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Effects of Congestion Charge on Relocation Decisions under
Non-Capital Functions Relieving Strategy in Beijing, China

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Abstract

This paper explores the relocation decisions under the non-capital functions relieving strategy in Beijing and its combination with the congestion charge scenario using a stated preference experiment. The questionnaires were distributed in six wholesale markets face to face and involved 321 respondents. Two ordered Logit models were conducted to test respondents' willingness to leave Beijing under the relieving strategy and its combination with congestion charge. Influential factors include personal and household characteristics, residential and job-related characteristics, commuting and freight related characteristics, attitudes towards policies, life cycle events, social inclusion and expected change in new markets all play important roles on their relocation decisions. The findings show that congestion charge has both positive and negative effect on the process of wholesale markets' relieving. It could enlarge the population being likely to leave, but also will increase respondents' place attachment and the difficulty to break their habits. Peer effect could also be used to attract more merchants relocate to new markets.

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Keywords: Relocation decisions; Non-capital functions relieving strategy; Congestion charge; Stated preference; Ordered logit model

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1. Introduction and background

With the rapid development of economy and city size, Beijing has been puzzled by "Metropolitan Malaises" in recent years, which caused by the contradictions between limited social and natural resources and the high concentration of population and functions in Beijing. To solve the problems caused by these contradictions, Beijing government has implemented a series of policies to relieve urban population to promote economic and social development in tune with urban population, resources and environment (stated by President Xi in 2014), named 'Non-capital Functions Relieving' strategy since 2015. According to President Xi's statements in 2014, Beijing should be considered as the national political center, cultural center, international communication center, and science and technology center of China. And industries which don't fit these capital urban strategic positionings need to be moved out.

This strategy could also trigger a large-scale population migration. According to the 13th Five-Year Plan of Beijing, two million permanent residents living in six core districts in Beijing is expected to be extracted by 2020. These residents are people working in industries which belong to four non-capital functions of Beijing, include (1) general manufacturing industry, (2) regional logistics bases and wholesale markets, (3) several educational and medical organizations, and (4) several administrative departments and non-profit service institutions (source: Beijing Official Website). These four non-capital functions are planned to be transferred to Hebei or Tianjin provinces—two provinces bordering on Beijing. It is necessary to know these four crowds' willingness to relocate and their expected relocation decisions. These are very important not only for forecasting actual effect of the strategy but also for adjusting related policies dynamically. Besides, possible interactions between relieving strategy and other policies which has been carried out or will be implemented also should be paid attention to, especially the later one. This is because the actual effects of new policies are uncertain, so it is better to know their possible effect before real implementation, especially under this special urban strategy.

Actually, residents' real responses to this strategy are not quite be what the government expect. Up to 2017, in wholesale markets planned to be relocated, more than 70% of immigrant employees still live in Beijing and are not willing to relocate (source: 2016~2017 Beijing Economic Development Report), even if the government have built several new markets in nearby Hebei or Tianjin provinces for them. However, as one of the key relieving objects, wholesale markets concentrate a large number of populations and cause severe traffic and environmental problem. By the end of 2016, the total number of wholesale markets in Beijing covering commodities include agricultural and sideline products, building materials, clothing, small commodities and so on is 781, in which contain more than 240 thousand stalls and about 53.4% of them located inside the six core districts in Beijing (source: 2017 Beijing Statistical Yearbook). 10% of these wholesale markets service customers not only from Beijing, but also Beijing-Tianjin-Hebei region, the whole nation and even on a global scale. More than 300 thousand people working in this kind of wholesale market (Zhang & Deng, 2017). Take the wholesale market near Beijing Zoo as an example, though it brought about 60 million-yuan benefits for Xicheng district every year, the government paid less than 100 million yuan to solve the traffic congestion and environment problems came with it (Xing et al., 2016).

Therefore, people working in Beijing wholesale markets play a very important role in the relieving strategy. Their relocation decisions will affect the implementation process of the relieving strategy and its actual result. And in present circumstances, relieving strategy alone is not enough to relieve the large population from planned wholesale markets so that traffic congestion and environmental pollution may still exist, and this is against the original intention of the strategy. In this situation, policy mix should be considered.

