own their homes and they were under pressure to retain some of their income to support their families left behind in rural areas [20].

Car ownership has increased significantly among Chinese high- and middle-income households, which not only brings social inequality but also negative environmental impacts. The emission from private vehicles is a major contributor to the air pollution in China, and Xu and Lin [33] point out cars have affected more in the eastern region, where car ownership is higher than in the other areas. Air pollution has posed high costs on Chinese residents, especially on levels of health and productivity [34]. Increasing car ownership in Chinese cities is harmful for both social and environmental sustainability.

2.1.2. Uneven Access to Alternative Transport Options

Public transport and non-motorized travel are the main modes for low-income workers in general [35]. However, one research suggested that beyond private cars, low-income people found it difficult to gain access to other transport options, whereas high- and middle-income groups had a suite of options available to them [29]. Furthermore, to save travel costs, some low-income households were less likely to choose public transport compared to high-income residents [36]. To the extent that the poor had access to private vehicles at all, these tended to be motorcycles rather than cars—especially in rural areas [37]. Motorcycles were prohibited in some historic inner-city zones, such as Guangzhou [38]. While this was positive in terms of reducing air and noise pollution and increasing traffic safety, it also disadvantaged the poor and increases transport poverty [38]. Such tradeoffs are typical in transport planning where conflicting agendas tend to characterize the sustainability paradigm [39].

Even a relatively cheap mode such as cycling—which was once a fixture of the Chinese urban landscape [6]—appears to be more available to the wealthy than to the poor. Low-income workers showed little participation in the public bicycle sharing program due to its complexity and high cost of registration [40]. The same results were also found in a dockless bike share study, which revealed that dockless bikeshare was less popular among low-income groups [41].

2.2. Spatial Factors

2.2.1. Imbalances in the Urban Structure

Urban gentrification has a range of distinct effects on different socioeconomic groups [42]. Gentrification refers to urban development processes where new businesses relocate to areas with improved residential or commercial property, often bringing in middle-class or wealthier residents. This can have substantial impacts on the spatial distribution of different socioeconomic groups and exacerbate social inequality for disadvantaged groups, such as the urban poor [42]. Two types of imbalances appear to exacerbate transport poverty in Chinese cities: jobs-housing mismatch and transport-land use mismatch. In terms of transport-land use mismatch more broadly, a study set in Guangzhou found that residents in subsidized rental housing (i.e., poorer residents) had to travel longer distances to shopping venues [43]. However, this aspect has not been extensively studied, whereas more is known about the jobs-housing mismatch.

Wang et al. [44] explained that, since property prices were soaring in city centers, lower income workers were pushed to the suburban areas where there was a lack of amenities for the residents. Some middle-income workers were also moving to newly built satellite towns with good public transport to escape overcrowded housing in inner cities [26]. As many tended to retain their urban job, commuting distances increased, but the upside was improved housing quality [26]. Higher mixed land use, due to its effect on housing rent, was another factor that can make the low-income residents leave the community and experience disadvantages to access a range of services [36]. All of these trends result in a mismatch in the location of jobs and housing that affect lower income workers disproportionally [8][43][45]. Where household incomes decrease, commuting times increase as a consequence—and vice versa [46]. Lower-income earners are particularly sensitive to the travel distances between home and work, as these affect the household transport budget. Compared to their counterparts, low-income residents also had less ability to adjust their housing location to reduce commuting times [47]. However, the tolerance of longer travel time to jobs had limits, even for low-income workers [48].

Affordable housing is one of the major housing types, and large-scale affordable housing communities are occupied by low-income workers. However, these communities are typically located on the urban fringe. The poor location leads to low accessibility levels for low-income workers [9][16][49][50][51][52][53]. This may exacerbate transport disadvantage because few public housing residents can afford a car to substitute for inadequate public transport services [53]. Compounding the problem is the fact that many of the industries employing the poor tended to be concentrated in the inner cities [54]. Therefore, unlike communities facilitated with adequate services that are normally occupied by the rich, the uneven distribution of public transport and other services of the location for affordable housing leads to social segregation of low-income workers [13].

