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
**Inequalities in the Commuting Burden: Institutional Constraints and
Job-housing Relationships in Tianjin**

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Being a dissertation submitted to the Faculty of The Built Environment as part of the requirements for the award of the MSc Transport and City Planning at University College London:

I declare that this dissertation is entirely my own work and that ideas, data and images, as well as direct quotations, drawn from elsewhere, are identified and referenced.

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List of Acronyms and Abbreviations

HPF	Housing Provident Fund
SPSS	Statistical Package for the Social Science
TSB	Tianjin Statistic Bureau
TUPDI	Tianjin Urban Planning and Design Institute

Abstract

The burden of commuting has been a key issue for urban transport equity in developing countries, and the inequality of the commuting burden is accompanied by the institutional aspect. Among the many institutional factors, the housing and employment institutions bring major impacts on individuals' choices of accommodation and job, thus restrict commuting behaviour and job-housing relationships. The purpose of this paper is to analyse the role of employment and housing system constraints such as Hukou (a form of household registration in mainland China) and Danwei (the name of work unit or workplace in mainland China) in the unequal commuting burden taking Tianjin as an example. By distributing self-completed questionnaires among 400 Tianjin commuters and conducting semi-structured interviews with five of them, this study collects information about the commuters' commuting patterns to understand how they balance job-housing relationships under institutional barriers. The results of multiple linear regression show that factors such as Hukou status, employment sector and housing source have a significant impact on commuting time. Some commuters are employed by Danweis or have Tianjin Hukou, so they can join the housing plans of Danwei, which means that Danweis provide some solutions for their accommodation so that their commute time is significantly decreased. Interviews found that institutional barriers constrained the job-housing balance of high-skilled immigrants, while local residents and low-skilled immigrants avoided institutional barriers by returning to Danwei housing and choosing informal housing separately. The study provides new evidence for which groups have suffered from the commuting burden caused by institutional barriers. In terms of improvement measures, commuters are looking forward to eliminating the legacy of Danweis' housing benefits and achieving equal housing subsidies. At the same time, they appealed for improvements of housing benefits, the quality of public transport and mixed housing-workplace planning. This study finds that institutional discrimination causes social inequality in the commuting burden, which could continue to worsen unless unequal institution is eliminated. The findings can be used to assist planners in developing strategies.

1 Introduction

1.1 Research Background

It is essential for individuals to choose where to live and work (Gobillon et al., 2007). With the capability of commuting, people can choose where to live and what jobs to do (Nordbakke, 2013). However, the commuting services vary from places to places, so such a universal requirement is unrealistic and participation cannot take place in some situations (Button et al., 2005; Heinen et al., 2010). Commuting behaviours and patterns have been studied intensively by researchers to promote the reduced commuting distances and time (Banister, 2002; Newman and Kenworthy, 2007), and Novaco et al. (1990) concern that the different groups have suffered unfair distribution of the commuting burden.

Vulnerable groups suffer from a spatial mismatch between housing and job location, resulting in their unequal commuting burden (Horner and Mefford, 2007). Previous studies have explored the reason, including income, gender, building environments (Cao et al., 2007), technology and travel attitudes (Handy et al., 2005), moreover, institutional factor¹ result in unfair commuting burden (Gordon et al., 1989; Pinto, 2002; Zhao, 2015). Institutional restrictions shape people's choices of what locations and what jobs are available for them, and certain choices of housing and job may result in the significant inequality in people's commuting burdens (Pinto, 2002). Gordon et al. (1989) also believes government intervention prevent individuals to choose their locations of job and apartments freely to achieve a better job-housing balance.

Previous studies have provided evidence for the inequalities in commuting burdens in developed countries (Banister et al., 1997; Musterd and De Winter, 1998; Taylor and Ong, 1995), however, the situation is worse in developing countries where housing and mobility institutions could result in unequal commuting burden, particularly for countries experiencing social transformation from planned economy to market-oriented economy such as China (Kim, 2008; Pucher et al., 2007). In China, individual opportunities and rights are determined by housing and mobility systems, which may limit the free choice of housing and workplaces of different social groups, creating an unequal commuting burden (Wang and Yao, 2018; Zhang et al., 2018; Zhao, 2015). As the unique institutions in China, Hukou² and Danwei³ have excluded some groups from the labour and housing markets (Zhao, 2015). Zhao et al. (2011) claim that commuters living in the Danwei community are closer to the workplace, so commuting time is shorter. The Hukou system also defines who can enjoy the housing and employment benefits provided by the companies or by the country, influencing their commuting patterns. It is difficult for the vulnerable groups to be isolated by the system to obtain job and housing (Zhao et al., 2011). This study conducts a case study of Tianjin

¹ Institutional factor, which means social and economic norms and rules, clarify individual rights and access to opportunities and thus may restrict individuals' mobility and travel behavior (Cervero and Duncan, 2006).

² Hukou is a unique labour market system related to the accessibility of workers' work. The people are divided into residents with urban Hukou and residents with rural Hukou.

³ Danwei provided an institutional context that integrated urban productive activities, social infrastructures and housing in the same location. Housing is provided by Danwei to workers. Danweis are state-owned or collectively owned work units, including state-owned enterprises, government departments and public institutions.

which has the most stringent Hukou system and many Danweis system heritage, resulting in discrimination in the choice of housing and job for workers (Zhao and Li, 2016).

1.2 Overall Research Aim and Objectives

This study aims to explore how institutional restriction result in unequal commuting burdens with a case study of Tianjin, and the following objectives have been developed:

- 1)To identify institutional factors that explain the variations in workers' commuting burden;
- 2)To explore the impacts of these institutional constraints on workers' choices of jobs and housing;
- 3)To investigate improvements in commuting burden from the commuter perspective.

1.3 Structure of the Dissertation

This dissertation consists of six chapters, with the research background, research aim and objectives presented in Chapter 1. Following that, Chapter 2 critically reviews the main themes and arguments within existing literature on the relationship between job-housing balance and commuting burden, with further investigation into the questions that how institutional factors could impact the commuting burden and whether other potential factors could cause unequal commuting burden. And it also discusses how to improve unequal commuting burden. Chapter 3 and 4 provide more details about the case study and methodology for the self-completed questionnaire and semi-structured interview. Chapter 5 discusses the results of Chapter 4 in relation to the main research objectives, and their wider context. Finally, Chapter 6 summarises the findings of the research providing contribution to policy implications, making conclusions.

2 Literature Review

2.1 Importance of Commuting and Commuting Burden

Commuting refers to the process that workers travel between residence and workplace, and the time of commuting have a major impact on the quality of life because commuting may squeeze the time for relax, meeting friend, taking rest or other activities in life. The high time cost of commuting imposes some restrictions on the quality of life, limits the time for workers to company with their families, and takes up the time for them to do outdoor activities (Hamilton and Burnett, 1979). Additionally, commuting is regarded as paramount within the social equality agenda because it is the main way in which people can lift themselves out of poverty and access to jobs (Burchart et al., 2002).

However, when commuting becomes a burden that affects the quality of life (Novaco et al., 1990), it consumes personal resources, especially time, money and energy (Ong and Blumenberg, 1998). Reducing the commuting burden has become a key issue in the development of sustainable transport systems (Banister, 2005; Banister et al., 1997). A wide range of factors contribute to the growth of the commuting burden, such as rapid urbanisation, sustained population growth, land-use change, transportation infrastructure shortages and weak regulatory institutions (Gordon et al., 1991; Pucher et al., 2007). Particularly, many researches have emphasised that institutional factors change the workers' jobs-housing balance, resulting in commuting burden (Downs, 1992; Gwilliam, 2003; Levinson and Kumar, 1994).

2.2 The Relationship Between Jobs-housing Balance and Commuting Burden

The jobs-housing balance is related to the spatial relationship between jobs and housing units within a given geographical area (Cervero, 1991; Giuliano and Small, 1993). The literature on how spatial location within the region of work and housing affects the individual's economic prospects stems from Kain's (1968) spatial mismatch hypothesis, in which the researcher puts forward this hypothesis in the context of the space transformation of the United States after World War II: the suburbanisation of the affluent and work, and the disadvantaged ethnic minorities are limited to the inner city where there was a lack of affordable transport for people to get to work. Eventually the inconvenience of transportation led to the low employment rate and high commuting burden of ethnic minorities. Additionally, the so-called "co-location hypothesis" believes that the balanced job-housing relationship could shorten the commuting time (Downs, 1992). The "co-location hypothesis" assumes that people can make rational choices about their workplace and housing based on market rules (Mieszkowski and Mills, 1993; Zhao et al., 2011). Gordon et al. (1989) believe that workers often change their jobs or accommodation to avoid spending too much time on commuting. Therefore, the hypothesis reflects the mutual adjustment of employment between housing and job.

Jobs-housing balance can significantly impact on commuting. Cervero (1989) even argues that many of the most urgent commuting problems in the United States-congestion, like

excessive time consumption, could be alleviated by balancing job and housing. Dubin (1991) proposes that decentralised workplaces can reduce commuting time as job opportunities are normally located at where the nearby population lives, and the commute time remains stable in this case although the average commute distance increases. Moreover, in the housing and labour markets, job-housing balance occur spontaneously, especially affecting commuting (Levinson and Kumar, 1994). For instance, Gordon (1989) points out in his study that from 1980 to 1985, the average commuting time of the top 20 cities in the United States decreased obviously because of the co-location of housings and businesses. Additionally, Hu et al.(2017) define job-housing separation as the mismatch between any particular groups of people where they live and the job opportunities they are available. According to the research by Hu et al.(2017) , the deterioration of spatial mismatch is due to changes in population distribution, rather than changes in job distribution or transportation network (Hu, 2016; Hu et al., 2017). This job-housing separation model has made the disadvantaged groups even worse in terms of commuting burdens (Fan, 2012; Houston, 2005).

However, some studies claim that commuting is not influenced by job-housing relationship (Giuliano and Small, 1993). Hamilton and Röell (1982) point out that job-housing trends caused by the movement of job-to-residences shifts does not result in a reduction in average commuting time. Moreover, Ewing (1995) finds out that job-housing relationship has a weaker link with average commuting time when controlling socio-demographic variables.

