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# **Inequalities in the commuting burden: Institutional constraints and job-housing relationships in Tianjin, China**

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## **Abstract**

Encouraging transport equality is vital in order to create a liveable city. However, the burden of commuting has become a key concern in urban areas, particularly in developing countries. Inequalities in the commuting burden are accompanied by inequalities in housing and employment, because these institutions have a significant impact on individuals' choices of accommodation and jobs, thus shaping commuting behaviour and causing imbalances in job-housing relationships. Therefore, this paper aims to analyse the role of employment and housing system constraints in the unequal commuting burden by using Tianjin as a case study. The results of the study show that the effects of institutional factors, such as Hukou and the Danwei system, help to explain imbalances in the job-housing relationship and the unequal commuting burden. Some commuters are employed by Danweis or have Tianjin Hukou, and can, therefore, live in Danwei housing, which means that Danweis provide effective solutions for some people in terms of their accommodation, enabling them to significantly decrease the time they spend commuting. Moreover, our study provides new evidence that institutional barriers constrain the job-housing balance in the case of high-skilled immigrants, while local residents and low-skilled immigrants can avoid institutional barriers by returning to Danwei housing and choosing to live in informal housing. In terms of suggesting measures for improving commuting inequalities, commuters generally wanted to eliminate the housing benefits resulting from the legacy of the Danwei system and for equal housing subsidies to be implemented. At the same time, they appealed for improvements to be made in terms of housing benefits, the quality of public transport and mixed housing-workplace planning. This study finds that institutional discrimination causes social inequalities in relation to the commuting burden, which could continue to worsen unless the influence of institutional factors is eliminated. The findings could be used to assist planners and decision makers in developing effective strategies to promote sustainable urban development.

## **Keywords**

Transport inequality; Transport policy and governance; Institutional constraints; Commuting burden; Job-housing relationship; Tianjin

## **Highlights**

- A combination of quantitative and qualitative approaches is used to explore inequalities in the commuting burden.
- The institutional factors of the Danwei and Hukou systems constitute significant institutional barriers.
- Certain social groups have had to take on a disproportionate share of the commuting burden.
- Local residents have reduced their commuting burdens by returning to live in Danwei housing.
- Low-skilled immigrants rely on informal housing and jobs to improve their job-housing relationships.

## 1. Introduction

Individuals have a fundamental right to choose where to live and work (Gobillon, Selod & Zenou, 2007). Commuting gives people more choice about where to live and what jobs to do (Kawabat & Shen, 2007; Nordbakke, 2013). However, the quality and accessibility of commuting services varies from places to place, so, in reality, not everyone has equal access, and, under some circumstances, certain groups are denied this basic right (Button, Nijkamp & Rietveld, 2004; Heinen, Van Wee & Maat, 2010). Concerns about transport equity have become increasingly pressing in recent years (Attard, 2020; Banister, 2005; Cao & Hickman, 2019a; Cuthill et al., 2019; Oviedo & Dávila, 2016; Lucas, Martens, Di Ciommo & Dupont-Kieffer, 2019; Martens, 2017), and achieving equality with respect to commuting is one of the main challenges. Externalities created by commuting inequalities include serious environmental pollution, increased traffic accident mortality and high household travel expenses (Attard, 2020; Banister, 2005; Cao, Chen & Hickman, 2017; Cao & Hickman, 2018; Haas, Morse, Becker, Young & Esling, 2013; Hickman & Banister, 2014). Commuting behaviours and patterns have been studied intensively by researchers in order to try to reduce commuting distances and time (Banister, 2002; Newman & Kenworthy, 2007). Novaco, Stokols and Milanesi (1990) also asserted that certain groups had to shoulder an unfair proportion of the commuting burden.

Vulnerable and socially disadvantaged groups often suffer from a spatial mismatch between housing and job location, resulting in an unequal commuting burden (Cho-yam Lau, 2011; Horner & Mefford, 2007; Houston, 2005). Previous studies have explored factors that have an impact on this, such as income, gender, and the built environment (Cao, Mokhtarian & Handy, 2007), technology, and travel attitudes (Handy, Cao & Mokhtarian, 2005). Moreover, institutional factors also contribute to the unfair commuting burden (Gordon, Kumar & Richardson, 1989; Pinto, 2002; Zhao, 2015). Institutional restrictions shape people's choices regarding which residential locations and jobs are available to them, and certain choices may result in significant inequalities in people's commuting burdens (Pinto, 2002). Gordon, Kumar and Richardson (1989) also pointed out that government intervention prevented individuals from choosing freely where to live and work and also from achieving a better job-housing balance.

Previous studies have provided evidence of inequalities in the commuting burden of developed countries (Banister, Watson & Wood, 1997; Cao & Hickman, 2019b; Musterd & De Winter, 1998; Taylor & Ong, 1995). However, the situation is even worse in developing countries where housing and mobility institutions may contribute to the unequal commuting burden, particularly in countries that are undergoing a social transformation from a planned economy to a market-oriented economy, such as China (Kim, 2008; Pucher, Peng, Mittal, Zhu & Korattyswaroopam, 2007). In China, individual opportunities and rights are determined by Hukou (a type of household registration systems that operates in mainland China) and Danwei (the name used to refer to a work unit or workplace in mainland China), which may limit the

free choice of housing and workplaces for some social groups, thus creating an unequal commuting burden (Wang & Yao, 2018; Zhang, He & Zhao, 2018; Zhao, 2015). Hence, the unique institutions of Hukou<sup>1</sup> and Danwei<sup>2</sup> have excluded some groups from the labour and housing markets in China (Zhao, 2015). Zhao, Lu and Roo (2011) claimed that commuters living in the Danwei community were closer to their workplace, and so their commuting time was shorter. The Hukou system also determines who can enjoy the housing and employment benefits provided either by companies or by the government, thus influencing their commuting patterns. Consequently, the Hukou system can make it even more difficult for socially vulnerable groups to obtain jobs and housing (Zhao, Lu & Roo, 2011). This research uses a case study of Tianjin, which has a relatively stringent Hukou system and a strong tradition of Danweis (Chai, Liu, Li, Gong, Shi & Wu, 2002), resulting in an unfair situation that makes it very difficult for some people to choose where to work and live (Zhao & Li, 2016).

Previous studies have discussed the influence of institutional factors on individual commuting burdens in China (Li & Liu, 2016; Wang & Chai, 2009; Zhao & Lu, 2010). However, the relationship between institutional restrictions and individual commuting burdens – meaning that institutional factors may have different effects on different social groups – has been overlooked. Moreover, there is still a need to study how individuals deal with institutional constraints when making decisions about their job-housing balance, as well as the measures that need to be implemented from the perspective of commuters to improve the current unequal commuting burden.

Therefore, this study aims to address the aforementioned gaps by exploring how institutional restrictions result in unequal commuting burdens using Tianjin as a case study. Multiple linear regression models were applied to identify institutional factors that explain the variations in workers' commuting burdens. In addition, semi-structured interviews with commuters were conducted to explore the impacts of these institutional constraints on different social groups' choices of jobs and housing. In-depth interviews also helped to investigate which improvements commuters would like to make in order to tackle commuting inequalities. This research reveals the connection between institutional constraints and personal commuting dilemmas. In practical terms, it offers insights that can inform housing policies and labour mobility management systems with regard to commuting times, an essential step in helping transport researchers to develop effective strategies and commuters to reduce their commuting time and enjoy greater flexibility in choosing jobs.

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<sup>1</sup> Hukou is the Chinese household registration system. People who do not have Hukous are unable to enjoy the same benefits as those who do, such as buying property, applying for a car registration plate or sending their children to grammar schools, etc.

<sup>2</sup> Danwei provides an institutional context that integrates urban productive activities, the social infrastructure and housing within the same location. Under Danwei, workers can be provided with accommodation very close to their workplaces. Generally, Danweis are state-owned or collectively owned work units, including state-owned enterprises, government departments and public institutions.

The rest of the paper is divided into five sections: Section 2 critically reviews the existing literature in terms of the relationship between the job-housing balance and the commuting burden. It also investigates how institutional factors could impact on the commuting burden and whether there are other potential factors that could contribute to the unequal commuting burden. Section 3 describes the data and methodology. Following that, Section 4 presents and discusses the findings. Finally, Section 5 summarises the research and suggests policy implications.