As an efficient way to alleviate congestion, congestion charge has been carried out in some countries or cities, such as Singapore and London, and it is now being discussed heatedly in Beijing. Most researchers pay attention to its short-term effect, like the influence on individuals' route choice, departure time and travel mode decision. But what also needs attention is congestion charge could also effects households' residence and job choice in long run. It may encourage people to relocate or look for another job through influencing their transport costs (Tillema et al., 2010).

Therefore, the long-term impact of congestion charge may be helpful to relieve the large number of populations working in planned wholesale markets and then promote the process of non-capital functions relieving strategy. However, there are quite limited empirical studies working on the influence of congestion charge on people's relocation decisions. Up to now, we only found two papers working on that topic using samples from Dutch by stated preference approach (Arentze & Timmermans, 2007; Tillema et al., 2010). But under the special social background in Beijing, the relocation effect of congestion charge could be changed. And this potential effect is useful for government to have a comprehensive understanding of congestion charge under Beijing current urban strategy before it being implemented.

The remainder of the paper is organized as follows. Section 2 present the theoretical framework. Section 3 reviews literatures about relocation decisions under non-capital relieving strategy and congestion charge scenario separately. Section 4 describes the survey design, data collection and descriptive statistics. Section 5 reports the factors influencing relocation decisions under sole relieving policy and its combination with congestion charge separately, based on the results of two ordered logit models. Section 6 concludes with a further discussion of the results and policy implications.

2. Theoretical framework

Residential relocation decisions could be divided into two stages (Cai & Xu, 2005). The first stage named awakening, is the result of internal and external pressures (Zhou & Xu, 1996; Cai & Xu, 2005; Tillema et al., 2010). Internal pressures include the tangible demand of housing space and facilities, and the intangible demand of new pursuit and ideal (Zhou & Xu, 1996). This kind of pressure mostly comes from the change of households' life cycle and life style, such as changes in family structure, income and preference (Tillema et al., 2010). External pressures come from the change of immediate environment caused by the change of housing conditions and socioeconomic status of neighbourhood (Zhou & Xu, 1996; Cai & Xu, 2005; Tillema et al., 2010). Therefore, when the total pressure is big enough, households will decide to relocate to improve their living conditions. The second stage is called searching. That is to say households searching an ideal living area, collecting housing information and determining the new residence after comparison and trade off (Zhou & Xu, 1996).

The job-related location is always in connection with the residential location. Lots of researched have proven that travel costs play a very important role in the relationship between residential and job relocation. For example, Ommeren et al. (1999b) studies the relationship between job relocation, residential relocation and commuting behaviour using search theory. In their opinion, when consider switching costs, people search new job and residence constantly to maximize their future living and working utility and minimize commuting costs. By constructing a search model, they find that people's relocation behaviour is positively correlated with commuting costs, and commuting costs are the only link between residential and job relocation. Tillema et al. (2010) propose that households need to make trade-off between travel cost and other factors (such as house rent) before relocating to a new place, which reflects the idea of trade-off theory. Kan (2002,2003) mention that there are not only substitutional but also complementary relationship between job and residential relocation. For instance, if changing job will not affect commuting cost and the new workplace is far away from the current residential location, households may also change house after job relocation. However, besides travel costs, other factors such as marital status, spouse (Ommeren et al. 1999a), risk preference (Kan, 2003) and policy intervention (Qi, 2018) could also influence households' job relocation decision.