Despite many issues associated with the location of jobs and housing, balancing job-housing can still serve as a solution to reduce commuting burden. The following part of this study investigates further into this issue and explores how job-housing balance affects commuting burden.

2.3 Institutional Factors: Unequal Job-housing Match Leading to the Unequal Commuting Burden

2.3.1 Unequal Commuting Burden

People are faced with varied levels of job-housing balance, thus have unequal commute burdens as a result. Studies find out that unequal distribution of commuting burdens contributes to social exclusion (Preston and Raje, 2007). High commuting burdens caused by financial and energy costs limit individuals' access to a variety of social opportunities. This is because excessive commuting time and monetary costs limit disadvantaged groups' available resources for leisure and other pursuits (Church et al., 2000). Therefore, the difference in commuting burdens highlights the necessity for commuting equity (Litman, 2014).

2.3.2 The Institutional Factors and Unequal Commuting Burden

Cervero (1989) claims that institutional factors may be an essential reason affecting job-housing balance and causing the unfair commuting burden. Institutional factors refer the a set of social economic norms and rules that clarify individual rights and access to opportunities, playing an important role in shaping the mobility and driving performance of

individuals. According to the co-location hypothesis, better job-housing balance can only be achieved in the free market system when workers are free to choose their housing location (Daniels and Cervero, 1990). When planning and development management limits this option, they are considered to be institutional barriers to job-housing balance (Newman and Kenworthy, 1996). Healey (2006) proposes that understood inequality under the context of specific institutional structures. Only then can the invisible inequality come to light.

Institutional factors, including housing supply, market institutions (Maat et al., 2005; Oswald, 1999), labour mobility management, and labour market restrictions (Dubin, 1991; Hamilton, 1982), significantly affect commuting burden by influencing the commuting time. The location of housing and labour mobility are also affected, which is a typical situation in transitional countries that maintain strong planning controls, such as China (Zhao and Lu, 2010). In China, discrimination in housing and labour markets determines which vulnerable groups are affected by the burden of commuting (Zhao, 2015). Under the combined influences from planned economy and market economy, some groups of people have access to certain advantages in terms of employment and housing (Zhao, 2015). However, it has hindered the free choice of vulnerable groups in job and housing. Job-housing relation is shaped by the institutional status of workers (Healey, 2006). Therefore, the commuting burden mainly depends on the housing supply structure and labour mobility policies (Zhao and Lu, 2010).

2.3.3 Housing Institutions: Danwei and HPF

Institutions restrict housing supply systems and affect housing consumption, including housing allocation, ownership rules, housing affordability and formal regulations. Oswald (1997) find out that home ownership is essential to labour mobility. In general, workers with housing tend to commute for a shorter period of time and have a higher level of access to work (Oswald, 1999). Healey (2006) claims that the housing system is a decisive factor in the formation of job-housing relationships. In China, this is also the case and it is almost not possible to avoid the impact of job-housing relationship on people's choice of jobs and housing.

In China, housing is provided to employees by Danwei as a kind of social welfare (Zhao and Lu, 2010). Before the 1980s, the government of China normally assigned jobs to people, so the workers go to self-contained Danwei which provided housing free of charge to them. In such situations, the job-housing relationship was optimistic with a short commuting time for workers, because social infrastructure and housing were built around the production activity area under the Danwei system (Zhao et al., 2011). However, since the 1990s, people had to move out of the housing provided by Danweis and buy their private apartments as a result of housing reforms during the decade. However, the private housing and workplaces are not necessarily close to each other, so the workplace which could break the worker's job-housing balance. Although some of the Danweis were reorganised into private companies during the market economy reform, the remaining Danweis still provided housing subsidies and allocated housing near the workplace to employees (Wang and Chai, 2009; Wu, 1996; Zhao and Li, 2016). In contrast, there is no direct spatial relationship between the location of the

housing provided by the private developer and the job location of the owner (Zhao, 2015). As a result, those who buy private apartments may need to spend more time on commuting. Additionally, China's dual-track Housing Provident Fund (HPF) has exacerbated this inequality in the housing system. In the early 1990s, previous system of housing welfare in China has evolved into HPF, which means that employees deposit a percentage of their wages into a state-managed personal housing fund account while employers provide the same amount of subsidy into the housing allowance account of the employees (Yeung and Howes, 2006). However, Danwei usually has a higher deposit amount because there is no mandatory regulation of the deposit amount (Chen and Deng, 2014). In contrast, private companies often try to minimize the amount of deposits to save labour costs. As a result, workers in Danweis are more likely to obtain higher housing deposits and improve their ability to purchase properties (Zhao, 2015). In this regard, even in a market-based housing system, non-Danweis' workers who seek cheaper housing, usually away from the workplace are at a disadvantage because of the low housing affordability caused by the intentional HPF system (Zhang et al., 2018). Therefore, the HPF has increased unequal commuting.

In such institutional context and housing plans of Danwei, workers in Danweis manage to maintain a more balanced job-housing than workers out of Danweis, who become more vulnerable to the rising house prices.

2.3.4 Labour Mobility Institutions: Hukou

Crampton and Simpson (1993) argue that labour mobility management limits labour mobility and thus affects workers' commuting time. Strong labour mobility management limits the adjustment between housing and job, which could have impact on commuting burden (Amin and Thrift, 1994).

To manage the labour mobility, Hukou has emerged as a major form to control population movements, in the planned economy era. This is a unique labour market system in China, which can be related to the accessibility of opportunities (Zhao et al., 2011). Since the relaxation of control over rural labour mobility in the 1990s, the legacy of this system is maintaining social injustice, especially for immigrants without local urban Hukou. Immigrants without local urban Hukou are excluded from civil rights in the place they live, including public services and housing welfare (Zhao and Howden-Chapman, 2010). Immigrants who are unable to enter the local urban Hukou system only have limited choices of employment and housing location (Zhao, 2015) which may result in severe employment discrimination and low job mobility for these immigration workers.

Moreover, few companies are willing to provide housing welfare for immigrants (Fan, 2001; Ma, 2004) so that they can only choose to live in cheaper housing in the suburbs while residents with a local urban Hukou live in more central areas of the city where most workplaces are located. As a result, these immigrants workers suffer from poor transport services, longer commuting time, and an unequal commuting burden in an unfair labour and housing market (Zhao, 2015). This is exactly the case in Tianjin although more than 35% of the working population in Tianjin are immigrants (TSB, 2018). They are faced with

discrimination in terms of employment and housing (Zhao et al., 2011). Some Danweis believe that hiring non-Tianjin Hukou immigrants has a greater risk. However, there are still some policies that encourage the provision of lower-cost social housing near job centres to reduce housing and commuting burdens (TUPDI, 2016). For example, in 2015, 1.4 million square meters of low-cost rental housing and 1.54 million square meters of affordable housing have been built, which has played an active role in improving the job-housing relationship and reducing the commuting burden. However, the reality is that the policy aims to serve workers with a Tianjin Hukou, which is often beyond the reach of non-Tianjin Hukou residents.

2.4 Socio-demographic and Socio-economic Factors

Apart from institutional factors, other socio-demographic and socio-economic factors could also influence on inequality commuting burden. Preston and McLafferty (2016) find out that the socio-economic characteristics can significantly affect job-housing balance and explain the unequal commuting burdens. For example, workers' commuting time may be affected by the level of household income, which results in different choice of accommodation location and decides what kind of commuting patterns they can afford (Giuliano, 1991; Vandersmissen et al., 2003). In addition, the occupation of worker also has impacted on commuting time. Stead et al. (2000) note that high-tech practitioners who are engaged in professional or managerial work have less commuting burden than those who work in low-tech careers. Additionally, socio-demographic factors, like gender, also cause unequal commuting burden. Women are also more prone to suffer long-distance commuting because their gender limit matching job-housing relationships, accessing to efficient travel tools (Rapino and Cooke, 2011). Based on the factors mentioned above, this study reviews all of them and further explore the issue.

2.5 Improvements in Unequal Commuting Burden

On recognizing that housing supply and labour mobility management institution have a great impact on workers' commuting time, governments and organisations have made previous efforts to reduce unfair commute time, such as increasing public transport shifts, lowering fares and providing commuting subsidies (Hine, 2003; Lucas and Jones, 2012; Lucas and Stanley, 2009). Other researchers believe that the use of spatial planning for mixed land use helps to curb the increase in commuting burdens faced by low-income people in developing countries, thereby promoting commuting equity (Burton, 2000). This is because local job-housing balance and land use diversity are significantly associated with commuting time for low-income people (Cervero, 1996). In practice, targeted employment development aims to help low-income community residents find jobs near their community, which could help to improve job-housing balance, and to reduce the commuting burden.

However, researches have paid little attention to institutional innovation which is aimed to reduce commuting time. On recognising the impact of institutional factors on commuting time, it would be more possible to develop innovative policies so as to improve job accessibility (Healey, 2006). In China, the housing and labour mobility institutions are being

tried to reform. Relaxation of Hukou institution is conducive to significantly increasing labour mobility, especially from rural areas and small cities to large cities. Moreover, it also increases options of employment location for non-urban Hukou immigrants (Zhao et al., 2011; Hill, 2005). The demolition of the Danwei system's legacy increases the demand for labour, which may have a major impact on workers' access to work (Zhao, 2015). Additionally, recent market-oriented housing reforms have reduced the share of Danweis' housing sources and have gradually broken the traditional relationship between job and housing locations (Hill, 2005). However, Zhao et al. (2011) claim that high-priced commercial housing has replaced the low-cost buildings in the original city center, and most workers have to find low-cost housing in the suburbs. The housing market could lead to job-housing imbalances, which in most cases increase commuting time. Therefore, in the context of China, the cancellation of Danweis' housing heritage may require relevant supporting and complementary measures.