## **2. Institutional constraints, the commuting burden and transport inequality**

Commuting refers to the process whereby workers travel between their residence and workplace, and the time spent commuting can have a major impact on people's quality of life, because commuting can use up valuable time that could otherwise be spent relaxing, with family or friends, or doing other leisure activities (Garceau, Atkinson-Palombo, Garrick, Outlaw, McCahill & Ahangari, 2013; Hamilton & Burnett, 1979; Hamilton & Roell, 1982). Additionally, commuting is regarded as paramount on the social equality agenda (Schleith & Horner, 2014), because it is the main way in which people can lift themselves out of poverty and access jobs (Burchart, Le Grand & Piachaud, 2002).

However, when commuting becomes a burden that affects the quality of life (Novaco, Stokols & Milanesi, 1990), it consumes personal resources, especially time, money and energy (Ong & Blumenberg, 1998). This is because excessive time spent commuting and monetary costs limit the amount of resources available to disadvantaged groups for leisure and other pursuits (Church et al., 2000). In addition, commuting inequalities can shorten the path that leads to social exclusion (Church, Frost & Sullivan, 2000; Lucas, Grosvenor & Simpson, 2001), because they impede people's access to opportunities (Oviedo & Titheridge, 2016). Therefore, the differences between various social groups in terms of commuting burdens highlights the need for greater commuting equity (Litman, 2014). Reducing the commuting burden has become a key issue in the development of sustainable transport systems (Banister, 2005; Banister, Waston & Wood, 1997; Yang, 2020).

This study used time costs rather than financial or energy costs as a measure of the commuting burden in Tianjin, because the Tianjin municipal government heavily subsidises transport fares, which makes the financial cost of commuting relatively cheap and affordable. Therefore, commuting time is a more reliable and appropriate indicator of the commuting burden, at least in the context of Tianjin.

### *2.1. Social constraints on job-housing relationships*

A wide range of factors have contributed to the growth of the commuting burden, such as rapid urbanisation, sustained population growth, changes in land use, deficiencies in the transportation infrastructure and weak regulatory institutions (Gordon, Richardson & Jun, 1991; Lim et al., 2015; Pucher, Peng, Mittal, Zhu & Korattyswaroopam, 2007; Shen, 2000). In particular, many studies have emphasised that socio-economic demographics influence inequalities in the commuting burden. Preston and McLafferty (2016) found that socio-economic characteristics can significantly affect the job-housing balance and help to explain commuting inequalities. For example, workers' commuting times can be affected by their level of household income, which in turn has an impact on where they choose to live and what kind of commuting patterns they can afford (Giuliano & Small, 1993; Sanchez, Shen & Peng, 2004; Vandersmissen, Villeneuve & Theriault, 2003). Due to rising land prices in the city centre and suburbanisation (Zhang, He & Zhao, 2018), some low-income households have had to relocate to the suburbs, further away from their workplaces (Sanchez, Shen & Peng, 2004). Unfortunately, the high price of cars and the insufficient provision of public transport services in suburban areas has aggravated the commuting problem for these residents (Cervero & Duncan, 2006; Currie, 2010). In addition, workers' occupations also have an impact on commuting times. Stead, Titheridge and Williams (2000) noted that workers with a high level of technological skills who were employed in professional or managerial work had a lesser commuting burden than those who worked in low-tech careers. Additionally, socio-economic demographic factors, such as gender, also play a role in the unequal commuting burden (Rapino & Cooke, 2011).

### *2.2. Institutional constraints on job-housing relationships*

In addition to social constraints, institutional factors also have an influence on workers' job-housing balance, and consequently their commuting burdens (Downs, 1992; Gwilliam, 2003; Levinson & Kumar, 1994). Cervero (1989) claimed that institutional factors could significantly affect the job-housing balance and cause commuting inequalities. Institutional factors refer to a set of socio-economic norms and rules that clarify individual rights and access to opportunities. A better job-housing balance can only be achieved when workers are free to choose where they want to live (Daniels & Cervero, 1990).

Institutional factors, including housing supply (Maat, Van Wee & Stead, 2005; Oswald, 1999), labour mobility management, and labour market restrictions (Crampton & Simpson, 1993; Dubin, 1991; Hamilton, 1982; Pan et al., 2020), significantly affect commuting burdens by influencing the time spent commuting, especially in the case of transitional countries whose governments maintain a strong element of planning controls, such as China (Yang et al., 2019; Zhao & Lu, 2010). In China, discrimination in the housing and labour markets determines which vulnerable groups are most affected by the burden of commuting (Zhao &

Howden-Chapman, 2015). Under the combined influences of the planned economy and the market-oriented economy, some groups enjoy certain advantages in terms of employment and housing (Hu, 2016; Zhao, 2015). However, this has hindered the freedom of choice of many vulnerable groups in relation to jobs and housing. The unequal commuting burden is largely due to the unfairly biased housing supply system and labour mobility policies in urban China (Hu, Fan & Sun, 2017; Zhao & Lu, 2010).

### *2.2.1. Housing institutions: Danwei and housing provident fund (HPF)*

In China, housing is provided to employees by Danwei as a form of social welfare (Zhao & Lu, 2010). Before the 1980s, the Chinese government normally assigned jobs to people, so workers would go to self-contained Danweis which provided them with housing free of charge. Under these circumstances, the job-housing relationship was generally good, with workers having only short commuting times, because the social infrastructure and housing were built around the production activity area under the Danwei system (Zhao, Lu & Roo, 2011). However, since the 1990s, people have increasingly had to move out of the housing provided by Danweis and purchase private apartments as a result of the housing reforms that have been implemented during this time. Unfortunately, private housing and workplaces are not normally located close to each other. Therefore, this has had an adverse effect on the job-housing balance for workers. Although some of the Danweis were reorganised into private companies during the period of market economy reforms, the remaining Danweis continued to provide housing subsidies and allocated housing to employees near their workplace (Wang & Chai, 2009; Wu, 1996; Zhao & Li, 2016). The older generation of workers who formerly worked in the Danweis were able to benefit from this reform by buying relatively affordable housing from their Danwei in the inner city area (Zhang, He & Zhao, 2018). Therefore, they could live close to their work place which meant they had a shorter commuting time. After the housing reform of 1998, Danweis no longer constructed housing for employees (Ta, Chai, Zhang & Sun, 2017). As a result, younger workers were unable to maintain and benefit from the Danwei-based job-housing relationship and therefore had to buy private properties. In contrast to the former system, there is now no direct spatial relationship between the location of the housing provided by a private developer and the location of the owner's workplace (Zhao, 2015). Therefore, younger workers have suffered due to the effects of job-housing separation. Additionally, China's dual-track HPF has exacerbated this inequality in the housing system. In the early 1990s, China's previous housing welfare system evolved into the HPF, which means that employees deposit a percentage of their wages into a state-managed personal housing fund account, while their employer also pays the same amount into the employee's housing allowance account (Hassard, Morris, Sheeham & Yuxin, 2006; Yeung & Howes, 2006). However, Danweis usually have a higher deposit, because there are no mandatory regulations regarding the amount (Chen & Deng, 2014). In contrast, private companies often try to keep the deposit to a

minimum in order to save on labour costs. As a result, workers in Danweis are more likely to receive higher housing deposits which makes it easier for them to purchase properties (Zhao, 2015). In this regard, even in a market-based housing system, non-Danwei workers who are looking for cheaper housing, usually away from their workplace, are at a disadvantage because of the low level of housing affordability caused by the HPF system (Zhang, He & Zhao, 2018). Therefore, the HPF system plays a part in increasing commuting inequalities.