This study focuses on the first stage of their relocation decision, which is to say people make the job and residential relocation decision. For people working in Beijing wholesale markets have to consider both job and residential relocation. Their relocation decision could be roughly divided into three kinds: (1) still stay in Beijing, (2) move to new markets in Hebei or Tianjin provinces and (3) move to other provinces. And for most of them, the third choice also means back to hometown, which are most located in south of China (according to our interview). As two external triggers, both the relieving strategy and congestion charge could affect their relocation decision. Comparatively

speaking, the relieving strategy has a stronger influence than congestion charge, because those people who belongs to the relieving object must make a relocation decision. But that doesn't mean that congestion charge couldn't have additional effect on their decision. Congestion charge could influence their relocation decision by increase commuting cost, freight cost and even their customers' purchase cost, which will further influence their living cost and potential income, and change their relocation decision in the end. Which factors play an important role in households' relocation decisions under non-capital relieving strategy? How does their significant change after adding a congestion charge scenario? And what could be done to promote the wholesale markets' reliving process according to these factors? We hope to find the answers by this research.

3. Literature review

3.1. Effect of the relieving strategy on relocation decisions

Although non-capital relieving strategy have a considerable effect on residences' relocation decisions, the quantitative researches about their willingness to move are quite limited. Xu et al. (2018) studied the willingness of young migrants to leave Beijing by a questionnaire survey among 446 migrants from 18 to 35 years old. They conducted a bivariate logit model of migrants' willingness to leave and explored the effect of five kinds of influential factors, include demographic characteristics, human capital, career development, family status and social capital. According to their results, only county household registration has a significant positive effect. However, people working in wholesale markets cover a larger age range, and some factors about their stall, markets and commuting or freight transport also could be considered. Zhang and Deng (2017) explored the relocation decisions of market stall entrepreneurs and their employees using descriptive statistics analysis. They found that 68.3% respondents didn't want to leave Beijing, but people who had a higher income, were younger, or were employees would be more likely to move out. In conclusion, more quantitative analyses in this field should be carried out to have a better understanding of potential influential factors on wholesale merchants' relocation decision. In addition, besides the individual relieving policy, the interaction between relieving policy and other policies that could also affect households' relocation decision should be considered.

3.2. Effect of congestion charge on relocation decisions

Congestion charge has been proved to be an efficient way to alleviate congestion and solve the problems of negative externality caused by traffic congestion in theory. In line with this perspective, many researchers explore the short-term effect of congestion charge on residents' travel route, travel mode and departure time (e.g. Ubbels & Verhoef, 2005). However, in a longer duration, as a result of the change of these three short-term behaviors, people may also change their housing and working locations (Zhang & Kockelman, 2016). The real data from London just give us an evidence. The implementation of congestion charge has promoted entertainment department move into the charging zone, but pushed retail and catering companies out (Broaddus, 2015).

Some researchers study the relocation effect of congestion charge by simulation method, but get different results. For instance, Mattsson (2008) construct an axisymmetric city which is similar to Stockholm, and simulate the effect of congestion charge on location choices of four daily activities covering working, housing, shopping and public service. They find that congestion charge will lead to the move-out of residential, job and public service locations, but it will also attract shops moving in at the same time. However, Zhang & Kockelman (2006) get different conclusion. They study the effect of different charge types on residential and job relocation, with monocentric and polycentric city structures separately. The results show that people will move out workplace but move in residential location under the monocentric city model. However, under the polycentric city model, the direction that people relocate depends on charge type. Cordon toll and vehicle-miles traveled toll have opposite effect. We could find that different city structures may influence the relocation effect of congestion charge. That is why there is not a general charge mode around the world. Besides, the influence of a same kind of congestion charge may also different from city to city. So, it is necessary to conduct empirical researches for a certain city (in this paper: Beijing) and under a certain social

background. In addition, the heterogeneity of residents also needs to be considered when estimate the expected change, especially for our research which focus on a very special sample group. But it is hard to be reflected by simulation approach, so an empirical study based on stated preference approach is much suitable for this research.