2.6 Summary

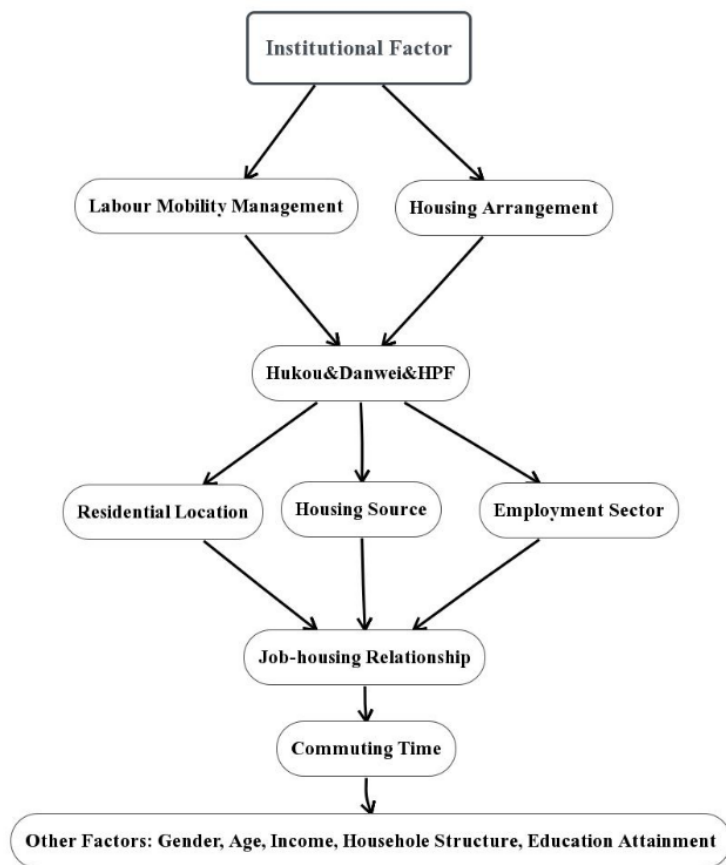


Figure 2.1: Factors Effecting Commuting Burden (source: author)

According to the literature review, institutional factors, especially housing and labour mobility institutions, are the main factors that lead to job-housing balance and unfair commuting burden in the row. Furthermore, socio-economic and socio-demographic factors are also relevant (Figure 2.1).

Most studies have focused on the role of gender, race, occupation, and economic status in commuting time and cost inequality, while ignoring the role of institutional factors in the commuting burden. Another gap in research is how individuals deal with their institutional constraints. In the context of China's distinctive system, many researches have tried to explore the impact of Danwei system's heritage and Hukou system on workers' commuting burden (Zhao, 2015; Zhao and Lu, 2010). After the reform of housing policies in China, the new institutions influence workers' purchase of house, thus shape workers' job-housing relationships in the post-reform era. Some of the changes after the housing policy reform may make the situation worse, resulting in more inequality in terms of commuting burden of workers. However, some studies have shown the opposite result. That is to say, workers in non-Danweis do not suffer from heavy commuting pressure (Li and Liu, 2016), because informal housing in urban centres, such as basements, can be affordable for workers who do not pursue housing quality, which helps them closer to job opportunities. As can be seen from previous literature, it is difficult to join a conclusion about the impact of institutional factors on the commuting burden. As for situations in places other than Tianjin, similar studies have been conducted in the Shanghai, Beijing and Guangzhou, which feature different demographics and culture, as well as urban structures, but those investigations cannot reflect the unequal commuting problem in Tianjin.

Additionally, in order to improve workers' unfair commuting, measures can be made to improve transport infrastructure, increase commuting subsidies, mix land use spatial planning and promote institutional innovations. The main body of commuting activities is workers, and the views of them are very important. This research then uses questionnaires and interviews to find out the question that which measures most effective in improving commuting efficiency from their perspective.

In order to resolve disputes and fill the gap in the previous literature, this paper places discrimination in the labour and housing system at the forefront of its analysis of commuting inequality. By comparing the commuting burden of workers inside and outside the system, and the commuting burden of workers who have or do not have Hukou in Tianjin, this paper tends to resolve existing disputes about identifying vulnerable commuting groups under the influence of institutional factors. Also, it explores improvements in commuting burden from the commuter perspective.

3 Case Study Context

Tianjin is a municipality directly under the Central Government, with a geographical area of 11916.85 square kilometers, 16 municipal districts, and a population of 15.59 million in 2018. The study area is the main working area of the city (TSB, 2018), including six administrative districts: Heping; Hebei; Hongqiao; Nankai; Hexi; Hedong (Figure 3.1).

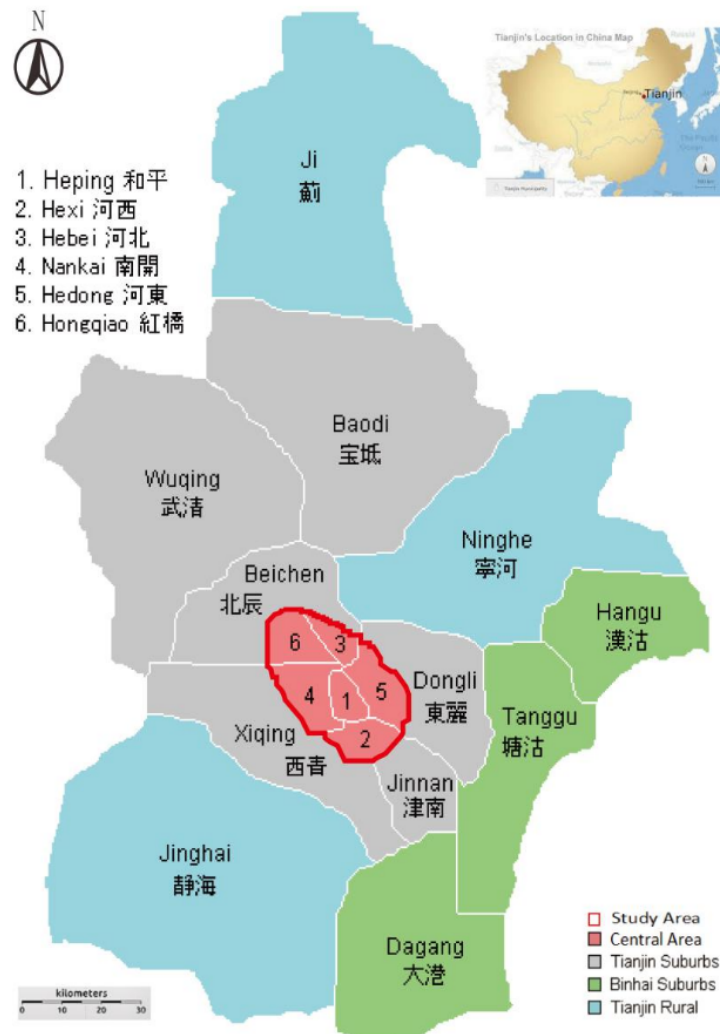


Figure 3.1: Case Study of Tianjin (source: author)

Tianjin is suitable for the case study of this research due to the following reasons. Firstly, the commuting burden of residents in Tianjin has increased dramatically in the past few years. The one-way average pass of the administrative district covers a distance of 9km and the time

to cover this administrative area is 40.3 minutes (China Urban Transport Report 2018, 2019). The main reason for the increase in the commuter burden of workers in Tianjin is the spatial imbalance between the workplace and the place of residence. TSB (2018) shows that most opportunities are distributed in the study area, which is the six districts in the city center, but the population of the central six districts accounts for only one-third of the total population of Tianjin.

Secondly, Tianjin has the most stringent Hukou system in China, because most regional governments have strict rules and regulations for the quota of obtaining Tianjin local Hukou, especially for low-skilled immigrants. As the Hukou policies tighten and interact with general housing policy, residents of non-Tianjin Hukou must provide a continuous payment of more than 2 years of social insurance or personal income tax certificate in Tianjin if they want to buy apartment or house, and they are prohibited from purchasing the second house.

Additionally, serious discrimination exists in Tianjin's housing and labour system. As one of the four municipalities directly under the Central Government, Tianjin includes many Danweis, including municipal institutions, state-owned enterprises and national public institutions, which gain more housing benefits through their political influence. Moreover, 90% of the household quota per year is allocated to Danweis, which could make it almost impossible for immigrants working outside of Danweis to obtain Hukou (Zhao and Li, 2016). As a result, institutional restrictions on employment and housing have caused some groups to bear an unequal commute burden.

4 Research Methodology

This study applies both quantitative and qualitative methods, including quantitative survey used to clarify the impact of institutional factors on workers' job-house balance, and qualitative semi-structured interview used to understand the issue from the commuters' view. The quantitative survey also explores unequal commuting burden and how to improve the situation from the commuter perspective. The survey involves self-completion questionnaire, which was used to get the answers from respondents without interviewers' assistance (Bryman, 2016). This method could provide a rich and detailed data set on individual cases about their commuting characteristics. To further understand the results of questionnaire, this study also applies multiple linear regression, a statistical analysis method that determines the quantitative relationship between dependent variables and two or more independent variables (Armstrong and Hilton, 2014), which was considered the most appropriate method for statistical analysis of data and has been used by many studies (Zhao et al., 2018; Zhao and Lu, 2010). Additionally, it was also considered that the most appropriate way would be via statistical testing using SPSS Statistics, a software package for data management and analysis (Greasley, 2007). As for qualitative method, this study conducts semi-structured interview, which involves a series of questions, and it allows interviewers to change the order of the questions and discuss key issues in detail if necessary (Bryman, 2016). That is to say, these questions of semi-structured interview were flexible enough to explore the impact of social, family and environmental factors on the commuting behavior. Therefore, this method answers the questions about commuters' job and residence options under the institutional constraints as well as commuters' strategies to handle the commuting burden and institutional barriers.

4.1 Quantitative Methods

4.1.1 Self-completion Questionnaire

The questionnaire gathers social demographic information (i.e. gender, age, income, education, family structure), institutional attributes (Hukou status, housing source, housing ownership, employment sector) and commuting burden (monetary cost and time cost), and also covers perspective of commuters on the issue of reducing the commuting burden. The design of questions in questionnaire is based on the literature and research objectives covered, and the full version of questionnaire can be found in Appendix 1. The questionnaire includes a total of 17 questions, and the respondents need 4-5 minutes to complete all of them. This aimed to minimise the wrong answers caused by respondents' response fatigue (Bryman, 2004). In addition, the questionnaire consists of closed questions, providing more accurate and clearer opinions for the researcher to get quantitative data (Bryman, 2016).