### *2.2.2. Labour mobility institutions: Hukou*

In addition to the unfair housing system, labour mobility institutions also cause severe inequalities in terms of residential and job-mobility in China. In order to manage labour mobility, Hukou emerged as an important means of controlling population movement, during the planned economy era. This is a labour market system unique to China, which can have consequences for the accessibility of opportunities (Zhao, Lu & Roo, 2011). Since the relaxation of control over rural labour mobility in the 1990s, the legacy of this system has served to maintain social inequalities, especially for immigrants without local urban Hukou. Attracted by job opportunities, rural and low-skilled immigrants migrate to cities. However, limited by the Hukou system, these immigrants are generally excluded in their place of residence, including public services and housing welfare (Zhao & Howden-Chapman, 2010). A large number of immigrants creates a huge demand for low-rent housing. In this context, urban villages have played an active role in providing low-rent housing for rural migrants in the central area (Liu, He, Wu & Webster, 2010). Most urban villages are constructed by local landless farmers, as the process of urban expansion has encroached upon surrounding villages and generally involves the requisitioning of farmland by the city government. Thus, some villagers have lost their farmland as a result, and with it their main source of household income, although they still retain the use rights of their houses and a certain amount of land that is collectively owned. In some cases, villagers have not received adequate compensation for the loss of their farmland, nor sufficient social welfare support. Consequently, they needed to find alternative sources of income. Therefore, taking advantage of a high demand for housing and relatively low construction costs, they have built high-density housing with poor ventilation and lighting, from which they can earn rental income (Zhang, Zhao & Tian, 2003). Landless villagers are disadvantaged in the labour market because of their limited skills, and rental income can contribute a large proportion of their household income, even though rents are quite low. Due to the concentration of immigrants in urban villages, low-end commercial services for immigrants and low-income groups have been catalysed, thereby providing a source of informal jobs, particularly for immigrants (He, Liu, Webster & Wu, 2009). Although rural and low-skilled immigrants only have limited choices of employment and housing locations, the existence of informal housing and jobs helps migrants to achieve a relatively good job-housing balance (Hu, 2016; Zhao, 2015).

Moreover, few companies are willing to provide housing welfare for immigrants (Fan, 2001; Ma, 2004), meaning that they can only afford to live in cheaper housing in the suburbs, while residents with a local urban Hukou generally live in the more central areas of the city where most employment centres are located (Zhao, 2015). As a result, these immigrant workers are more likely to have to use poor quality transport services resulting in longer commuting times. This is certainly the case in Tianjin, where more than 35% of the working population are immigrants (Tianjin Municipal Statistics Bureau, 2019). They are therefore more likely to experience unequal treatment in terms of employment and housing (Zhao, Lu & Roo, 2011). Some Danweis believe that hiring immigrants who do not have Tianjin Hukou involves higher risks. Nonetheless, there are still some policies designed to encourage the provision of lower-cost social housing near employment centres to reduce housing and commuting burdens (Tianjin Urban Planning and Design Institute, 2016). For example, in 2015, 1.4 million square metres of low-cost rental housing and 1.54 million square metres of affordable housing was built, which has played an active role in improving the job-housing balance and reducing the commuting burden. However, the policy is primarily aimed at workers with Tianjin Hukou, so the housing is often beyond the reach of those without Tianjin Hukou.

### *2.3. Improving the unequal commuting burden*

Having recognised that the housing supply and management of labour mobility have a substantial impact on workers' commuting times, governments and organisations have made efforts to reduce the unequal commuting burden, for example by increasing public transport operating hours, reducing fares and providing commuting subsidies (Hine, 2003; Lucas & Jones, 2012; Lucas & Stanley, 2009). Some researchers believe that the use of spatial planning to achieve mixed land use can help to curb the increase in commuting burdens, particularly those faced by low-income people in developing countries, thereby promoting commuting equity (Burton, 2000; McCahill, 2018). This is because the local job-housing balance and land use diversity are strongly associated with commuting times for people on low incomes (Cervero, 1996; Cervero, 1991; Schleith & Horner, 2014). In practice, the targeted development of employment is aimed at helping residents in low-income communities find jobs near their community, which can also reduce the commuting burden.

However, studies have paid little attention to institutional innovation. Given that the impact of institutional factors on commuting time has been recognised, it would be useful to develop innovative policies aimed at improving job accessibility (Healey, 2006). In China, attempts are being made to reform housing and labour mobility institutions. The relaxation of the Hukou system is conducive to significantly increasing labour mobility. Moreover, it also increases the range of employment locations available to immigrants without urban Hukou immigrants (Zhao, Lu & Roo, 2011; Bray, 2005). The dismantling of the Danwei system's

legacy has increased the demand for labour, which may have a substantial knock-on effect on workers' access to employment opportunities (Zhao, 2015). Additionally, recent market-oriented housing reforms have gradually broken the traditional relationship between job and housing locations (Bray, 2005). However, Zhang et al. (2018) claimed that high-priced commercial housing has replaced the original low-cost buildings in the city centre, and so most workers have to find low-cost housing in the suburbs. The nature of the housing market thus leads to job-housing imbalances, which in most cases increase commuting time. Therefore, in the context of China, the abolition of the Danwei housing legacy may require other supportive and complementary measures to be put in place.

#### *2.4. Research gap*

Although efforts have been made to explore the effects of Hukou and the legacy of the Danwei system and their influence on commuting burdens in China, following the housing reforms, the new institutions have also had an influence on different social groups' ability to buy housing. Thus, workers' job-housing relationships are being shaped in new ways in the post-reform era. Some of the changes brought about by housing policy reforms may have made the situation worse, resulting in greater inequalities in terms of workers' commuting burdens. However, some studies have shown the opposite, namely that workers who work outside the Danwei system do not experience heavy commuting pressures (Li & Liu, 2016), because informal housing in urban centres, such as basements, is affordable for workers if they are not particularly concerned about housing quality, which means they can live closer to job opportunities. As can be seen from the previous literature, it is difficult to reach a firm conclusion about the impact of institutional factors on the commuting burden.

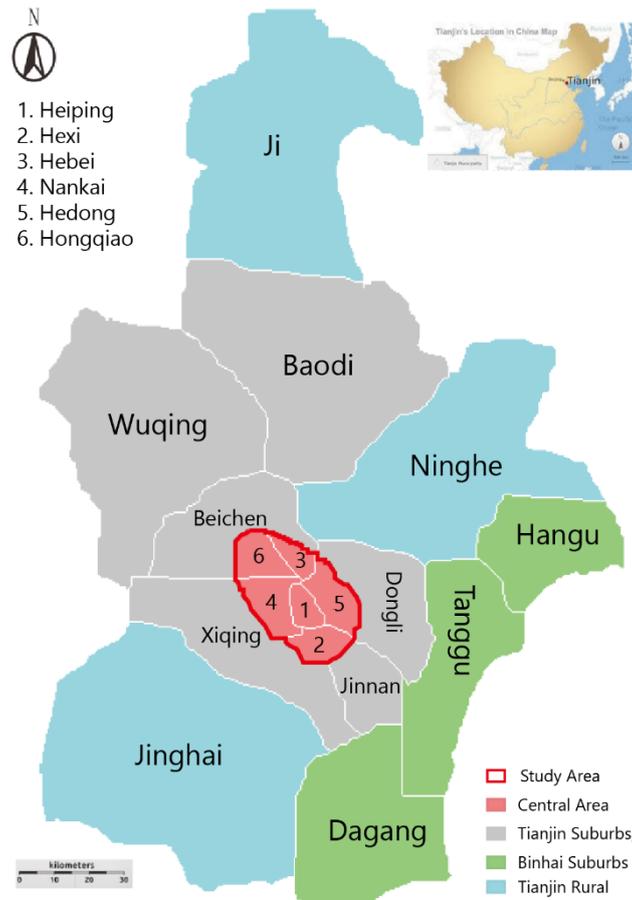
Additionally, in order to reduce the unfair commuting burden, action can be taken to improve the transport infrastructure, increase commuting subsidies, use spatial planning to encourage mixed land use and promote institutional innovations. The vast majority of commuting activity is undertaken by workers, and therefore their views are very important. Thus, this research aims to find out which measures commuters think would be most effective in improving commuting efficiency.

In order to resolve disputes and fill the gap in the previous literature, this study places the discrimination inherent in the labour and housing systems at the forefront of its analysis of commuting inequalities. By comparing the commuting burden of workers inside and outside of Danweis, and of workers who do and do not have Hukou in Tianjin, this paper aims to resolve existing disputes about identifying which commuting groups are most vulnerable to the influence of institutional factors. It also explores what improvements could be made to reduce the commuting burden from the perspective of commuters.