Nonetheless, empirical studies on the relocation effect of congestion charge is quite limited. We only find two papers that investigate the effect of congestion charge on relocation decisions empirically: Arentze & Timmermans (2007) and Tillema et al. (2010). Arentze & Timmermans (2007) study the long-term behavioral responds of 395 car or train users under congestion charge scenario by stated adaptation experiment. They find that 1.2% respondents will change workplace closer to their house, and 8.6% respondents will move house to get closer to their workplace. Tillema et al. (2010) get quite different results using stated preference approach. Their results show that 5% Dutch car users reflect a high possibility to change residential location because of congestion charge, and about 13% respondents show a high possibility to change job. However, both of them include three types of relocation options: moving house (closer to job), changing job (closer to house) or not change, failing to reflect the relocation direction relative to the city boundary. But under the non-capital relieving strategy, inter-city relocation rather than inner-city relocation is more important for us to forecast the efficiency of the strategy. And in this situation, job relocation and residential are not decided separately, they need to be considered as a whole. So, in this paper, we consider respondents' relocation decision on a larger scale: still stay in Beijing, move to new markets in Hebei or Tianjin provinces and move to other provinces. In addition, none of them combine urban strategy which could also affect relocation decisions. However, these urban strategies play a very important role in household's relocation decisions, especially for developing countries who lack voluntary residential mobility (Dieleman, 2001). In the study worked out by Zhang and Kockelman (2016), they propose that the whole benefits of the city may increase when combine a land use policy which could move out residents' workplace with congestion charge, which give us another basis to combine these two policies. What's more, for people working in Beijing wholesale markets, factors influence their relocation decision may be quite different from common commuters. Some new influential factors emerge, such as freight transport, main supplier's location, evaluation of new markets and etc.

4. Survey design, data collection and descriptive statistics

4.1. Survey design

In this paper, stated preference approach was adopted to test the implication of congestion charge on respondents' relocation decision. This is because congestion charge is still under consideration and has not been implemented in Beijing, so there is no observed data of responses of congestion charge could be used. Besides, for Beijing government, it is important to make it clear what are citizens' possible responses to congestion charge before they implement it. In this situation, stated preference approach which can explore respondents' expected change under simulative scenarios, is better than revealed preference approach.

In addition, because the respondents in our research are very special. They are not general commuters, but people working in Beijing local wholesale markets. Although most of them live and work in Beijing, but they don't have Beijing registered residence and have to change house or job from time to time. What's more, they may also need to consider their stalls, consumers, suppliers and freight transport when making relocation decisions. Therefore, the influential factors that could affect their relocation decisions may be different from general commuters studied by previous researches, and some new factors may emerge. So, before the questionnaire design, we also use focus-group interviews to explore these potential influential factors, and have a preliminary understanding on people's behavioral response to the relieving policy and congestion charge scenarios. Then, combining with the relevant literatures, this paper develops a measurement scale of influential factors for Beijing wholesalers' relocation decision, covering seven categories and forty-nine sub-categories, shown in table 1.