2.2.2. Inadequate Public Transport Provision

Over the last decade, a significant portion of China's national expenditure has funded urban public transport infrastructure [6]. Unfortunately, public transport provision remains inadequate due to rapid urbanization. It has been difficult for public and private providers to meet the travel demands of a growing urban population. Poor land use planning compounds this problem, particularly in major cities. A study in Beijing showed that, low-income workers were forced to move to public housing located in the outer suburbs that were served by low-quality public transport, which had created a commuting barrier [8][16]. The imbalance of investment between highway and public transport was another factor that exacerbated the commuting barrier between high- and low-income commuters [13]. With more investment in highway construction, high-income residents tended to benefit more due to their high level of car ownership [13]. This situation is also found in other developing countries, such as Latin America, where public transport is unevenly distributed [54].

2.3. Institutional Factors

Hukou System

Institutional factors, including the *hukou* and *danwei* housing system—*danwei* were work-live units created by state-owned enterprises—have a significant impact on job-housing relationships and further affect workers' commuting time [55] [56]. *Hukou*, a factor unique to China, is an official registration record or local residence permit, which rural-urban migrants need to obtain when settling in a new city to get access to all levels of local services, and it is highly associated with low-skilled and low-income migrants. The *hukou* system plays a significant role in low-income migrant mobility [57]. Those migrants without *hukou* tend to suffer more from longer commuting times and lower accessibility to employment and other

services in general [56][58][59][60]. One reason given by Zhao and Howden-Chapman [57] was that some social housing, which was typically built within the proximity of major transport hubs to improve access to public transport for low-income workers, was exclusive to local *hukou* holders. Migrant workers without *hukou* also faced the dilemma of choosing between poor living conditions close to their employment or low accessibility of living in the suburb with better housing [55][60][61][62][63]. The basement was one of the informal housing types for avoiding the burden of commuting [61]. Although these types of housing options did not require local *hukou*, they still created social issues, which tended to result in social exclusion [61]. This social segregation could be explained by the fact that low-income migrants tended to limit their social interaction to only those from the same hometown [64]. On the other hand, high-income migrant workers were less sensitive to commuting burdens and preferred to live in the suburbs where the environment was better [55].

3. Impacts of Transport Poverty in Chinese Cities

Several research publications focus on the impacts of transport poverty among low-income commuters. The research suggests the following major impacts: less mobility and longer travel times; curtailed access to jobs and essential services; higher household expenditures on travel; and lower quality of life and health issues. Therefore, our main themes of impacts are modified as mobility, accessibility, health and environment, based on the dimensions illustrated by Lucas et al. [65]. A summary of the studies addressing the impacts of transport poverty in Chinese cities is represented in Table 2.

3.1. Mobility

3.1.1. Less Mobility and Longer Travel Times

Commuting time is a key measure of transport poverty. Longer commuting times are one of the most significant impacts of transport poverty, particularly for low-income groups in China [7][23][28][46][56][57]. Low-income residents also had restrained mobility [64], which could lead to rigid space–time constraints [66]. A study also argued that, due to lower car ownership rates, middle-income workers, who lived in the Chinese suburbs might also carry a greater commuting time burden [11]. Although low-income commuters tended to make fewer and shorter trips, their average trip duration was still longer than higher income commuters [12], which was due to imbalances in the urban structure [43]. Family income could also have an impact on university student mobility, where students from high income families tended to travel more frequently and longer distances to access different services [67]. Chen et al. [68] addressed the impact of travel time uncertainty on socioeconomically disadvantaged groups, which could also exacerbate accessibility inequality.

Unlike Western cities, particularly the U.S., where many wealthy families live in the suburbs, the wealthy aspire to live in the urban core in China. As transport infrastructure tended to be inadequate in poorer suburbs, residents had to pay more, in terms of time, for transport [53][62]. Zhao and Li [21] suggested that this was also true from non-work travel. When considering relocating, high- and middle-income groups sought to improve their housing conditions, whereas low-income groups sought to minimize their commuting time [26].

While these are the general trends, in a complex country like China there are exceptions. For example, a study set in the historic zone of Guangzhou found that higher income individuals tended to spend more time traveling due to longer travel distances, whereas low-income workers had a lower travel times [38]. This could be explained by lower income workers seeking jobs closer to their homes due to limited mobility options. While shorter travel times were an advantage, a problem still remained because transport availability constrained employment options for the poor [38].

However, a study in Beijing found that medium-income workers enjoyed the shortest travel times [56]. This group tended to avoid the spatial mismatch problem by choosing to live in lower quality, but more affordable housing within the urban perimeter. Given the choice between shorter commutes and better housing, middle-income workers tended to choose the former. Higher income commuters, by contrast, were less compromising in terms of housing quality, whereas lower income commuters were more sensitive to housing costs [56].