### **3 Data and methodology**

#### *3.1. City context*

This paper uses Tianjin as a case study, which is a municipality directly under the control of the Chinese central government. The study area is the city's main employment area (Tianjin Municipal Statistics Bureau, 2019), consisting of six administrative districts, namely Heping; Hebei; Hongqiao; Nankai; Hexi; and Hedong (Figure 1). Tianjin is a suitable case study for this research due to the following reasons. First, the commuting burden of residents in Tianjin has increased dramatically during the past few years. The one-way average travel pass for the administrative district covers a distance of 9 km and the time that it takes to cover this administrative area is 40.3 minutes (Baidu Map, 2019). Tianjin Municipal Statistics Bureau (2019) has shown that most opportunities are distributed within the study area, which comprises the six districts of the city centre; however, the population of the six central districts accounts for only one-third of the total population of Tianjin. Second, similarly to Beijing, in comparison to some other Chinese cities, such as Xian and Dalian, Tianjin has a relatively stringent Hukou system (Li & Chai, 2000; Zhou, Murphy & Long, 2014). In Tianjin, most regional governments have quite strict rules and regulations for obtaining local Hukou status, as there is a set quota for how many people it can be granted to. For example, the Hukou quota for 2019 was only 20,000 (Tianjin Development and Reform Commission, 2019). Additionally, as one of the four municipalities directly under the control of the central government, Tianjin has many Danweis, comprised of municipal institutions, state-owned enterprises and national public institutions, which obtain more housing benefits through their political influence. As a result, institutional restrictions on employment and housing have caused some groups to bear an unequal share of the commuting burden.



**Fig. 1** Case study map of Tianjin

### 3.2. Data and methodology

This study used a self-completion survey to clarify the impact of institutional factors on workers' job-housing balance, and semi-structured interviews to gain insight into this issue from commuters' perspectives. The survey method has the advantage of being able to generate a rich and detailed data set on individual cases about their commuting characteristics. This survey was carried out using the face-to-face method from May to August 2019. A total of 400 valid samples were received, and the population distribution (Tianjin Municipal Statistics Bureau, 2019) was used as the probability weight to determine the number of respondents selected from the six districts (Table 1). In terms of the data collection, the percentage of residents from each administrative district in our sample who completed the survey broadly corresponded to the percentage of permanent residents percentage in each district. A random sampling approach was used (Bryman, 2016).

**Table 1**

Population and sample size of the six districts (adapted from Tianjin Municipal Statistics Bureau, 2019)

Administrative districts	Permanent residents (10,000 persons)	Permanent residents percentage	Sample size (n = 400)	Sample percentage
Nankai	114.16	23.50%	94	23.50%
Hexi	98.92	20.35%	81	20.25%
Hedong	97.28	20.02%	80	20.00%
Hebei	88.94	18.31%	73	18.25%
Hongqiao	56.50	11.63%	47	11.75%
Heping	30.07	6.19%	25	6.25%

A multiple linear regression was applied to examine the association between the commuting time and possible impact factors, because this method has been used in other similar transport-related social inequality studies, for example by Zhang, He & Zhao (2018), and Zhao, Lu & Roo (2011). Based on the results of the survey, the multiple linear regression revealed the impact of the institutional factors on respondents' commuting time. The workers' commuting time is defined as a dependent variable, while institutional factors, including socio-economic characteristics and transport modes, are defined as independent variables. Housing sources and housing ownership were chosen to demonstrate the influence of institutional factors on the housing supply and markets. The employment sector and Hukou status were used to reflect the institutional factors associated with labour mobility management. The following section shows the estimated equation (1), while Table 2 lists the variables, with each variable recoded into a dummy variable before the model was run.

$$Y_i = \alpha_0 + \alpha_1 G_i + \alpha_2 I_i + \alpha_3 E_i + \alpha_4 HS_i + \alpha_5 ES_i + \alpha_6 O_i + \alpha_7 HSS_i + \alpha_8 HO_i + \alpha_9 HK_i + \alpha_{10} T_i + \varepsilon$$

(1)

$$i=1, \dots, n \ (n=400)$$

Where:

$\alpha_0, \dots, \alpha_{10}$  are the estimated coefficients;

$Y_i$  is the daily commute time of worker  $i$ ;

$G_i$  is the gender of worker  $i$ ;

$I_i$  is the income of worker  $i$ ;

$E_i$  is the educational attainment of worker  $i$ ;

$HS_i$  is the household structure of worker  $i$ ;

$O_i$  is the occupation of worker  $i$ ;

$ES_i$  is the employment sector of worker  $i$ ;

$HSS_i$  is the housing source of worker  $i$ ;

$HO_i$  is the housing ownership status of worker  $i$ ;

$HK_i$  is the Hukou status of worker  $i$ ;

$T_i$  is the transport mode of worker  $i$ ;

$\varepsilon$  is the random error.

**Table 2**

Description of the variables

Variable type	Name of variables	Value and description
Socio-economic characteristics	<i>Gender</i>	=1 If male
	<i>Age</i>	Continuous variable
	<i>Monthly income</i>	
	Low income	=1 If monthly income less than 2,000 RMB
	Middle income	=1 If monthly income between 2,001 and 7,000 RMB
	High income	=1 If monthly income higher than 7,000 RMB
	<i>Educational attainment</i>	
	Bachelor, Master, Doctorate	=1 If worker has bachelor, master or doctoral degree
	Junior college diploma, high school diploma and below	=1 If worker has junior college diploma, high school diploma or below
	<i>Household structure</i>	
Single	=1 If single	
Sharing housing with others	=1 If cohabiting	
Nuclear family	=1 If nuclear family	
Institutional factors	<i>Employment sector</i>	
	Party authority, government and public institutions	=1 If worker is employed by party authority, government or public institutions
	State-owned enterprise	=1 If state-owned enterprise
	Joint venture, private enterprises and enterprises funded by foreign direct investment	=1 If joint venture, private enterprises or enterprises funded by foreign direct investment
	Self-employed and others	=1 If self-employed or others
<i>Occupation</i>		
Low-skilled work	=1 If low-skilled work	

	Middle or high-skilled work	=1 If middle or high-skilled work
	Public officer	=1 If public officer
	<i>Hukou status</i>	
	Household with Tianjin Hukou	=1 If household with Tianjin Hukou
	Household with urban Hukou issued in other cities	=1 If household with urban Hukou issued in other cities
	<i>Housing source</i>	
	Owned or rented by Danwei	=1 If Danwei owned or rented
	The housing is not owned or rented by Danwei (for example, housing from private developers, from a housing bureau, resettlement housing, etc.)	=1 If the housing is not owned or rented by Danwei (for example, housing from private developers, from a housing bureau, resettlement housing, etc.)
	<i>Housing ownership</i>	
	Housing owned	=1 If housing owned
Transport mode	Walking or cycling	=1 If walking or cycling
	Public transport (Public bus, Danwei bus and subway)	=1 If public transport mode (Public bus, Danwei bus and subway)
	Car (private car or vehicles provided by Danwei)	=1 If car (private car or Danwei car provided by work unit)

The Hukou and Danwei systems in Tianjin have a significant influence on residents' access to work, vehicles and other social resources, which in turn restricts some of their life choices. Among these choices, their job-housing relationship is the result of intricate and diverse negotiations. Individual privilege or marginalised status as a result of institutional arrangements leads to unequal commuting burdens. In terms of the qualitative method applied, this study used semi-structured interviews, which involved asking a series of relatively flexible questions (see Appendix A), to examine the impact of social, family and environmental factors on commuting behaviour and to understand the issue from the viewpoint of commuters. Semi-structured interviews were conducted via telephone or internet voice calls with 36 respondents who agreed to take part in further interviews after completing the questionnaires. After examining the socio-economic characteristics of the respondents, 15 respondents were selected for the interviews. The interviews were carried out between September and December 2019, and each of the interviews lasted between 45 and 90 minutes. The sampling process used for the semi-structured interviews ensured that all social groups (in-system workers versus out-system workers, Danwei house dwellers versus commercial housing owners, Tianjin Hukou holders versus non-Tianjin Hukou holders) were included. Therefore, this method was used to collect responses to questions about different social groups' employment and residence options as well as their strategies for tackling the commuting burden and institutional barriers.