Table 1. Measurement Scale of variables

Attribute	Factor	Value	Sample
Personal and household characteristics	Gender	male=1	G
	Age	continuous variable, be standardized	age
	Education	junior high school and below, high school, junior college and above	EDU1~EDU3
	Marital status	married=1	Mag
	Family register	Beijing, Hebei or Tianjin, other provinces	BJ, HT, OT
	Personal monthly income	≤5000¥=1, 5000~10000¥=2, 10000~20000¥=3, ≥20000¥=4	INC
	Employed household members living in Beijing	1, 2, ≥3	EHM1~EHM3
	Children still at home	0=0, 1=1, ≥2=2	CD
	Children living in other cities	yes=1	CIO
	Personal income/family income	≤50%=1, 50%=2, 50%~99%=3, 100%=4	INCP
car availability	never, sometimes, always	CA1~CA3	
Residential and job-related characteristics	House ownership	owner=1	HO
	Duration living in Beijing	continuous variable, be standardized	BL
	Duration working in current market	≤1 year, 2~5 years, 6~10 years, ≥10 years	WM1~WM4
	Job title	first-hand tenant, second-hand tenant, purchasing guide	DR, SR, PG
	Working with friends/relatives	yes=1	FR
	Working with spouse	yes=1	SP
	Working days per week	seven days per week=1	WD
	Departure time	before 7:01a.m., 7:01~8:00, 8:01~9:00, after 9:00a.m.	DT1~DT4
	Closing time	Before 17p.m., 17~17:59, 18:00~18:59, after or at 19 p.m.	BT1~BT4
	Major supplier	manufacturers, larger wholesale markets, others	F, W, O
	Major supplier's location	Beijing, Hebei/Tianjin, other provinces	BJS, HTS, CHS
	Major clients' location	Beijing, Hebei/Tianjin, other provinces	BJC, HTC, CHC
Major business type	wholesale=1	BTY	
Commuting and freight related characteristics	Commuting mode	car, public transport, riding/walking	D, B, W
	Commuting time	continuous variable, be standardized	CT
	Commuting distance	≤1km, 1<X≤5, 5<X≤15, >15	CDS1~CDS4
	Congestion situation around current market	serious congestion, moderate congestion, mild congestion, basic smooth, smooth	CG1~CG5
	Delay time caused by congestion	0min, 0<X≤10, 10<X≤20, >20	CDelay0~CDelay3
	The frequency of buying supplies by car per week	0, 1~3, more than 3	BG0~BG2
	Whether need to deliver goods by car	yes=1	DG
Attitudes towards policies	Feedback of new markets	better than current markets, worse, as same as	good, bad, same
	Support of wholesale markets relieving policy	strongly oppose, oppose, neutrality, support, strongly support	PS1~PS5
	Satisfaction of wholesale markets relieving policy	very dissatisfied, dissatisfied, neutrality, satisfied, very satisfied	SF1~SF5
	Support of congestion charge	strongly oppose, oppose, neutrality, support, strongly support	CS1~CS5
	Minimize prepare time for relocating	2 months, half a year, 1 year, 3 years	MST1~MST4
	Whether prefer government designate an ingoing new market	yes=1	DIM

Life cycle events	Recent experiences	get married/have a baby, change job, move house	MBR, CJR, CHR
	Plans in the next two years	get married/have a baby, change job, move house, plan to live in Beijing for long duration, send children to Beijing local schools	MBF, CJF, CHF, BJL, SIB
Social inclusion	Friends or relatives living in Beijing	continuous variable, be standardized	FLBJ
	Times of changing house in Beijing	continuous variable, be standardized	CH
	Times of changing jobs in Beijing	0, 1<X≤3, >3	CJ0~CJ2
Expectation of new markets	Income	much worse 1 ~ much better 5	FI
	Working environment	much worse 1 ~ much better 5	EV
	Local price level	much lower 1 ~ much higher 5	PL
	Convenience of logistics	much worse 1 ~ much better 5	LG

According to the measurement scale, our questionnaire is designed as followings. The first part is about potential influential factors, include personal and household's characteristics, residential and job-related characteristics, commuting and freight related characteristics, life cycle events, social inclusion, attitudes towards policies and expected change of new markets in Hebei or Tianjin. In the second part, respondents were asked to indicate how likely they were to leave Beijing under individual relieving policy scenario and its combination with congestion charge scenario separately. The possibility is measured on a 5-point scale ranging from "highly unlikely" to "highly likely". Besides, we also asked their detailed relocation type under the relieving policy scenario, which include moving to new markets in Hebei or Tianjin, living in Beijing and moving to markets that haven't been relocated, living in Beijing and changing jobs, living in Beijing and changing to online-stores, going to other provinces and having no idea.

With regard to the scenario design, we conduct the relieving policy scenario and congestion charge scenario separately. The wholesale market relieving policy is "The Beijing municipal government plans to release or upgrade 120 wholesale markets in the city by 2020, and your market is one of it.", which is based on the real plan from government website. And the congestion charge scenario is "Based on the relieving policy showed in the first question, the government also implement congestion charge at the same time." The charging mechanisms are shown in table 2. Because most of our respondents have low educational level, to help them have a clear understanding, we just considered four attributes include charging time, charging area, charging type and charging level in our scenario. The levels of each attributes are determined by our focus-group interview, in which respondents thought their life could be affected if implementing this kind of congestion charge. The reason why we design a circular charging area around wholesale markets is to enhance respondents' understanding and attention.