In terms of the form of distributing questionnaires, internet is a convenient and cost-effective way (Fowler, 2014). This questionnaire is distributed through the Wenjuanxing⁴ to reach a larger population. It allowed respondents to complete the questionnaire at a convenient time.

The self-completion questionnaire was conducted from June to July 2019. A total of 400 samples were taken, and the population distribution (Tianjin Statistical Yearbook 2018, 2018) is used as the probability weight to determine the number of selected respondents from the six districts (Table 4.1). The link was sent to people working in these six districts who are encouraged to distribute the questionnaire to their friends, neighbors and colleagues living in the same six districts as well. This Simple Random Sampling ensured that a larger population could be reached (Bryman, 2016). Individuals in the sample were not drawn repeatedly. These methods maximised the number of individuals reached, maximizing the potential for representative samples.

Table 4.1: Sample Sizes of Six Districts (adapted from: Tianjin Statistical Yearbook 2018, 2018)

Administrative districts	Permanent population (10000persons)	Sampling size
Nankai	114.16	94
Heping	30.07	25
Hedong	97.28	80
Hexi	98.92	81
Hongqiao	56.50	47
Hebei	88.94	73

4.1.2 Multiple Linear Regression

Based on the results of survey, multiple linear regression reveals the impact of the institutional factors on 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 are chosen to demonstrate institutional factors in housing supply and markets. The employment sector and Hukou status are used to reflect the institutional factors of labour mobility management. The following part lists the estimated equation (1) and Table 4.2 lists the variables, with each variable recoded into a dummy variable before the model runs.

$$Y_i = \alpha_0 + \alpha_1 G_i + \alpha_2 I_i + \alpha_3 E_i + \alpha_4 HS_i + \alpha_5 ES_i + \alpha_6 O_i + \alpha_7 HSS_i + \alpha_8 HO_i + \alpha_9 HK_i + \alpha_{10} T_i + \varepsilon \quad (1)$$

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

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 ;

⁴ It is a professional and popular online survey application similar to Survey Monkey, and the questionnaire can be spread on a larger scale via email, social software, etc.

I_i is the income of worker i ;
 E_i is the education 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 house source of worker i ;
 HO_i is the house ownership of worker i ;
 HK_i is the Hukou status of worker i ;
 T_i is the transport mode of worker i ;
 ε is the random error.

4.2 Semi-structured Interviews

Hukou and Danwei systems in Tianjin significantly influence 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 based on institutional arrangements leads to unequal commuting burdens. To response the objective 2&3, some questions showed in Appendix 2 are mentioned in semi-structured interviews to explore how the participants of study maintain the balance between job and housing under the institutional constraints, as well as their strategies to handle the rising commuting burden and institutional barriers. A pilot survey of five people is conducted before the investigation was officially started, based on the feedback of which the wording is slightly modified.

Semi-structured interviews are conducted via internet phone between June 2019 and July 2019 among 36 respondents of the questionnaire who agree to take further interviews. After examining the socioeconomic characteristics of the respondents, 15 respondents are selected to take the interview, and each of them takes approximately 45 to 90 minutes. In the sampling process, the semi-structure interviews ensure that all social groups (in-system workers VS out-system workers, Danwei house dwellers VS commercial housing owners, Tianjin Hukou holders VS non-Tianjin Hukou holders) can be included.

Based on the results of questionnaire and interviews, descriptive analysis of the information gathered in interviews clarifies how institutional constraints specifically shapes the job-household relationship of worker and helps the researcher further understand the interpretation behind the regression results. More importantly, in response to the third research objective, workers' strategies for dealing with commuting burdens and institutional barriers are also covered, as well as their perspectives on improving the unfair commuting burden.

Table 4.2: Variables Analysed (source: author)

Variable type	Name of variables	Value and description
Socio-economic characteristics	Gender	=1 If male; other=0
	Age	Continuous variable
	<i>Monthly income</i>	
	Low income	=1 If monthly income less than 2000 RMB; other=0
	Middle income	=1 If monthly income between 2001 and 7000 RMB; other=0
	High Income	=1 If monthly income higher than 7000 RMB; other=0
	<i>Education attainment</i>	
	Bachelor, Master, Doctor	=1 If worker has bachelor, master or doctor degree; other=0
	Junior college diploma, High school diploma and below	=1 If worker has junior college diploma, high school diploma and below; other=0
	<i>Household structure</i>	
	Single	=1 If single; other=0
	Sharing housing with others	=1 If cohabiting; other=0
	Nuclear family	=1 If nuclear family; other=0
Institutional factors	<i>Employment sector</i>	
	Party authority, government and public institutions	=1 If worker is employed by party authority, government and public institutions; other=0
	State-owned enterprise	=1 If state-owned enterprise; other=0
	Joint venture, private and enterprises founded by Foreign Direct Investment	=1 If joint venture, private and enterprises founded by Foreign Direct Investment; other=0
	Self-employed and others	=1 If self-employed and others; other=0
	<i>Occupation</i>	
	Low-skilled work	=1 If low-skilled work; other=0
	Middle or high-skilled work	=1 If middle or high-skilled work; other=0
	Public officer	=1 If public officer; other=0
	<i>Hukou status</i>	
	Household with Tianjin Hukou	=1 If household with Tianjin Hukou; other=0
	Household with urban Hukou issued in other cities	=1 If household with urban Hukou issued in other cities; other=0
	<i>Housing source</i>	
	Owned or rented by Danwei	=1 If Danwei owned or rented; other=0
	The housing is not owned or rented by Danwei (for example, the housing from private developers, the housing from housing bureau, resettlement housing, etc.)	=1 If The housing is not owned or rented by danwei (for example, the housing from private developers, the housing from housing bureau, resettlement housing, etc.); other=0
	<i>Housing ownership</i>	
	Housing owned	=1 If housing owned; other=0
Transport mode	Walking or riding bicycle	=1 If walking or using bicycle; other=0
	Public transport (Public bus, Danwei bus and subway)	=1 If public transport mode (Public bus, Danwei bus and subway); other=0
	Car (private car or vehicles provided by Danwei)	=1 If car (private car or Danwei car provided by work unit); other=0

5 Results and Discussion

This chapter first analyses the results of questionnaires and discusses objective 1 of this study, before proceeding to discussion of objective 2 & 3 together with analysing of institutional constraints on workers' job and housing choices, and ways to mitigate these adverse effects from commuters' perspective.

5.1 Institutional Factors Result in Unequal Commuting

5.1.1 Questionnaire Result

This section discusses objective 1 which aims to examine institutional factors that explain the variations in workers' commuting burden. Before analysing the questionnaire data, this study first excludes questionnaires with incomplete answers to ensure a good geographical distribution of responses (Table 4.1), as a result, 400 questionnaires are available for analysis.

As shown in Table 5.1, 50% of the respondents of questionnaire are male and 50% are female. As for the breakdown by age, 65% of the participants are between 20 and 35 years old, which is the most concentrated age group for respondents. Over a half of the participants have a middle to high level of income (RMB 4500-7000). Moreover, 60% of them live with their partner and children. In terms of Hukou, 55% of respondents have Tianjin Hukou. In addition, only 35% of respondents live in houses provided by Danweis. For employment sector, 59% of respondents work in the private sector or stay self-employed, and 41% work in Danweis.

This study notices a significant difference in the average commuting time between people depending on their varied social characteristics. Females have a shorter average commute time [43 minutes] than males. The average commute time of the Tianjin Hukou holders is shorter 25 minutes than that of the non-Hukou holders. In addition, immigrants have longer commuting time than local residents do, which can be explained by restrictions faced by immigrants in terms of buying apartments in more central areas of Tianjin. As for difference between commuting time resulted the employment sector, the commuting time of employees in the government departments and state-owned enterprises is shorter than that of other commuters. For housing source, commuting time for people living in non-Danweis' housing is obviously longer [53 minutes] than those with Danweis' housing. Danweis' housings close to the work site, which significantly reduce commute time.

Table 5.1: Data Summary of the Sample (source: author)

Variables	Classification	Percentage (%)	Average commuting time (min)
Gender	Female	52	43.03
	Male	48	46.18
Age	20-35	65	48.16
	36-50	30	39.7
	>50	5	26.6
Monthly income(RMB)	<2000	1	30
	2000-4500	14	46.6
	4501-7000	54	48.1
	>7000	31	37.7
Education attainment	Bachelor, Master, Doctor	62	46.9
	Junior college diploma, High school diploma and below	38	40.8
Household structure	Single	16	40
	Cohabiting	22	48.6
	Nuclear Family	60	44.3
	Other	2	43.3
Hukou status	Household with Tianjin Hukou	55	33.4
	Household with urban Hukou issued in other cities	45	58
Living time in Tianjin	Lived in Tianjin since childhood	52	33.4
	Moved to Tianjin between 1 and 17 years old	8	50.9
	Moved to Tianjin after adulthood	40	58.1
Housing source	Danwei owned or rented	35	29.5
	The housing is not owned or rented by danwei (for example, the housing from private developers, the housing from housing bureau, resettlement housing, etc.)	65	52.6
Housing ownership	Housing owned	78	39.7
	Other	22	55.6
Employment sector	Employed by party authority, government and public institutions	15	32.3
	State-owned enterprise	26	37
	Joint venture, private and enterprises founded by Foreign Direct Investment	54	51.7
	Self-employed and others	5	41.1
Occupation	Low-skilled work	19	41.9
	Middle or high-skilled work	78	45.8
	Public officer	3	28.3
Transport mode	Walking or using bicycle	14	45.5
	Public transport mode (Public bus, Danwei bus and subway)	61	47.4
	Car (private car or Danwei car provided by work unit)	25	39.5

5.1.2 Result of the Multiple Linear Regression

Table 5.2: Summary of Regression Models Result (source: author)

	R	R square	Adjusted R square	Std. Error of the estimate	Durbin-Watson	F	Sig. (p-value)
Regression model for worker's commuting time	0.841	0.708	0.690	0.274564	1.953	39.591	p < 0.001

Table 5.2 presents the regression analysis for workers' commuting time. According to Heim et al. (1995), high colinearity or multicollinearity exists between independent variables only when the VIF value exceeds 3. The regression results in Table 5.3 show that the VIF value is up to 2.979, indicating that there is no collinearity between the independent variables. It means that the regression analysis has a goodness of fit associated with the independent variable. Moreover, the Durbin-Watson value is 1.920, close to 2, which indicates that the residual independence is better. The regression results show that the adjusted R² is 0.690, indicating that 69% of the individual worker commute time variation can be explained by the independent variables in Table 5.3. The F value is 39.591 with a significant level (p<0.001), which indicates that the regression analysis is statistically significant and the regression equation has a high degree of goodness of fit.