## 4 Findings and discussion

### 4.1. Institutional factors resulting in commuting inequalities

As shown in Table 3, 52% of the respondents were male and 48% were female, while 65% of the participants were between 20 and 35 years old. Over half of the participants had an income level in the middle to high bracket (4500-7000 RMB<sup>3</sup>). Moreover, 60% of them lived with their partners and children. In terms of Hukou, 55% of respondents had Tianjin Hukou. In addition, only 35% of respondents lived in houses provided by Danweis. In terms of their employment sectors, 59% of respondents worked in the private sector or were self-employed, and 41% worked in Danweis.

The results show a significant difference in the average commuting time between people depending on their various socio-economic characteristics. Females had a shorter average commute time than males. The average commute time for Tianjin Hukou holders was shorter, at 25 minutes, than that of the non-Hukou holders. In addition, immigrants had a longer commuting time than local residents, which can be explained by the restrictions faced by immigrants that make it difficult for them to buy apartments in more central areas of Tianjin. Regarding differences in commuting times between employment sectors, the commuting times of employees working for government departments and state-owned enterprises were shorter than those of other commuters. In terms of housing, predictably the commuting times for people who do not live in Danwei housing were longer than those who do, as Danwei housing is located close to the workplace, thereby significantly reducing commuting time.

**Table 3**

Descriptive statistics

Variables	Classification	Percentage (%)	Average commuting time (minutes)
Gender	Female	52	43
	Male	48	46
Age	20-35	65	48
	36-50	30	40
	>50	5	27
Monthly income (RMB)	<2000	1	30
	2000-4500	14	47
	4501-7000	54	48

<sup>3</sup> 1GBP ≈ 9 RMB

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	>7000	31	38
Educational attainment	Bachelor, Master, Doctorate	62	47
	Junior college diploma, high school diploma and below	38	41
Household structure	Single	16	40
	Cohabiting	22	49
	Nuclear Family	60	44
	Other	2	43
Hukou status	Household with Tianjin Hukou	55	33
	Household with urban Hukou issued in other cities	45	58
Time living in Tianjin	Lived in Tianjin since childhood	52	33
	Moved to Tianjin aged between 1 and 17 years old	8	51
	Moved to Tianjin after adulthood	40	59
Housing source	Danwei owned or rented	35	30
	The housing is not owned or rented by Danwei (for example, housing from private developers, from a housing bureau, resettlement housing, etc.)	65	53
Housing ownership	Housing owned	78	40
	Other	22	56
Employment sector	Employed by party authority, government and public institutions	15	32
	State-owned enterprise	26	37
	Joint venture, private enterprises and enterprises funded by foreign direct investment	54	52
	Self-employed and others	5	41
Occupation	Low-skilled work	19	42
	Middle or high-skilled work	78	46
	Public officer	3	28
Transport mode	Walking or cycling	14	46
	Public transport mode (Public bus, Danwei bus and subway)	61	48
	Car (private car or Danwei car provided by work unit)	25	40

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In order to understand the underlying factors that influence commuting behaviour, especially how institutional constraints can cause inequalities in commuting burdens between different social groups, a regression model was constructed with commuting time as the dependent variable. Table 4 presents the regression analysis for workers' commuting time. According to Hair, Black, Babin & Anderson (2014), a high collinearity or multicollinearity exists between independent variables only when the VIF value exceeds 3. In Table 5, all the VIF values meet this requirement, which indicates that there is no collinearity between the independent variables. The regression results show that the adjusted R<sup>2</sup> value is 0.690, indicating that 69% of the variation in individual workers' commuting times can be explained by the independent variables in Table 4. The F value is 39.591 with a significance level of p<0.001, which indicates that the regression analysis is statistically significant, and the regression equation has a high degree of goodness of fit.

**Table 4**

Summary of results from regression models

	R	R square	Adjusted R square	Std. Error of the estimate	F	Sig. (p-value)
Regression model for workers' commuting time	0.841	0.708	0.690	0.275	39.591	p < 0.001

The following conclusions can be drawn from Table 5:

- Participants aged over 50 years old have shorter commuting times, of approximately 27.3% less than those of people aged 20-35;
- The commuting times of low-income workers are significantly higher than those of high-income workers;
- The commuting times of highly educated workers are 10.5% more than those with below degree level education;
- The commuting times of workers living in nuclear families are 21.7% higher than those of single workers;
- The commute times of people who purchased or rented apartments from Danweis are 29.9% less than those buying or renting private apartments;

- The commute times of workers employed by the government, public institutions and state-owned enterprises are significantly less than those of workers not in the Danwei system; medium- or high-skilled workers have 1.2 times longer commute times than low-skilled workers;
- Workers who drive to work have shorter commute times than people who walk or ride manual or electric bicycles to work.

**Table 5**

Regression analysis results

Independent Variables		Coefficients	SE	VIF
Constant		3.550***	0.081	
Gender (ref.: Male)	Female	-0.048	0.030	1.127
Age (ref.:20-35)	35-50	-0.029	0.035	1.306
	>50	-0.273***	0.075	1.353
Monthly income (RMB) (ref.:>7000)	<2000	0.613***	0.170	1.143
	2000-4500	0.119**	0.051	1.640
	4501-7000	0.132***	0.035	1.502
Educational attainment (ref.: Junior college diploma, High school diploma and below)	Bachelor,	0.105**	0.033	1.285
	Master,			
	Doctorate			
Household structure (ref.: Single)	Cohabiting	0.211***	0.050	2.209
	Nuclear Family	0.217***	0.049	2.979
	Other	0.227**	0.106	1.306
Hukou status (ref: Household with urban Hukou issued in other cities)	Household with Tianjin Hukou	-0.234***	0.034	1.429
Time living in Tianjin (ref.: Lived in Tianjin since childhood)	Moved to Tianjin aged between 1 and 17 years old	0.143**	0.056	1.190
	Moved to Tianjin	0.261***	0.037	1.672

	after adulthood			
Housing source (ref.: The housing is not owned or rented by Danwei)	Buy or rent house(apartment) from Danweis	-0.299***	0.035	1.423
Housing ownership (ref.: Other)	Housing owned	-0.096**	0.047	1.896
Employment sector (ref.: Joint venture, private enterprises and enterprises funded by Foreign Direct Investment)	Employed by party authority, government and public institutions	-0.234***	0.050	1.587
	State-owned enterprise	-0.192***	0.036	1.298
	Self-employed and others	-0.042	0.074	1.237
Occupation (ref: Low-skilled work)	Middle or high-skilled work	0.200***	0.042	1.533
	Public officer	-0.048	0.100	1.540
Transport mode (ref: Walking or cycling)	Public transport mode (Public bus, Danwei bus and subway)	-0.017	0.044	2.349
	Car (private car or Danwei car provided by work unit)	-0.091*	0.051	2.502

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Note: \*  $P < 0.1$ ; \*\*  $P < 0.05$ ; \*\*\*  $P < 0.01$ .

The statistical analysis illustrates that institutional factors have a significant impact on the commuting time of workers, and workers employed in the Danwei system have significantly shorter commuting times than those who do not work in Danweis. Our findings echo those of previous research conducted by Zhao (2015). Typically, Danweis provide workers with free or low-cost housing, which is normally built on freely allocated land that was retained during the planned economy period, and thus at a low cost. Danwei workers and

their families have access to permanent housing rights. At the same time, the gap in housing subsidies between non-Danwei housing and Danwei housing has exacerbated the disadvantages faced by non-Danwei workers in the housing market. The financial allowance made available to Danwei workers from government revenues provides them with the highest housing subsidies. In the case of joint ventures, private enterprises and enterprises funded by foreign direct investment (FDI), employers may try to minimise their HPF contribution in order to reduce labour costs. Zhang, He and Zhao (2018) claimed that only 40% of out-system companies provided housing subsidies or pay HPF, while, in comparison, the amount of HPF received by staff within the system could be twice as high as staff outside the system. As a result, the commute times of Danwei workers are reduced, due to their relatively well balanced job-housing relationships.