Table 2. The congestion charge scenario

Attributes	Level
Charging time	7:00 a.m. to 19:00 p.m.
Charging area	a circular region with the market as center and a 2.5km radius
Charging type	Cordon charge
Charging level	15¥ per crossing
Charging object	private cars

4.2. Data collection

The target respondents of this study are people working in Beijing wholesale markets which are being or will be relocated or updated. These people include first-hand tenants who rent their stalls from wholesale markets directly, second-hand tenants who rent their stalls from first-hand tenants, and purchasing guides who are employed by first-hand or second-hand tenants. We conducted a survey in six wholesale markets in Beijing inner city, shown in figure 1, which almost covers all areas on the list of markets planned to be relocated. To make sure respondents could understand the congestion charge scenario and ensure the completeness and accuracy of each questionnaire, we

distributed the questionnaires face to face. We distributed them from April to May in 2018 and collected 350 responds in total. Among them, 321 questionnaires are valid, and the rest are fragmentary. The first of question in our questionnaire is "Have you ever heard the wholesale markets' relieving policy in Beijing?", so people who don't know this policy are not include in our sample.

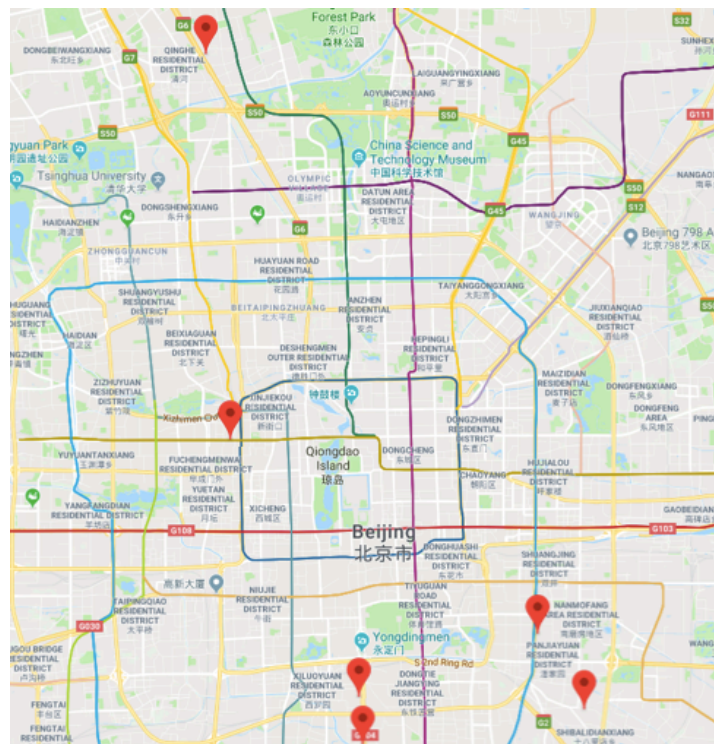


Fig. 1. Investigated markets' locations

4.3. Descriptive statistics

4.3.1 Basic information

Among our 321 respondents, 67.3% of them are female, which accords with the actual situation in studied wholesale markets, observed by our investigators. 45.2% of our respondents are from 26 to 35 years old and majority has poor educational background. More than 70% of them haven't been to college before, and even 25.6% haven't been educated higher than the junior middle school. According to the households' registration, only 10.3% are Beijing local residences, most of them are migrants. Besides, 34.6% have low income which are lower than the average wage earnings in Beijing (according to the statistics of the Beijing Social Security Bureau, the average annual salary of employees in Beijing in 2016 was 92477 yuan). 49.2% of them never have available private cars and 77.9% don't have their own house in Beijing. About 75% of respondents have been in Beijing for more than 5 years. According to their daily commuting, 53% go to work by riding or walking and 61.4% have a commuting distance less than 5 kilometers. In regard to the congestion situation around wholesale markets, 46.7% think the congestion level is moderate or serious. The result is less than our previous expectations. Some respondents told us that because some wholesale markets nearby have been closed, so the traffic condition turned better recently.