From Table 5.3, the following conclusions can be drawn:

- Participants aged over 50 years old have a shorter commuting time, around 27.3% less than that of 20-35 years old;
- The commuting time of low-income workers is significantly higher than that of high-income workers;
- The commuting time of highly educated workers is 10.5% more than that of the low degree holders;
- The commuting time of workers living in nuclear families is 21.7% more than that of the single workers;
- The commute time of people who purchase or rent apartments from Danweis is 29.9% less than those buying or renting private apartments;
- The commute time of the workers employed by the government, public institutions and the state-owned enterprise is significantly less than that of the workers in non-Danweis system; medium or high-skilled workers have 1.2 times more commute time than low-skilled workers;
- For commuting tools, workers driving to work have a less commute time than people walking, riding bicycles or electric bicycles to work.

Table 5.3: Regression Analysis Results (source: author)

Independent Variables		B(unstandardized coefficients)	Std. Error	Beta(standardized coefficients)	T(Statistics)	Sig.	VIF
Constant		3.550***	0.081		43.615	0.000***	
Gender (ref: Male)	Female	-0.048	0.030	-0.48	-1.596	0.111	1.127
Age(ref:20-35)	35-50	-0.029	0.035	-0.027	-0.837	0.403	1.306
	>50	-0.273***	0.075	-0.121***	-3.637	0.000***	1.353
Monthly income(RMB)(ref:>7000)	<2000	0.613***	0.170	0.110***	3.603	0.000***	1.143
	2000-4500	0.119**	0.051	0.085**	2.320	0.021**	1.640
	4501-7000	0.132***	0.035	0.133***	3.815	0.000***	1.502
Education attainment (ref: Junior college diploma, High school diploma and below)	Bachelor,Master, Doctor	0.105**	0.033	0.104**	3.213	0.001**	1.285
Household structure (ref: Single)	Cohabiting	0.211***	0.050	0.177***	4.180	0.000***	2.209
	Nuclear Family	0.217***	0.049	0.216***	4.390	0.000***	2.979
	Other	0.227**	0.106	0.070**	2.145	0.033**	1.306
Hukou status (ref: Household with urban Hukou issued in other cities)	Household with Tianjin Hukou	-0.234***	0.034	-0.237***	-0.237	0.000***	1.429
Living time in Tianjin (ref: Lived in Tianjin since childhood)	Moved to Tianjin between 1 and 17 years old	0.143**	0.056	0.079**	0.079	0.011**	1.190
	Moved to Tianjin after adulthood	0.261***	0.037	0.259***	0.259	0.000***	1.672
Housing source(ref:The housing is not owned or rented by Danwei)	Buy or rent house(apartment) from Danweis	-0.299***	0.035	-0.290***	-8.517	0.000***	1.423
Housing ownership (ref: Other)	Housing owned	-0.096**	0.047	-0.081**	-2.052	0.041**	1.896
Employment sector (ref: Joint venture, private and enterprises founded by Foreign Direct Investment)	Employed by party authority, government and public institutions	-0.234***	0.050	-0.168***	-4.681	0.000***	1.587
	State-owned enterprise	-0.192***	0.036	-0.171***	-5.281	0.000***	1.298
	Self-employed and others	-0.042	0.074	-0.018	-0.569	0.570	1.237
Occupation (ref: Low-skilled work)	Middle or high-skilled work	0.200***	0.042	0.167***	4.746	0.000***	1.533
	Public officer	-0.048	0.100	-0.017	-0.478	0.633	1.540

Transport mode (ref: Walking or using bicycle)	Public transport mode (Public bus, Danwei bus and subway)	-0.017	0.044	-0.017	-0.383	0.702	2.349
	Car (private car or Danwei car provided by work unit)	-0.091*	0.051	-0.080*	-1.770	0.078*	2.502

* P<0.1; ** P<0.05; *** P<0.01.

5.1.3 Discussion of the Modelling Result of the Multiple Linear Regression

The statistical analysis illustrates that institutional factors have a significant impact on the commuting time of workers, and workers from Danwei have significantly shortened commuting time that those do not work in Danweis. This finding echoes the research of Zhao (2015). Typically, Danweis provide workers with free or low-cost housing, which are normally built on freely allocated land that is retained during the planned economy period, and thus at a low cost. Danweis' workers and their families have access to permanent housing rights. At the same time, the gap in housing subsidies between non-Danweis and Danweis has exacerbated the disadvantages of non-Danwei workers in the housing market. A sufficient financial allocation from government revenues provides Danweis' workers with the highest housing subsidies. For joint venture, private and enterprises founded by foreign direct investment, the employers may try to minimise their contribution to HPF to reduce labour costs. Zhao et al. (2018) claim that only 40% of out-system companies provide housing subsidies or paid HPF, while in comparison, the HPF of staff in the system may be twice as high as the staff outside the system. As a result, the commute time of Danweis' staffs are reduced because the balanced work and housing relationships.

Additionally, the type of housing for workers also influence their time of commuting, for living in Danwei houses can significantly reduce the time of travelling to work compared with living in private commercial accommodation. This finding responds the results of study by Zhao et al. (2011). With the phase out of Danwei system and the government's promotion of market-based housing supply, the commuting time increases for ordinary workers. These findings may also indicate that the working mobility of the post-reform era is still limited. Despite the transformation into free-flowing labour market after 1997, a considerable number of workers still live in the previous Danwei houses, which could maintain the job-housing relationship based on Danwei.

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

In addition to institutional factors, other socio-economic factors are also associated with the workers' commuting time. First, middle or high-skilled workers have longer commutes than low-skilled ones, which can be explained by the latter groups' low-sensitivity to commuting costs and living environment. As a result, the latter group of people find it easier to improve job-housing relationships by living in informal housing, such as the basement house in the central area (Li and Liu, 2016). Second, higher income workers tend to commute longer. In general, 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 commuting time because they do not need to consider their family members. Taking into account their family members, workers may sacrifice the job-housing balance so that their partners can commute easily. They would face more things to consider when it comes to the case with children, because they may need to find homes close to hospitals, high-schools and other social facilities for the sake of their children.

5.2 How Commuters' Job-housing Relationship Effected by Institutional Arrangements

Although the regression results describe the correlation between institutional factors and commuting time in a quantitative way, it is still ambiguous that in what ways the workers' job-housing relationship is shaped by institutional constraints. In addition, even if institutional constraints affect the balance between job and housing, choosing some methods may reduce commuting time, like an effective commuting model, moving to housing close to job. To further understand the explanation behind the regression results, semi-structured interviews are conducted to explore individual choices of work and residential locations under biased institutional arrangements, with special focus on how workers balance job and residence, their attitudes toward Hukou and Danweis' welfare, and their strategies for dealing with commuting burdens and institutional barriers. Based on the socio-economic characteristics of the 15 respondents, which are shown in Table 5.4, three groups are identified to discuss the institutional barriers faced by different social groups and the interaction of job and housing relationships that occurred on them. Three findings are discussed for the results of the interview.

Table 5.4: Interview Respondents (source: author)

Group	Who	Respondents
Local resident(A)	Working in Danweis, Buying Danweis' house, Having Tianjin Hukou	A1,A2,A3
	Working in private enterprise,Buying Commodity house, Having Tianjin Hukou	A4,A5
Highly-skilled migrant(B)	Working in Danweis, Buying Danweis' house, Having Tianjin Hukou	B1,B2,B3
	Working in Danweis, Rental Danweis' house, Having Tianjin Hukou	B4,B5,B6
	Working in non-Danweis, Buying commodity house, Having Tianjin Hukou	B7,B8
Low-skilled migrant(C)	Temporary work, Rental house, Having non-Tianjin Hukou	C1
	Self-employed, Rental house, Having non-Tianjin Hukou	C2

5.2.1 Local Residents Are More Likely to Reduce the Commuting Burden

The interview finds out that local people are hardly limited by the institutions, so they can better maintain the balance of work-housing. They are also preferred by the labour market because of their Hukou and identity as local people of Tianjin, which is unfavourable for immigrants to the city when they compete for jobs. One of the main reasons for this kind of employment discrimination is the allocation of household quotas. The mechanism of household quotas requires employers to recruit more locals if they want to obtain quotas (Wang and Yao, 2018). On the other hand, immigrants tend to switch to foreign-funded enterprises or private companies after obtaining their Hukou because of higher-income, which become a loss of talent for enterprises. As a result, locals with Hukou tend to look for work near their homes, which leads to more flexibility for them in choosing careers and adjusting the distance from the workplace to their homes to reduce commuting time. These findings are the same as those of Wang and Yao (2018) and Zhao et al. (2011).

“It’s obvious that locals have an advantage in finding a job. It’s a trend for Danweis not to hire non-Tianjin Hukou workers. They just want to get an Hukou there and then switch to high-paying jobs. Recruiting immigrants is risky and quotas for immigrants is also decreasing every year.” (A1, Senior Official of Government, 50)

Although most local residents purchase commercial apartments after the marketisation of the housing market, the increased commuting burden and crowded traffic forced them to return to the previous Danwei house. In spite of the higher quality and larger space in newly constructed commercial houses than Danwei houses, these new private accommodations are often located at suburbs, far from work, public schools and hospitals. These factors result in residents’ return to the Danwei house. Especially in the case of worsening commuting conditions, moving back to the old Danwei house is an effective way to reduce time wastage, especially families with children.