Additionally, the type of housing that workers live in also influences their commuting time. People living in Danwei housing can significantly reduce the amount of time they spend travelling to work compared to people living in private commercial accommodation. This finding is in line with the study carried out by Zhao, Lu and Roo (2011). With the phasing out of the Danwei system and the government's promotion of a market-based housing supply, younger workers are unlikely to benefit from Danwei housing, and their commuting times have increased for ordinary workers. These findings may also indicate that employment mobility in the post-reform era is still limited. Despite China's transformation into a free labour market economy after 1998, a considerable number of workers over 50 continue to buy relatively affordable housing from their Danwei in the inner city, which has helped to maintain the existing job-housing relationship based on the Danwei system.

Whether workers have local Hukou also has a significant impact on their commuting times, which is consistent with the findings obtained by Zhao and Howden-Chapman (2010). Tianjin Hukou holders have shorter commuting times than residents without local Hukou, and the latter are constrained by their income levels, forcing them to find accommodation in the suburbs where prices in the informal housing market are lower.

In addition to institutional factors, other socio-economic factors also have an impact on workers' commuting times. First, our results show that middle- or high-skilled workers have longer commuting times than low-skilled ones, which can be explained by the fact that the latter have low sensitivity to commuting and housing conditions. Consequently, low-skilled workers usually find it easier to improve their job-housing relationships by living in informal housing, such as basement houses in the central area of the city (Li & Liu, 2016). Second, higher income workers tend to have longer commutes, which is in accord with Hu's (2016) research. This is because some higher-income households are more likely to choose high-quality homes in the suburbs, because they are more sensitive to the residential environment, but less sensitive to commuting burdens. Finally, it is easier for single workers to reduce their commuting time, because they do not have to consider the needs of other family members. Those workers who live with family members may decide to make

compromises regarding their job-housing balance, so that their partners can commute more easily. They also have more factors to consider if they have children, as they may need to find homes close to schools, hospitals and other social amenities.

Overall, institutional factors relating to Hukou, the housing supply and labour management have a significant impact on individual commuting times in Tianjin. Workers who hold Tianjin Hukou have shorter commuting times. People working in Danweis are more likely to live in the Danwei communities, which helps them to maintain a better job-housing balance, thus showing that the legacy of Danwei housing still has a major impact on reducing commuting times. Deficiencies in the market-oriented housing reforms mean that they have not been very effective in improving the job-housing balance, and therefore workers still have to endure long commutes. The dismantling of the Danwei system has had a major impact on people’s access to work by increasing labour mobility and the separation of jobs and housing (Bray, 2005).

#### *4.2. How commuters’ job-housing relationships are affected by institutional arrangements*

Although the regression results show the association between institutional factors and commuting time in quantitative terms, it is still unclear in what ways workers’ job-housing relationships are shaped by institutional constraints. In addition, even if institutional constraints affect the balance between jobs and housing, there are still things that can be done to reduce commuting times, such as implementing an effective commuting model, or moving to housing closer to one’s job. In order to further understand the implications of the regression results, semi-structured interviews were conducted to explore individual choices of work and residential locations under biased institutional arrangements, with a special focus on how workers achieve a balance between their jobs and residences, their attitudes towards Hukou and the Danwei system, and their strategies for dealing with the commuting burden and institutional barriers. Based on the socio-economic characteristics of the 15 respondents, which are shown in Table 6, three groups were identified to discuss the institutional barriers faced by different social groups and the factors that affected their job-housing relationships. Three main themes of the findings that emerged from the interviews are discussed below.

**Table 6**

Interview respondents

Group	Characteristics	Respondents
Local resident (A)	Working in Danwei, Buying Danwei house, Has Tianjin Hukou	A1, A2, A3
	Working in private enterprise, Buying Commodity house, Has Tianjin Hukou	A4, A5

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Highly-skilled migrant (B)	Working in Danwei, Buying Danwei house, Has Tianjin Hukou	B1, B2, B3
	Working in Danwei, Renting Danwei house, Has Tianjin Hukou	B4, B5, B6
	Working outside of Danwei system, Buying commodity house, Has Tianjin Hukou	B7, B8
Low-skilled migrant (C)	Temporary work, Renting house, Does not have Tianjin Hukou	C1
	Self-employed, Renting house, Does not have Tianjin Hukou	C2

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#### 4.2.1. Local residents are more likely to be able to reduce their commuting burdens

The results of the interviews showed that local residents with Tianjin Hukou have few institutional limitations, so they can maintain a better job-housing balance. They also prefer the free labour market, because of their Hukou status and identity as local residents of Tianjin, which makes it more difficult for immigrants when they come to the city and have to compete for jobs. One of the main reasons that this kind of employment discrimination occurs is the allocation of household quotas. The household quota mechanism requires employers to recruit more local residents if they want to obtain quotas (Wang & Yao, 2018). However, immigrants tend to go and work for foreign-funded enterprises or private companies after obtaining their Hukou because they pay higher wages, resulting in a loss of talent for local enterprises. As a result, local residents with Hukou tend to look for jobs nearer their homes, which gives them more flexibility in choosing careers and minimising the distance from they have to travel between their workplace and home, thereby reducing their commuting time. These findings are in line with those of Wang and Yao (2018) and Zhao and Lu (2010).

*“It is obvious that local residents have advantages in finding jobs. It is a trend for Danweis not to hire non-Tianjin Hukou workers. Some immigrants just want to get Hukous from the employers and then switch to high-paying jobs. Recruiting immigrants is very risky, and quotas for immigrants are also decreasing year by year.” (A1, Senior Official of Government, 50)*

Although most local residents purchased commercial apartments after the opening up of the housing market, the increased commuting burden and traffic congestion forced them to return to the former Danwei housing in many cases. For some older citizens who are aged over 50, the Danwei housing they obtained before the reform has helped them avoid spending unnecessary time commuting. Although the newly constructed commercial houses are of higher quality and more spacious than Danwei houses, they are often located in the suburbs, a long way from workplaces, public schools and hospitals. As a result, residents have returned to Danwei housing, because it offers an effective way to reduce commuting time, especially for families who have children.

*“I have a high-quality house in Hexi District, but my family and I still live in the house provided by the Danwei in Heping District, mainly because it is within walking distance of my workplace, instead of nearly 90 minutes of commuting*

*every day. At the same time, my child can receive a better education with much less commuting (most grammar schools are located in central areas).” (A3, Senior Manager of State-owned Enterprises, 44)*

It is easier for local residents with Hukou to achieve a better balance between their homes and workplaces because they have more flexibility. Without the constraints of Hukou, the preferential labour market conditions and the pooling of resources between family members help them to improve their job mobility and make a wide range of housing and employment options available to them. Danwei housing helps local young and middle-aged residents to live closer to the commercial centre of the city, effectively reducing their commuting time.

#### *4.2.2. Restrictions faced by highly-skilled immigrants to maintaining a good job-housing balance*

In the case of high-skilled immigrants, Hukou, the HPF and Danwei welfare systems shape their job-housing relationships. It is difficult for high-skilled immigrants to maintain a good job-housing balance, because they may need to work in a Danwei for a long time in order to obtain Hukou and effectively change their status from immigrants to local residents. Younger high-skilled immigrants are unable to live in apartments allocated by Danweis, because the system of Danwei housing construction and allocation has been phased out. In order to obtain Hukou and buy housing, immigrants have to make social security payments and pay personal income taxes in the long term, as well as find stable employment. People may not be completely free to change jobs if they want to retain these qualifications that will enable them to obtain Hukou in the long term, thus illustrating the negative impact of these institutions on employment and residential mobility for high-skilled immigrants. Hukou quotas, the HPF, and housing welfare have made it more advantageous for high-skilled immigrants who wish to settle down in Tianjin to find employment in Danweis. Clearly, there is a huge difference in the commuting burden between those who work in Danweis and those who do not.