Table 3. Basic information of respondents

Factors	Items	No.	Pct.
Gender	Male	105	32.71%
	Female	216	67.29%
Age	≤25	59	18.38%
	26~35	145	45.17%
	36~45	72	22.43%
	>46	45	14.02%
Education	Junior high school and below	82	25.55%
	High school	155	48.29%
	Junior college and above	84	26.17%
Family register	Beijing	33	10.28%
	Hebei/Tianjin	48	14.95%
	Other cities	240	74.77%
Personal monthly income	≤5000 ¥	111	34.58%
	5000<X≤10000 ¥	131	40.81%
	10000<X≤20000 ¥	48	14.95%
	≥20000 ¥	31	9.66%
Car availability	Never	158	49.22%
	sometimes	104	32.40%
	Always	59	18.38%
House ownership	Tenant	250	77.88%
	Owner	71	22.12%
Duration living in Beijing	≤5 years	82	25.55%
	6~10	101	31.46%
	11~20	87	27.10%
	≥20	51	15.89%
Commuting mode	car	45	14.02%
	public transport	106	33.02%
	riding/walking	170	52.96%
Commuting distance	≤1km	72	22.43%
	1<X≤5	125	38.94%
	5<X≤15	80	24.92%
	>15	44	13.71%
Congestion situation around current market	serious congestion	53	16.51%
	moderate congestion	97	30.22%
	mild congestion	65	20.25%
	basic smooth	65	20.25%
	smooth	41	12.77%

4.3.2 Attitudes towards policies

In our focus-group interview, we found that how long markets tell them the certain relocating time in advance could also affect respondents' relocation decision. That is similar with the conclusion in Goetgeluk (1997): the urgency of the move will partly affect people's willingness to substitute the most preferred dwelling for a less-preferred one (Dieleman, 2001). Therefore, in our study, the urgency of relocating may also affect respondents' willingness to leave Beijing. To explore its influence, we add the question, "Suppose your markets will be relocated. How long do the markets tell you the determinate relocating time in advance, you will be more likely to leave Beijing?" About 70% of our respondents need a minimize prepare time more than one year. However, the fact is most wholesale markets just inform them two months in advance, which has caused merchants' dissatisfaction. In addition, according to related news, it seems that merchants are very worried about the potential income if they relocate to the new markets in Hebei or Tianjin provinces. Because the industrial agglomeration effect will be broken if each merchant makes relocation decision separately. Therefore, we also ask, "Whether do you prefer the government designate an ingoing new market for all merchants in your wholesale market?" As shown in table 4, more than 60% of respondents hope the government designate so that the brand of the old market will not be diminished and their sales volume could be more secured. What's more, respondents' appraisal to the relieving policy and congestion charge are low. Most of them are not support these two policies and not satisfied with the implementing process of the relieving policy.

Table 4. Attitudes towards policies

Attribute	Level	Pct.	Average
Support of wholesale markets relieving policy	Strongly oppose 1	21.81%	2.48
	Oppose 2	22.12%	
	Neutrality 3	46.73%	
	Support 4	5.30%	
	Strongly support 5	4.05%	
Satisfaction of wholesale markets relieving policy	Strongly dissatisfied 1	22.12%	2.5
	Dissatisfied 2	16.82%	
	Neutrality 3	52.65%	
	Satisfied 4	5.30%	
	Strongly satisfied 5	3.12%	
Support of congestion charge	Strongly oppose 1	15.89%	2.79
	Oppose 2	15.58%	
	Neutrality 3	50.16%	
	Support 4	10.90%	
	Strongly support 5	7.48%	
Whether prefer government designate an ingoing new market	yes	60.40%	—
	no	39.60%	
Minimize prepare time for relocating	2 months	7.80%	—
	half a year	22.70%	
	1 year	36.10%	
	3 years	33.30%	

4.3.3 Expectation of new markets

As we can see in table 5, respondents' expectations of new markets' potential income, working environment, local price level and convenience of logistics are also low, with average scores of 1.97, 2.99, 2.45 and 2.59, respectively. The expectation of new markets' potential income gets the lowest score. More than 40% think their income will be much worse than now if they relocate to the new markets. However, 40.2% think the price level in Hebei or Tianjin will also be lower. The evaluation to the working environment of new markets is higher. About 25% think the working environment will be better than current markets. And 34.6% think the convenience of logistics will be as same as their current markets.