“I have a high quality house in Hexi District, but my family and I still live in the house provided by Danwei in Heping District, mainly because it is within walking distance of my work place, instead of nearly 90 minutes of commuting every day. At the same time, my child can receive a better education.” (A3, Senior Manager of State-owned Enterprises, 44)

It is easier and more flexible for local residents with Hukou to balance their homes and workplaces. This is because, without the constraints of Hukou, the preference of the labour market and the pooling of resources among family members help them improve their job mobility and bring them a wide range of housing and work options. The Danwei housing helps local young and middle-aged residents to get close to the job centre, effectively reducing their commuting time.

5.2.2 Restricted for Highly-skilled Immigrants in Keeping Job-housing Balance

For high-skilled immigrants, Hukou, HPF and Danwei welfare systems shape their job-housing relationships. It is difficult for highly-skilled immigrants to keep job-housing balance because they may need to work for a very long time in Danwei to get Hukou and to change from immigrants to locals. For immigrants who do not have Hukou, long-term payment of social security payments and personal income taxes, as well as stable work, are necessary for obtaining Hukou and purchasing housing. People may not be totally free when they want to change job if they want to retain these qualifications for the sake of Hukou in the long term, which may bring negative impact of the institutions on the job and residential mobility of high-skilled immigrants is obvious. Hukou quotas, HPF, housing welfare have increased the advantages of employment in Danweis, particularly for high-skilled immigrants who wish to settle down Tianjin. Clearly, institution creates a difference in the commuting burden between commuters in and outside Danweis.

“Two years ago I was hesitant between the private sector and 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 the 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 highly-skilled immigrants that do not work in Danweis, the serious commuting burden significantly reduces the time for their leisure activities, but it is difficult for them to solve 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 of Zhao and Howden-Chapman (2010) and Zhao (2015). The pressure on commuting and house prices have led to a decline in the quality of life for non-Danweis highly skilled immigrants, resulting more people prefer to work in Danweis. As B7 said:

“I got the Hukou through the “Talent Plan”. Although I have higher income, I can’t afford a property worth millions of Yuan in Heping district, which could cost me decades to repay loan. High prices force me to buy an apartment in the suburbs. I am always exhausted when coming back home at seven o’clock. Therefore I plan to buy a car to save time by driving to work, but it is also a big expense.” (B7, private company, 31)

Most high-skilled immigrants want to settle in Tianjin, but it has become increasing difficult for them to balance job and housing due to the employment discrimination created by the Hukou system, the changing and tightening housing purchases and access to social resources policy. The significant dual structure creates a difference in the commuting burden between commuters in and outside the system, leading to an increasing number of high-skilled immigrants trying to work in the system, which could help them to get housing from Danweis and adequate housing subsidies, reducing the commuting burden.

5.2.3 Low-skilled Immigrants Are Not Sensitive to the Institutional Impact

Low-skilled immigrants are not restricted by the Hukou system when adjusting the relationship between job and housing, for the reasons from the following three aspects. Firstly, most low-skilled immigrants self-employ or do not sign labour contracts, and are more flexible in choosing the time and place of work. Moreover, the development of the city creates many types of service opportunities in a wide range of areas. Additionally, the existing Danwei employment conditions and social policies for obtaining Hukou make it impossible for low-skilled immigrants without a university diploma to obtain Hukou and purchase housing in Tianjin. Because of this, low-skilled immigrants do not care about these institutions. Finally, low-skilled immigrants, who have relatively low-income, are motivated to find housing near their workplaces, and informal housing in the city centre has become their main source of housing. As C1 and C2 said:

“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 the basement of the neighborhood, 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 for live but we have no plan to buy a house in Tianjin, because it’s very expensive. We save up the money and pay for the tuition for kids.” (C2, self-employed, 42)

Low-skilled immigrants are more likely to adjust job-housing balance than high-skilled immigrants because they do not find it necessary to settle down in Tianjin, that is also why they do not care about the restrictions of the housing and employment system. Being highly sensitive to commuting costs but less sensitive to the housing conditions, low-skilled immigrants tend to look for housing in the city centre with various opportunities, which could enable them to live in crowded, somber but cheap basement or informal housing that close to the job centre. In addition, their informal connections with employers also make them more flexible in adjusting their workplace. However, it is obvious that they are excluded from the formal employment sector and Tianjin’s civil rights system.

5.3 Improvements in Commuting Burden from Commuters’ Perspective

From the perspective of the commuters, it remains a key issue to reduce the unequal commuting burden under the influence of the institutions. Followed is further discussion on what strategies can be adapted to relieve commuting burden and what measures commuters can take to reduce the commuting burden .

5.3.1 Commuter Support Measures and Their Actual Measures: Result

Table 5.5: The Strategies for Improving the Commuting Burden in the Perspective of Commuters (source: author)

Improvements in commuting burden	Vote rate(%)
Getting more efficient commuting facilities (increasing public transport shifts and lowering public transport fares)	44.5
Getting commuting subsidies	25.75
Mixed planning of residential and work areas	54.75
Relaxation of Tianjin household registration restrictions	17
Removing the legacy of Danwei housing welfare and equal housing subsidies(like: HPF)	58

Table 5.6: The Measure that Commuters to Reduce Commuting Time (source: author)

The Measure that Commuters to Reduce Commuting Time	Percentage(%)
Going to work earlier or later to avoid peak periods	12
Taking a taxi	5
Riding bicycles	13
Looking for a job near home	15
Choosing public transportation (bus/subway) that can be reached workplaces directly, avoiding transfer	19
Living closed to workplace	18
Choosing highway	6
Using mobile app to plan routes to find uncongested routes	12

5.3.2 Discussion

This study argues that commuters are aware of the longer commute times caused by institutional barriers, and have been taking active actions to cope with this issue. As for their preference of measures, most people expect to remove the job-housing privilege caused by the Danwei housing welfare heritage and to narrow the gap of HPF and other implicit subsidies between Danweis and private companies at the same time, in order to make the houses more affordable. This responds to the fact that housing supply and labour mobility are greatly influenced by established non-market institutions under the constraints of housing and employment systems (Zhao and Lu, 2010), which challenges the “co-location assumptions” based on free rational markets. Therefore, market rational housing and employment location decisions are limited. In this case, institutional constraints influence personal commuting time and has led to commuters’ claim about it. However, they are not sensitive to the relaxation of the restrictions on the application for Tianjin household registration, which can be possibly 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 reforms take a long time (Zhao et al., 2018). However, the fact is that a series of housing, car purchase and employment institutions related to household registration will have a profound impact on the job-house balance of vulnerable groups (Zhao and Howden-Chapman, 2010). In this regard, low-liquidity labour and housing markets can never achieve balanced job-housing relations.

The commuters’ strong appeal for reducing the commuting burden in the short term is reflected in their wide support for more efficient commuting facilities, such as increasing public transport shifts and lowering public transport fares. In terms of the practical measures,

they choose public transportation that can reach the workplace directly instead of routes requiring transfers 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 and Jones, 2012; Lucas and Stanley, 2009). Additionally, in the view of commuters, spatial planning is another way to alleviate the unequal commuting burden in addition to institutional measures also seen as a way, which is reflected in the fact that many respondents choose mixed planning for residential and work areas. Immigrants strongly support targeted employment or housing planning to achieve greater job-housing balance. In practice, they also try to move to an apartment close to the workplace or seek jobs near their apartment. Housing planning close to the job centre and improving the balance between housing location and residential location are considered to be very effective in reducing commuting costs and time (Zhao and Li, 2016). Also, Hu (2016) believes that governments need to plan land in appropriate locations to link disadvantaged households to economic opportunities, thereby helping to alleviate the deteriorating spatial mismatch faced by vulnerable groups.

In general, although commuters prefer short-term measures, such as more convenient public transport, and shortening the spatial distance between homes and workplaces, they also consider removing unreasonable institutional barriers and implementing rational planning as a way to improve job-housing balance in the long run.

5.4 Summary

The results of the questionnaires and interviews show that institutional factors such as Hukou, Danwei system heritage and HPF link individual rights with the benefits and opportunities provided by the state, thus play a vital role in explaining the commuting behavior of residents of Tianjin.

There are significant correlations between the household status, the employment sector and the housing source that directly reflect the institutional factors are significant related to commuting time. People with Tianjin Hukou and work in official institutions like government/party departments, public/civil sectors and state-owned enterprises have significantly fewer commuting burden, for they live in housing provided by Danwei and find it easier to achieve the balance between job-housing relationship. The relationship between individual job and housing in Tianjin is significantly influenced by the dual structure of the labour and social welfare system. “Institutional disadvantage groups”, including non-Danweis’ workers and non-Tianjin Hukou holders, experience a higher commuting burden.

In terms of the impact of institutional constraints on workers’ job and housing choices, high-tech immigrants suffer from serious commuting problems because institutions impose more restrictions on their job choices and housing welfare, making them unable to maintain a balanced job-housing relationship. In comparison, local residents with Hukou are welcomed by Danweis, and are more likely to live in Danwei welfare communities to maintain a better job-housing balance. Surprisingly, low-skilled immigrants are “fortunate” to avoid higher

commuting costs through informal employment and housing because they are excluded from the social welfare system in Tianjin.

It is suggested that policy makers take into consideration how commuters can suffer less from unfair commuting burdens. Solutions should be come up with to solve the inequality in commuting. From the perspective of commuters, removing the legacy of Danwei housing benefits and achieving equal housing subsidies and HPF are what they are most looking forward to in terms of institutional reforms, while appealing for improved quality of public transport and mixed housing-workplace planning.

6 Conclusions

6.1 Introduction

This study applies both quantitative and qualitative methods to investigate how institutional barriers affect individual job-housing relationships and to analyse how inequality in the commuting burden is formed, with Tianjin being analysed as a case study. This fills the gap of examples in China in the previous literature, paying particular attention to the comparison between different social groups facing the constraints of housing and work institutions. While considering the impact of new changes in the housing institutions such as HPF on the commuting burden, this study also answers the contradictory and questionable results of previous literature by presenting the findings that the commuting burden is a result of the institutionally restricted job-housing relationship, and the inequality of commuting burden is mainly attributable to biased institutional arrangements. In addition, this thesis explores the attitudes and opinions of commuters suffering from unequal commuting burdens to improve commuting conditions, which has hardly been mentioned in the previous literature.