*“Two years ago, I was unsure whether to work for the private sector or the government. The Hukou was provided by the Danwei with a long-term labour contract that did not allow me to change jobs. If I lose this opportunity, it will take me many years to get Hukou. Working in the government department, I can live in an apartment provided by Danwei, so that I have more leisure time after work rather than wasting my time on commuting.” (B4, Government Department Clerk, 28)*

For high-skilled immigrants who do not work in Danweis, the heavy commuting burden significantly reduces the time they have available for leisure activities, but it is difficult for them to resolve this problem by buying their own apartments due to the high costs. Therefore, they can only look for cheaper housing in the suburbs. This is consistent with the findings

obtained by Zhao and Howden-Chapman (2010) and Zhao (2015). The pressure on commuting and housing prices has led to a decline in the quality of life for highly skilled immigrants who work outside of Danweis, resulting in more people choosing to work in Danweis, as B7 explained:

*“I got the Hukou through the “Talent Plan”. Although I have a higher income, I still cannot afford a property worth millions of Chinese Yuan (RMB) in Heping district, which could cost me decades to pay the mortgage. High prices forced me to buy an apartment in the suburbs. I am always exhausted when I come back home at seven o’clock in the evening. Therefore, I plan to buy a car to save time by driving to work, but driving a car is also costly (e.g. car maintenance, petrol, insurance, and parking fees, etc.).” (B7, private company, 31)*

Most high-skilled immigrants want to settle in Tianjin, but it has become increasingly difficult for them to balance work and housing due to the employment discrimination created by the Hukou system, the housing reforms and high cost of housing, and access to social resources. The dual structure creates significant differences in the commuting burden between commuters inside and outside of the system, leading to an increasing number of high-skilled immigrants choosing to work within the system, so that they can get Danwei housing and adequate housing subsidies, thereby reducing their commuting burdens.

#### *4.2.3. Low-skilled immigrants are not as sensitive to institutional factors*

Generally speaking, low-skilled immigrants constitute a vulnerable group, because they are restricted by the Hukou system. Due to a lack of local Hukou and their low-income status, they are unable to access expensive private housing, social housing and Danwei housing. However, low-skilled immigrants are less likely to be restricted by the Hukou system in terms of trying to achieve a balance in their job-housing relationships for the following four reasons. Firstly, most low-skilled immigrants are self-employed or on temporary labour contracts, and so have more flexibility in choosing when and where to work. Moreover, the development that has taken place in the city has created many different types of service opportunities in a wide range of places. Additionally, the existing Danwei employment system and social policies for obtaining Hukou make it impossible for low-skilled immigrants without a university degree to obtain Hukou and buy property in Tianjin. Therefore, it may be the case that low-skilled immigrants cannot afford to care about these institutions. Finally, most low-skilled immigrants have to take relatively low-income jobs because they are disadvantaged in the labour market (Hine, Kamruzzaman, & Blair, 2012). A lot of them are engaged in the informal economy and are pushed into living in informal settlements (Liu & Wu, 2006; Wang, 2000). These workers are highly sensitive to commuting costs but less sensitive to housing conditions (Liu & Yan, 2007). As they have a strong motivation to find housing near their workplaces, informal types of housing in the central area, such as urban

villages, have become their main source of accommodation (Wu, 2006), which is illustrated by the following excerpts from C1 and C2:

*“I am a nanny in a family, taking care of their children. I can live in their homes on weekdays. At other times, I live in a basement in the neighbourhood community, where there are many people like me.” (C1, babysitter, 44)*

*“My husband and I run a breakfast eatery with mobile booth, so that we do not need to rent a place for work. We rent a basement to live in, but we have no plans to buy a house in Tianjin, because it is incredibly expensive. We need to save money and pay for tuition for our kids.” (C2, self-employed, 42)*

Low-skilled immigrants are more likely to be able to adjust their job-housing balance than high-skilled immigrants, because they do not need to settle down in Tianjin, which is why they are much less restricted by the housing and employment systems. Most low-skilled immigrants who are limited by their informal educational qualifications have no job security and a very low level of income (Oviedo & Titheridge, 2016). The issue is that low-waged workers may simply not have a choice about housing quality. Thus, they are forced to accept informal housing due to its lower land prices and rents (Oviedo & Dávila, 2016). Low-skilled immigrants tend to look for housing in the city centre where various opportunities can be found and high travel costs can be avoided, meaning that they often have to live in crowded, tiny and basic, but cheap, housing such as basements or informal housing, as long as they are close to the commercial centre. Although low-income workers can improve their quality of life by moving to formal housing in the suburbs, their commuting burden is increased because of insufficient public transport services (Oviedo & Dávila, 2016). In addition, their informal connections with employers also give them more flexibility in terms of where they work and changing jobs. However, they are excluded from the formal employment sector system.

As has been shown, institutional restrictions have a significant impact on the job and housing choices of the three social groups: local residents; high-skilled immigrants; and low-skilled immigrants. Specifically, local Tianjin residents who have Hukou or live in Danwei housing have shorter commuting distances. In addition, they are favoured by governments, institutions and state-owned enterprises. Despite the fact that they often have higher quality houses on the outskirts of the city, returning to residences provided under the Danwei system is a compromise strategy that many families use to reduce their commuting burden and make it easier and more convenient to get to work and other facilities in the city centre. High-skilled immigrants are limited by institutional barriers that make it difficult for them to achieve an optimal balance between work and housing. Although high-skilled immigrants are eager to work within the system, tightening immigration policies have increased discrimination, making it much more difficult for high-skilled immigrants to change their workplaces or residential areas. As a result, lengthy commuting times squeeze the amount of time they have available for relaxing or other leisure activities, so they tend to

work in institutions that provide good housing benefits (HPF) and buy cars, which are the primary methods that they use to try to adjust their job-housing relationships. On the other hand, low-skilled immigrants are less influenced by commuting burdens. Although informal employment and informal housing play a significant role in balancing the job-housing relationships of low-skilled migrants, this is at the expense of their housing quality and job security. Low-skilled immigrants are generally excluded from social welfare due to the institutional restrictions.

#### 4.3. Reducing the commuting burden from commuters' perspective

From the perspective of commuters, reducing inequalities in the commuting burden caused by institutional factors remains a key issue. The next section offers further discussion on what strategies can be adopted to relieve the commuting burden and what measures commuters can take to do so. Tables 7 and 8 summarise the support measures that commuters expect and the actual measures, respectively.

**Table 7**

Strategies that commuters expect in order to improve the commuting burden

Improvements	Vote rate (%)
Removing the legacy of Danwei housing welfare and equal housing subsidies (e.g. HPF)	58
Mixed planning of residential and work areas	55
Making commuting facilities more efficient (increasing public transport shifts and reducing public transport fares)	45
Providing commuting facilities	26
Relaxation of Tianjin household registration restrictions	17

**Table 8**

Current measures for reducing commuting time

Measures that commuters could take to reduce commuting time	Percentage (%)
Choosing public transportation (bus/subway) on direct route to workplace, avoiding transfers	19
Living close to workplace	18
Looking for a job near home	15

Cycling	13
Going to work earlier or later to avoid peak periods	12
Using mobile app to plan and avoid congestion (e.g. mobility as a service)	12
Choosing to drive on highway	6
Taking a taxi	5

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As can be seen from the survey results, commuters are aware of the longer commute times caused by institutional barriers and have been taking actions to try to address these issues. Regarding their preferences, most people think that the job-housing privileges resulting from the legacy of the Danwei housing welfare system should be revoked and the differences in the HPF and other implicit subsidies between Danweis and private companies should be minimised, in order to make housing more affordable. This is in response to the fact that housing supply and labour mobility are greatly influenced by established non-market institutions under the constraints of current housing and employment systems (Zhao & Lu, 2010). Therefore, people's capacity to make rational decisions about housing and employment locations is limited. Consequently, commuters are aware that institutional constraints influence their personal commuting times. However, they are not sensitive to the relaxation of the restrictions on applying for Tianjin household registration, which can possibly be explained by the fact that the current household registration system has existed in China for decades. It is not easy to change the status quo and to effectively reduce the commuting burden in the short term, because it takes a long time for reforms to be implemented and take effect. However, it is clear that a number of housing purchase and employment institutions related to household registration have a profound impact on the job-housing balance of vulnerable groups (Zhao & Howden-Chapman, 2010). In this regard, it is not possible for job-housing relationships to be improved by low-liquidity labour and housing markets.