3.1.2. Higher Household Expenditures on Travel

Longer commuting distances mean that low-income groups may have to spend a larger portion of their income on transport. Distance-based public transport fares (recently applied in Beijing and other cities) are regressive as they penalize lower income workers who live in outer suburban areas. By contrast, flat fares cross-subsidized commuters—wealthy riders traveling shorter distances paid the same fare as poor riders taking longer trips [69]. For the very poor, any public transport fare could be unaffordable—although metro ticket prices in Chinese cities might appear low by Western standards [53].

3.2. Accessibility

3.2.1. Curtailed Access to Jobs

Accessibility is a crucial component of transport poverty as noted by Lucas et al. [65] and others [70][71][72]. Several studies showed low-income commuters in Chinese cities suffered from a jobs-housing imbalance and struggled to access employment [23][38][73]. Employment accessibility by public transport, upon which low-income workers were dependent, was much poorer than that by private vehicles, and the distribution of public transport services were unequal for the poor [74].

Migrant workers—especially 'second class citizens' without local *hukou*—were particularly vulnerable and tended to have less access to employment opportunities [58][59]. However, the development of new industrial centers and informal housing constructed around them could be beneficial for low-income migrants as it meant less travel time [63]. A study of Guangzhou's new satellite towns showed that due to the rapid industrialization and urbanization, jobs and housing were moving outwards [75]. New towns were forming township and village enterprises that were developing affordable housing for industrial plant workers. To reduce travel times migrant workers employed in new industrial estates were starting to move into this housing [75]. In a sense, this signifies a return to the *danwei* arrangements of the Maoist era.

3.2.2. Limited Access to Essential Services and Facilities

Apart from jobs, accessibility to essential goods and services is also a problem for lower income people [12][23][51][52][73][76][77][78][79]. These services include health services, education, shopping and physical activity facilities. Longer travel times for these services may result in low satisfaction levels [51][78]. Among these services, poor access to medical facilities had a substantial impact on low-income households [22][24][79].

Children in low-income families are also transport disadvantaged as they have poor access to schools and other educational opportunities, in part because urban sprawl has led to longer travel distances for children. As education resources are unevenly distributed across urban areas, poorer children may be stuck in underfunded public schools close to their homes. In a society that greatly values educational achievement, this perpetuates a downward spiral of social exclusion [31].

Social inequality is also found in park accessibility in Chinese cities. Studies suggested that low-income groups tended to be excluded from using parks due to their disadvantaged locations [80][81][82]. Parks in low-income areas were not prevalent, and thus residents of these areas must rely on walking and substandard public transit to access parks [80][81][82]. However, a different result was found in a study of urban park access in Beijing [83], which showed a weak association between socioeconomic conditions and park access. That could be explained by the substantial funding from the government to ensure that park planning meeting the needs of residents from all socioeconomic backgrounds.

3.3. Health and Environmental Issues

While the wealthy can travel safely, comfortably and conveniently in their private cars [26] the conditions for the poor are considerably worse [12]. Zhou et al. [43] found that commuters from subsidized low-income rental housing relied heavily on cheaper transport modes, such as buses, while commuters from commercial and private-leased housing were more frequent users of the metro and private vehicles. As a result, the poor struggled to meet their daily travel needs, which could result in a lower quality of life [20].

Wang et al. [44] examined the link between density, lifestyle and being overweight among middle-aged and older adults in China. The results showed that adults living in densely populated areas had a higher risk of being overweight due to their inactive lifestyle. Similar results were found for residents that owned cars. Both of these factors were associated with household income levels since wealthy people tended to live in densely populated neighborhoods and had a high levels of car ownership, which made them more vulnerable to health risks from being overweight [44]. Weng et al. [84] examined the health benefits of walkable communities and showed that highly walkable neighborhoods tended to be located in city centers where the urban wealthy live.

Environmental pollution has become a key concern in urban China, with the transport sector being a major contributor. One study addressed the issue of exposure to pollution by comparing the ability of low- and high-income groups to switch travel modes based on weather conditions [85]. The results showed low-income workers were less likely to switch from cycling to motorized modes due to their limited financial resources, which would lead to more exposure to pollution. Meanwhile, the restrained access to medical services and parks, noted above, can exacerbate the health of low-income residents.