6.2 Key Findings

-In response to Objective 1

In Tianjin, the institution involving Hukou, housing supply and labour management has a significant impact on individual commuting time. Workers who have Tianjin Hukou have shorter commuting times. People working in Danweis are more likely to live in Danweis' communities that help them maintain a better job-housing balance, which proves that the heritage of Danwei housing still imposes a major impact on reducing commuting time. However, the imperfect market-oriented housing reform has not enough influence to promote the job-housing balance, and workers suffer long commute times. Demolition of the Danwei system has a major impact on workers' access to work by increasing labour mobility and the separation of job from housing (Hill, 2005).

- In response to Objective 2

The study draws the conclusion that institutional restrictions have a significant impact on the job and housing choices of the three social groups of Tianjin local residents, high-tech immigrants and low-skilled immigrants. Specifically, the local Tianjin residents who have Hukou or live in Danweis' housing have shorter distances for commuting. In addition, to some extent, they are favoured by governments, institutions and state-owned enterprises. Despite the fact that they have higher quality housing on the outskirts of the city, returning to the residence provided by Danwei is a compromise strategy that many families use to improve the commuting burden to pursue convenient commuting and facilities in the city centre. High-skilled immigrants are limited by institutional barriers that make it difficult for them to balance work and housing. Although high-skilled immigrants are eager for work within the system, tightening immigration policies increase discrimination, greatly increasing the difficulty of high-skilled immigrants adjusting their workplaces and residential areas. As the result, the long commuting time squeezes their time for relax or other activities, so they tend

to work in institutions that provide good housing benefits (HPF) and buying cars, which are the primary choices for them trying to adjust job-housing relationships. On the other hand, low-skilled immigrants are less influenced by commuting burdens. Informal employment and informal housing play an important role in balancing the job-housing relationship of low-skilled migrants. This is at the expense of the civil rights and social welfare of low-skilled immigrants.

As can be seen from this study, for high-tech immigrants, they are restricted by housing and employment institutions, suffering the long commute time. Local residents returned to Danwei' housing, and low-skilled immigrants eased traffic pressure through informal housing in urban centers.

- In response to Objective 3

From the perspective of commuters, they are very looking forward to eliminating inequality of commuting burden caused by institutions, which they consider to be the most urgent need to be addressed. To be more specific, they hope that the Danwei housing welfare heritage can be eliminated and the rights to HPF are equal. Traditional Danwei housing benefits some workers in the system. Ongoing market-oriented housing reforms tend to reduce the Danweis' housing while increasing private developers' housing in the market. In addition, commuters are also paying special attention to housing-workspace mixed planning strategies, with call for an appropriate match between housing, job and the socio-economic characteristics of workers. In practice, commuters also try to match the workplace with the location of the home by moving home or adjusting the location of the job. Finally, in the short term, it is essential to improve public transport services and provide commuting subsidies, which has been strongly supported by immigrants, and it is expected to reduce the commuting burden and promote equity.

6.3 Policy Implications

Workers and employers are dynamically connected through policies and social institutions, including Hukou, housing benefits and other civil rights. In this regard, low-liquidity labour and housing markets can never achieve a balanced job-housing relationship. In addition, only by eliminating institutional restrictions on vulnerable groups can the unequal commuting burden be eliminated. In the future, commuter recommendations could be adopted to reduce the commuting burden, more importantly, institutional innovations should be taken in terms of housing supply policies and Hukou management to improve transport services. In particular, policies should encourage the provision of low-price social housing to reduce commuting time for low-income workers. This could help to commuting equity.

6.4 Limitations and Suggestions for Further Research

This study has obvious limitations including the inadequacy of data collected by survey and the lack of more indicators to measure the commuting burden. First, the limited information gathered from the survey made it impossible to study more detailed the impact of different employers on worker-adjusted job-housing relationships. Some private companies also

provide housing subsidies, which are not considered in this study. These housing subsidies could significantly influence on the workers' job-housing relationship. Secondly, for the measurement of the job-housing relationship and the commuting burden, this study applies only time of travelling as the indicator of commuting. However this should not be the only criteria, for instance, commuting expenses can also be considered since the meaning of the commuting burden for different individuals or social groups is different.

As for further research in the future, the commuting cost can be investigated when measuring the commuting burden under the influence of the Hukou, Danwei system and HPF. In addition, other welfare of employee benefits at the individual level, such as the implicit housing subsidies, should be considered. When it comes to the strategies to improve the unequal commuting burden, it is necessary to try to adopt the commuters' opinions: to achieve an appropriate match between housing, job and workers' socio-economic characteristics in a mix-land use plan. In the process of removing Danweis' housing heritage, policies were added to regulate the housing market to avoid job-housing imbalances due to intervention.

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Appendices

Appendix 1: Self-completed Questionnaires Question List

Questions	Objectives	Literature support
Q1. Gender (Select one option) A. Female B. Male	1	Gobillon et al., 2007 Kasarda, 1995 McLafferty and Preston, 1991 Rapino and Cooke, 2011
Q2. Age Group (Select one option) A.20-35 B.35-50 C.>50	1	Gobillon et al., 2007 Rapino and Cooke, 2011
Q3. Gross Monthly Income Range (Select one option) A.<2000 RMB B.2000-4500 RMB C.4501-7000 RMB D.>7000 RMB E. No active income (E.g. Retirees, students etc.)	1	Giuliano, 1991 Rapino and Cooke, 2011 Sanchez et al., 2004 Vandersmissen et al., 2003
Q4. Education attainment (Select one option) A. Bachelor, Master, Doctor B. Junior college diploma, High school diploma and below	1	Stead et al., 2000
Q5. Household structure (Select one option) A. Single B. Cohabiting C. Nuclear Family	1	Zhao, 2015 Zhao and Lu, 2010 Zhang et al., 2018
Q6. Hukou status (Select one option) A. Household with Tianjin Hukou B. Household with urban Hukou issued in other cities	1&2	Zhao, 2015 Zhao and Lu, 2010 Zhang et al., 2018
Q7. Living time in Tianjin A. Lived in Tianjin since childhood B. Moved to Tianjin between 1 and 17 years old C. Moved to Tianjin after adulthood	1&2	Zhao, 2015 Zhao and Lu, 2010 Zhang et al., 2018
Q8. Housing source (Select one option) A. Danwei owned or rented B. The housing is not owned or rented by danwei (for example, the housing from private developers, the housing from housing bureau, resettlement housing, etc.)	1&2	Wang and Chai, 2009 Yiu and Tam, 2007 Zhao et al., 2011 Zhao and Howden-Chapman, 2010
Q9. Housing ownership (Select one option)	1&2	Oswald,1999

A. Housing owned B. Other		Oswald,1997 Wu, 1996
Q10. Employment sector (Select one option) A. Employed by party authority, government and public institutions B. State-owned enterprise C. Joint venture, private and enterprises founded by Foreign Direct Investment D. Self-employed and others	1&2	Hassard, 2006 Monkkonen et al., 2015 Wang and Yao, 2018
Q11. Occupation A. Low-skilled work B. Middle or high-skilled work C. Public officer	1&2	Hassard et al., 2006 Monkkonen et al., 2015 Wang and Yao, 2018 Zhao and Howden-Chapman, 2010
Q12. Daily commute time (Minute) (Select one option) A.0-10 B.11-20 C.21-30 D.31-40 E.41-50 F.51-60 G.>60 Can you write down the time in specific _____	1&2	China Urban Transport Report, 2018 Deacon and Sonstelie, 1985 Quarmby, 1967 Zhao and Lu, 2010 Zhang et al., 2018
Q13. Daily commute cost (RMB) (Select one option) A.0-10 B.11-20 C.21-30 D.31-40 E.41-50 F.51-60 G.>60 Can you write down the cost in specific _____	1&2	China Urban Transport Report, 2018 Cho-yam Lau, 2011 Schleith and Horner, 2014 Van Ommeren and Fosgerau, 2009
Q14. Transport mode (Select one option) A. Walking or using bicycle B. Public transport mode (Public bus, Danwei bus and subway) C. Car (private car or Danwei car provided by work unit)	1&2	Currie, 2010 Grengs, 2010 Kawabat and Shen, 2007 Van Acker and Witlox, 2010
Q15. How do you usually reduce commute time? _____	3	Currie, 2010 Kim and Ulfarsson, 2008 Schwanen, 2002 Shen, 2000
Q16. Which way is the most beneficial to	3	Currie, 2010

<p>reduce the burden of commuting in your option. (Select up to two)</p> <p>A. Getting more efficient commuting facilities (increasing public transport shifts and lowering public transport fares)</p> <p>B. Getting commuting subsidies</p> <p>C. Mixed planning of residential and work areas</p> <p>D. Relaxation of Tianjin household registration restrictions</p> <p>E. Removing the legacy of Danwei housing welfare and appealing to equal housing allowance and HPF</p>		<p>Kim and Ulfarsson, 2008 Schwanen, 2002 Shen, 2000</p>
<p>Q17. Your district</p> <p>A. Heping</p> <p>B. Nankai</p> <p>C. Hexi</p> <p>D. Hebei</p> <p>E. Hongqiao</p> <p>F. Hedong</p>		<p>Note: The aim of this question is only to control the number of samples in different districts.</p>
<p>Would you like to leave a contact for a more detailed interview?</p> <p>A. YES</p> <p>B. NO</p>		<p>Note: The aim of this question is to prepare for the semi-structured interview.</p>