The commuters' demands for reducing the commuting burden in the short term reflects their widespread desire for more efficient commuting facilities, such as increasing public transport operating times and reducing public transport fares. In terms of practical measures, they generally preferred modes of public transport that can take them directly to their workplace instead of routes requiring transfers, in order to save time. Some studies have claimed that this is the most convenient and effective way for commuters to reduce the commuting burden in the short term (Hine, 2003; Lucas & Jones, 2012; Lucas & Stanley, 2009). Additionally, commuters thought that better spatial planning would be another way to alleviate commuting inequalities in addition to institutional measures. This reflects the fact that some respondents favoured mixed planning for residential and work areas. McCahill (2018) pointed out that more spread out land use patterns contributed to increased commuting times. Some immigrants are more likely to support relatively mixed land use and proximity to

jobs and housing in order to achieve a better job-housing balance, according to the master plan published by the local government. In practice, they also often try to move to an apartment close to their workplace or seek jobs near their apartments. Building housing close to the commercial centre and improving the balance between employment and residential location are considered to be effective ways of reducing commuting costs and time (Schwanen, 2002; Zhao & Li, 2016). Moreover, Hu (2016) and Hu, Fan and Sun (2017) stated that governments needed to plan how to use land in appropriate locations in order to link disadvantaged households to economic opportunities, thereby helping to alleviate the deteriorating spatial mismatch faced by vulnerable groups.

To summarise, commuters consider eliminating inequalities in the commuting burden caused by institutions to be the most urgent priority. More specifically, they would like to see the legacy of the Danwei housing system eliminated and everyone given equal HPF rights. Traditional Danwei housing benefits some workers in the system. Ongoing market-oriented housing reforms have tended to reduce Danwei housing, while the amount of housing built by private developers has increased. In addition, commuters also thought that greater attention should be paid to mixed housing-workspace strategies and would like there to be an appropriate match between housing, jobs and workers' socio-economic characteristics. In practice, commuters also try to reduce the distance between home and their workplace by moving home or changing the location of their job. In general, although commuters prefer short-term measures, such as more convenient and affordable public transport, and reducing the spatial distance between their homes and workplaces, they also regard removing unreasonable institutional barriers and implementing rational planning as a way to improve the job-housing balance in the long run.

## **5 Conclusions**

Using Tianjin as a case study, this research has examined how institutional factors affect the job-housing relationships of individuals, and shown which groups are more disadvantaged by longer commuting times, resulting in transport-related social inequalities. The results indicate that the commuting burden is impacted by housing institutions, labour mobility institutions, and even the social welfare system. The impact of the Danwei and Hukou systems on job-housing relationships is an issue common to many Chinese cities. Workers have to endure a heavy commuting burden as a result of institutional restrictions, not only in Tianjin, but also in other Chinese cities, such as Beijing, Guangzhou, Dalian and Xian, etc. (Li & Chai, 2000; Liu & Huo, 2014; Zhao, 2015; Zhou, Murphy & Long, 2014). Because of these institutional barriers, different social groups have been unfairly restricted in terms of the extent to which they can improve their job-housing relationships.

As well as considering the impact of recent changes in the housing institutions, such as HPF, on the commuting burden, this study also addressed the contradictory and questionable results of previous literature by presenting evidence to show that the commuting burden is a result of institutional restrictions on job-housing relationships, and that inequalities are mainly

attributable to biased institutional arrangements. In addition, this research has also explored the attitudes and opinions of commuters affected by commuting inequalities regarding what they thought could be done to improve commuting conditions.

In previous studies, high-skilled immigrants are more likely to be high-income workers, and they generally have lower commuting times than their low-income counterparts who usually have to bear a heavier commuting burden. However, surprisingly, this study found that some high-skilled immigrants also experienced larger mismatches between jobs and housing due to institutional arrangements. This could be explained by the fact that some high-skilled immigrants may prefer a higher quality of housing, so they choose to relocate to upscale apartments in the suburbs where they can enjoy a better living environment and also reduce their living costs (Cao, Mokhtarian & Handy, 2009; Li & Wu, 2008; Feng, Zhou & Wu, 2008). Younger high-skilled immigrants are unable to benefit from the housing reform. Higher housing prices in the city centre force them to buy or rent apartments in the suburbs, which means they spend longer commuting (Huang, 2004; Wang & Chai, 2009). In addition, the tightening up of the Hukou policy after the reforms has made it difficult for these high-skilled immigrants attempting to settle in Tianjin to change their residence and work locations. The HPF welfare gap exacerbates housing costs for high-skilled immigrants who are working outside of Danweis. In contrast, low-skilled immigrants do not rely on formal housing because they are more sensitive to housing and commuting costs, and they generally do not have a choice when it comes to housing quality. Therefore, living in informal but low-cost settlements has become an important way for them to balance their job-housing relationships. In this context, urban villages play an important role in providing low-rent housing for rural and low-skilled immigrants. Informal employment and housing play an essential role in balancing the job-housing relationships of low-skilled immigrants. However, recent policies designed to make Tianjin a “clean city” are gradually removing basements and informal housing without property rights. Additionally, low-skilled immigrants have to accept poorer quality living conditions.

It is also noteworthy that the local residents who live in Danwei housing are the only group that can achieve a good balance in their job-housing relationships. Moving back into Danwei housing is thus an important strategy. This finding echoes that of Zhao (2015) who claimed that the “retreat to Danwei house” is a compromise strategy used by many households to negotiate the rising commuting burden. Meanwhile, this paper also revealed that the main reason why local residents have returned to Danwei housing is due to the high-quality living standards in the inner city area. Rapid urban sprawl has not decentralised job opportunities and social infrastructure such as schools and hospitals to the suburbs. The failure of urban growth arrangements has caused heavy traffic between the centre and the suburbs, so Danwei householders have returned to the downtown area attracted by its high quality public services and closer proximity to their workplaces. Overall, therefore, the remaining Danwei housing still plays a significant role in reducing the burden of commuting in the post-reform era.

This study contributes to the literature by providing new evidence on how to reduce the commuting burden through long-term policy arrangements. Workers are dynamically impacted by policies and social institutions, including Hukou, housing benefits and other welfare. In this regard, it is not possible for low-liquidity labour and housing markets to achieve a good balance between jobs and housing. Although this research focuses on Tianjin, our findings can also provide valuable insights for the international debate about the unequal commuting burden, particularly regarding the impacts of policies and institutions. Consistent with the findings from previous studies, such as in Bogotá, some policies could result in most transport infrastructure being constructed and concentrated in central areas, and connectivity in rural areas being overlooked (Bocarejo, Portilla & Pérez, 2013). In addition, higher-income groups usually tend to occupy better connected spaces/areas with higher levels of accessibility and obtain more key life opportunities (Cao and Hickman, 2019a), whereas relatively low-income cohorts are more likely to be excluded from attaining these levels of accessibility and opportunities due to unaffordable housing prices. In order to avoid heavy commuting burdens, due to the low coverage of public transport, some lower-income people have to live in crowded informal settlements in urban centres (Oviedo & Dávila, 2016). Additionally, for example, in Malta, the lack of policies promoting public transport may result in increased transport expenditure for low-income workers, which hinders labour mobility and exacerbates social inequality (Attard, 2020). Only by eliminating persistent institutional restrictions can inequalities in the commuting burden be reduced for vulnerable groups. Institutional innovations should therefore be considered, particularly in terms of housing supply policies and Hukou management. Policy implementation should encourage the provision of affordable social housing in order to help reduce commuting time for low-income workers.

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### **Appendix A. Interview questions**

1. Could you discuss the influence of Hukou quotas and housing welfare attached to in-system jobs? (e.g. choosing jobs, housing cost and commuting time or cost)
2. Have the changed policies on and tightening up of the Hukou quota, and housing purchases further reduce your job mobility? (Are you limited by these institutions when you want to change jobs?)
3. Would you prefer to look for a new job close to your home or choose a housing location based on your workplace?
4. To what extent does the commuting burden reduce your time available for leisure and other pursuits?
5. How do you try to shorten your commuting time and reduce travel expenses?
6. Do you feel privileged as a local (with Tianjin Hukou) with regard to balancing your job-housing relationship, and if so why?