Table 1. A summary of extracted studies addressing different dimensions of the causes.

Causes	Studies
Access to private vehicles	Cheng et al., 2013 [12]; Zhao, 2013 [13]; Feng et al., 2014 [27]; Zhao, 2014 [14]; Li and Zhao, 2015 [31]; Wang and Liu, 2015 [15]; Zhang and Man, 2015 [16]; Dai et al., 2016 [28]; Linn et al., 2016 [17]; Zhao and Li, 2016 [11]; Feng et al., 2017 [29]; Jiang et al., 2017 [18]; Wei and Pan, 2017 [19]; Guo et al., 2018 [20]; Liu et al., 2018 [32]; Zhao and Zhang, 2018 [26]; Li et al., 2019 [7]; Zhao and Bai, 2019 [25]; Zhao and Li, 2019 [21]; Du et al., 2020 [22]; Lau, 2020 [24]; Wu et al., 2020 [24]
Alternative transport options	Lau, 2013 [38]; Karki and Tao, 2016 [40]; Aizezi et al., 2017 [37]; Feng et al., 2017 [29]; Yu et al., 2019 [36]; Chen et al. 2020 [41]
Urban structure	Zhao and Lü, 2010 [47]; Liu and Wang, 2011 [48]; Zhao et al., 2011 [46]; Zhao, 2013 [13]; Zhou et al. 2013 [43]; Han et al., 2015 [49]; Zhang and Man, 2015 [16]; Zhao, 2015 [8]; Ta et al., 2017 [9]; Liu et al., 2018 [45]; Gao et al., 2018 [50]; Zhao and Zhang, 2018 [26]; Wang et al., 2019 [44]; Yu et al., 2019 [36]; Zeng et al., 2019 [51]; Wang et al., 2020 [52]
Public transport provision	Zhao, 2013 [13]; Zhang and Man, 2015 [16]; Zhao, 2015 [8]
*Hukou*system	Zhao and Howden-Chapman, 2010 [57]; Yu and Cai, 2013 [61]; Li and Liu, 2017 [58]; Li and Zhao, 2018 [64]; Zhang et al., 2018 [62]; Bi et al., 2019 [59]; Chen and Yeh, 2019 [60]; Liu et al. 2020 [55]; Zhao, 2020 [56]

Table 2. A summary of extracted studies addressing different dimensions of the impacts.

Impacts	Studies
Mobility and travel time	Zhao and Howden-Chapman, 2010 [57]; Zhao et al., 2011 [46]; Zhou et al., 2013 [43]; Cheng et al., 2013 [12]; Lau, 2013 [38]; Dai et al., 2016 [28]; Zhan et al., 2016 [67]; Zhao and Li, 2016 [11]; Li and Zhao, 2018 [64]; Zhang et al., 2018 [62]; Zhao and Zhang, 2018 [26]; Chen et al., 2019 [41]; Li et al., 2019 [7]; Zhao and Li, 2019 [21]; Zhao and Zhang, 2019 [69]; Chen and Yeh, 2020 [66]; Lau, 2020 [23]; Zhao, 2020 [56]
Household expenditure on travel	Zhao and Zhang, 2019 [69]
Curtailed access to jobs	Liu and Wang, 2011 [48]; Lau, 2013 [38]; Lau and Chiu, 2013 [75]; Li and Liu 2017 [58]; Bi et al. 2019 [59]; Cao and Hickman, 2019 [73]; Lau, 2020 [23]; Tao et al., 2020 [74]; Zhao and Cao, 2020 [63]
Access to essential services and facilities	Cheng et al. 2013 [12]; Li and Zhao, 2015 [31]; Wang et al., 2015 [80]; Xu et al., 2017 [81]; Xiao et al., 2017 [82]; Tu et al., 2018 [83]; Xiao et al., 2018 [76]; Cao and Hickman, 2019 [73]; Zeng et al., 2019 [51]; Cao and Hickman, 2020 [77]; Du et al. 2020 [22]; Lau, 2020 [23]; Liu et al., 2020 [78]; Wang et al., 2020 [52]; Wu et al., 2020 [24]; Zhao et al., 2020 [79]
Health and environment issues	Zhou et al., 2013 [43]; Cheng et al., 2013 [12]; Guo et al., 2018 [20]; Wang et al., 2019 [44]; Weng et al., 2019 [84]; Zhao et al., 2018 [85]

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