Appendix 2: Semi-structured Interview Question Structure

Question	Objective	Literature support
Q1. Can you talk about the influence of Hukou quotas and housing welfare attached with in-system jobs on you? (about job choosing, housing cost and commuting time or cost)	2	Wang and Chai, 2009 Yiu and Tam, 2007 Zhao, 2015 Zhang et al., 2018 Zhao et al., 2011 Zhao and Howden-Chapman, 2010 Zhao and Lu, 2010
Q2. Whether the changing and tightening policies on Hukou quota, housing purchase further reduces your job mobility. (Are you limited by these institutions when you want to change jobs?)	2	Oswald, 1999 Oswald, 1997 Wang and Chai, 2009 Wu, 1996 Yiu and Tam, 2007 Zhao, 2015 Zhang et al., 2018 Zhao et al., 2011 Zhao and Howden-Chapman, 2010 Zhao and Lu, 2010
Q3. Do you prefer to look for work near your home or choose the location of housing based on the workplace?	2&3	Hassard, 2006 Monkkonen et al., 2015 Wang and Yao, 2018
Q4. Whether the commuting burden pressed your time available for leisure and other pursuits? (to what extend?)	2&3	Cho-yam Lau, 2011 Deacon and Sonstelie, 1985 Quarmby, 1967 Schleith and Horner, 2014 Van Ommeren and Fosgerau, 2009 Zhao and Lu, 2010 Zhang et al., 2018
Q5. How do you try to shorten the commuting time and reduce expense?	3	Currie, 2010 Kim and Ulfarsson, 2008 Schwanen, 2002 Shen, 2000
Q6. Do you feel privileged as a local in balancing job-housing relationship, and why?	3	Zhang et al., 2018 Zhao et al., 2011 Zhao and Lu, 2010

RISK ASSESSMENT FORM FIELD / LOCATION WORK



The Approved Code of Practice - Management of Fieldwork should be referred to when completing this form
<http://www.ucl.ac.uk/estates/safetynet/guidance/fieldwork/acop.pdf>

DEPARTMENT/SECTION **BARTLETT SCHOOL OF PLANNING**

LOCATION(S) **TIANJIN**

PERSONS COVERED BY THE RISK ASSESSMENT **CHEN LIU**

BRIEF DESCRIPTION OF FIELDWORK **Questionnaire Interview**

Consider, in turn, each hazard (white on black). If **NO** hazard exists select **NO** and move to next hazard section. If a hazard does exist select **YES** and assess the risks that could arise from that hazard in the risk assessment box. **Where risks are identified that are not adequately controlled they must be brought to the attention of your Departmental Management who should put temporary control measures in place or stop the work. Detail such risks in the final section.**

ENVIRONMENT

e.g. location, climate, terrain, neighbourhood, in outside organizations, pollution, animals.

The environment always represents a safety hazard. Use space below to identify and assess any risks associated with this hazard

Examples of risk: adverse weather, illness, hypothermia, assault, getting lost.
Is the risk high / medium / low ?

LOW

CONTROL MEASURES

Indicate which procedures are in place to control the identified risk

- work abroad incorporates Foreign Office advice
- participants have been trained and given all necessary information
- only accredited centres are used for rural field work
- participants will wear appropriate clothing and footwear for the specified environment
- trained leaders accompany the trip
- refuge is available
- work in outside organisations is subject to their having satisfactory H&S procedures in place
- OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

EMERGENCIES

e.g. fire, accidents

Where emergencies may arise use space below to identify and assess any risks

Examples of risk: loss of property, loss of life

CONTROL MEASURES

Indicate which procedures are in place to control the identified risk

- participants have registered with LOCATE at <http://www.fco.gov.uk/en/travel-and-living-abroad/>
- fire fighting equipment is carried on the trip and participants know how to use it
- contact numbers for emergency services are known to all participants
- participants have means of contacting emergency services
- participants have been trained and given all necessary information
- a plan for rescue has been formulated, all parties understand the procedure
- the plan for rescue /emergency has a reciprocal element
- OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

EQUIPMENT

Is equipment used?

 NOIf 'No' move to next hazard
If 'Yes' use space below to identify and assess any risks*e.g. clothing, outboard motors.*

Examples of risk: inappropriate, failure, insufficient training to use or repair, injury. Is the risk high / medium / low ?

CONTROL MEASURES

Indicate which procedures are in place to control the identified risk

- the departmental written Arrangement for equipment is followed
- participants have been provided with any necessary equipment appropriate for the work
- all equipment has been inspected, before issue, by a competent person
- all users have been advised of correct use
- special equipment is only issued to persons trained in its use by a competent person
- OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

LONE WORKING

Is lone working a possibility?

 NOIf 'No' move to next hazard
If 'Yes' use space below to identify and assess any risks*e.g. alone or in isolation lone interviews.*

Examples of risk: difficult to summon help. Is the risk high / medium / low?

CONTROL MEASURES

Indicate which procedures are in place to control the identified risk

- the departmental written Arrangement for lone/out of hours working for field work is followed
- lone or isolated working is not allowed
- location, route and expected time of return of lone workers is logged daily before work commences
- all workers have the means of raising an alarm in the event of an emergency, e.g. phone, flare, whistle
- all workers are fully familiar with emergency procedures
- OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

ILL HEALTH

e.g. accident, illness, personal attack, special personal considerations or vulnerabilities.

The possibility of ill health always represents a safety hazard. Use space below to identify and assess any risks associated with this Hazard.

Examples of risk: injury, asthma, allergies. Is the risk high / medium / low?

LOW

CONTROL MEASURES

Indicate which procedures are in place to control the identified risk

- an appropriate number of trained first-aiders and first aid kits are present on the field trip
- all participants have had the necessary inoculations/ carry appropriate prophylactics
- participants have been advised of the physical demands of the trip and are deemed to be physically suited
- participants have been adequate advice on harmful plants, animals and substances they may encounter
- participants who require medication have advised the leader of this and carry sufficient medication for their needs
- OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

TRANSPORT

e.g. hired vehicles

Will transport be required

NO

YES

Move to next hazard

Use space below to identify and assess any risks

Examples of risk: accidents arising from lack of maintenance, suitability or training

Is the risk high / medium / low?

No

CONTROL MEASURES

Indicate which procedures are in place to control the identified risk

- only public transport will be used
- the vehicle will be hired from a reputable supplier
- transport must be properly maintained in compliance with relevant national regulations
- drivers comply with UCL Policy on Drivers http://www.ucl.ac.uk/hr/docs/college_drivers.php
- drivers have been trained and hold the appropriate licence
- there will be more than one driver to prevent driver/operator fatigue, and there will be adequate rest periods
- sufficient spare parts carried to meet foreseeable emergencies
- OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

DEALING WITH THE PUBLIC

e.g. interviews, observing

Will people be dealing with public

YES

If 'No' move to next hazard

If 'Yes' use space below to identify and assess any risks

Examples of risk: personal attack, causing offence, being misinterpreted. Is the risk high / medium / low?

LOW

CONTROL MEASURES

Indicate which procedures are in place to control the identified risk

- all participants are trained in interviewing techniques
- interviews are contracted out to a third party
- advice and support from local groups has been sought
- participants do not wear clothes that might cause offence or attract unwanted attention
- interviews are conducted at neutral locations or where neither party could be at risk
- OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

WORKING ON OR NEAR WATER

Will people work on or near water?

NO

If 'No' move to next hazard

If 'Yes' use space below to identify and assess any risks

e.g. rivers, marshland, sea.

Examples of risk: drowning, malaria, hepatitis A, parasites. Is the risk high / medium / low?

CONTROL MEASURES

Indicate which procedures are in place to control the identified risk

- lone working on or near water will not be allowed
- coastguard information is understood; all work takes place outside those times when tides could prove a threat
- all participants are competent swimmers
- participants always wear adequate protective equipment, e.g. buoyancy aids, wellingtons
- boat is operated by a competent person
- all boats are equipped with an alternative means of propulsion e.g. oars
- participants have received any appropriate inoculations
- OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

MANUAL HANDLING (MH)

Do MH activities take place?

NO

If 'No' move to next hazard

If 'Yes' use space below to identify and assess any risks

e.g. lifting, carrying, moving large or heavy equipment, physical unsuitability for the task.

Examples of risk: strain, cuts, broken bones. Is the risk high / medium / low?

CONTROL MEASURES

Indicate which procedures are in place to control the identified risk

- the departmental written Arrangement for MH is followed
- the supervisor has attended a MH risk assessment course
- all tasks are within reasonable limits, persons physically unsuited to the MH task are prohibited from such activities
- all persons performing MH tasks are adequately trained
- equipment components will be assembled on site
- any MH task outside the competence of staff will be done by contractors
- OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

SUBSTANCES

Will participants work with substances

 NO

If 'No' move to next hazard
If 'Yes' use space below to identify and assess any risks

e.g. plants, chemical, biohazard, waste

Examples of risk: ill health - poisoning, infection, illness, burns, cuts. Is the risk high / medium / low?

CONTROL MEASURES

Indicate which procedures are in place to control the identified risk

- the departmental written Arrangements for dealing with hazardous substances and waste are followed
- all participants are given information, training and protective equipment for hazardous substances they may encounter
- participants who have allergies have advised the leader of this and carry sufficient medication for their needs
- waste is disposed of in a responsible manner
- suitable containers are provided for hazardous waste
- OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

OTHER HAZARDS

Have you identified any other hazards?

 NO

If 'No' move to next section
If 'Yes' use space below to identify and assess any risks

i.e. any other hazards must be noted and assessed here.

Hazard:

Risk: is the risk

CONTROL MEASURES

Give details of control measures in place to control the identified risks

Have you identified any risks that are not adequately controlled?

 NO


Move to Declaration

 YES


Use space below to identify the risk and what action was taken

Is this project subject to the UCL requirements on the ethics of Non-NHS Human Research?

 No

If yes, please state your Project ID Number

For more information, please refer to: <http://ethics.grad.ucl.ac.uk/>

DECLARATION

The work will be reassessed whenever there is a significant change and at least annually. Those participating in the work have read the assessment.

Select the appropriate statement:

- I the undersigned have assessed the activity and associated risks and declare that there is no significant residual risk
- I the undersigned have assessed the activity and associated risks and declare that the risk will be controlled by the method(s) listed above

NAME OF SUPERVISOR

SIGNATURE OF SUPERVISOR

DATE