Table 5. Expectation of new markets

	Much worse	A little worse	Almost the same	A little better	Much better	Average
Income	43.30%	30.22%	15.89%	7.17%	3.43%	1.97
Working environment	12.46%	17.76%	36.45%	24.92%	8.41%	2.99
Price level	14.33%	40.19%	33.64%	9.35%	2.49%	2.45
Convenience of logistics	18.69%	28.97%	34.58%	10.59%	7.17%	2.59

4.3.4 Relocation possibility and relocation type

Among our 321 respondents, about 70% have the possibility (likely to very likely) to leave Beijing under the non-capital relieving strategy. This result is very different from the investigation in 2016, in which the number is less than 20%. That may be due to the wholesale markets' relieving policy has been implemented in the middle and late stages. And some respondents are facing the second relocation decision, so their probability of leaving Beijing increases. After adding congestion charge scenario, the proportion of people who think they are "very likely" to leave Beijing don't change. However, the proportion of "very unlikely" increases slightly. In regard to people who are not very determined (i.e. who choose "unlikely", "likely" or "more likely"), their willingness to leave may also decrease. In our further interview, some respondents think traffic congestion will be alleviated after implementing congestion charge, so more consumers will come to the market. And considering other stalls will relocate, which means the number of competitors will decrease, they will be more likely to stay in Beijing.

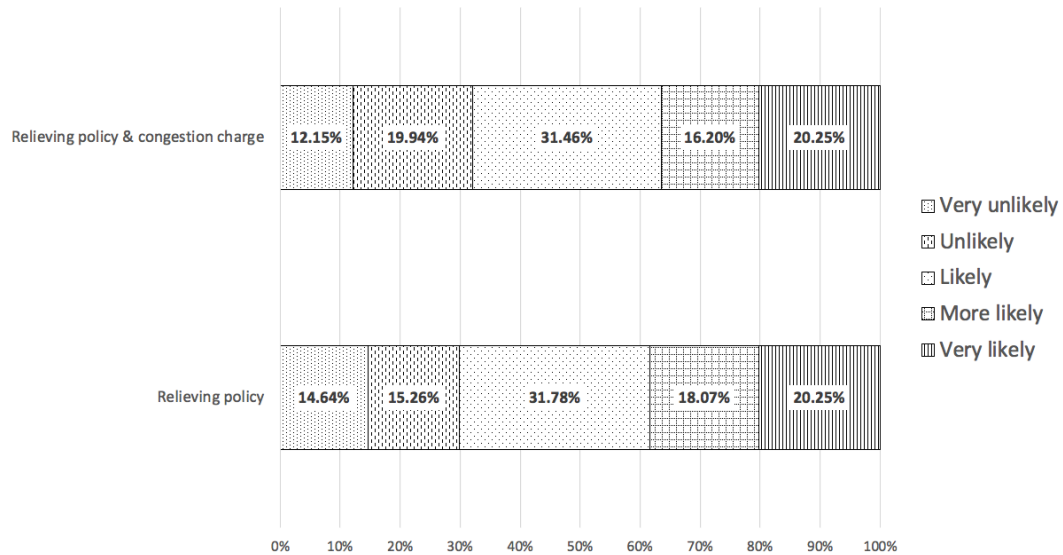


Fig. 2. Respondents' relocation possibility under different policy scenarios

We also ask their relocation type after markets relieved. As shown in figure 3, though most respondents have the possibility to leave Beijing, the proportion of going to other provinces is just 35.5%. Among them, only 9% are going to move to the new markets in Hebei or Tianjin. 39.3% haven't made a certain decision. 25.2% also want to live in Beijing, include 10% changing jobs, 9.4% moving to markets that haven't been relocated, 5.9% changing to online-stores.

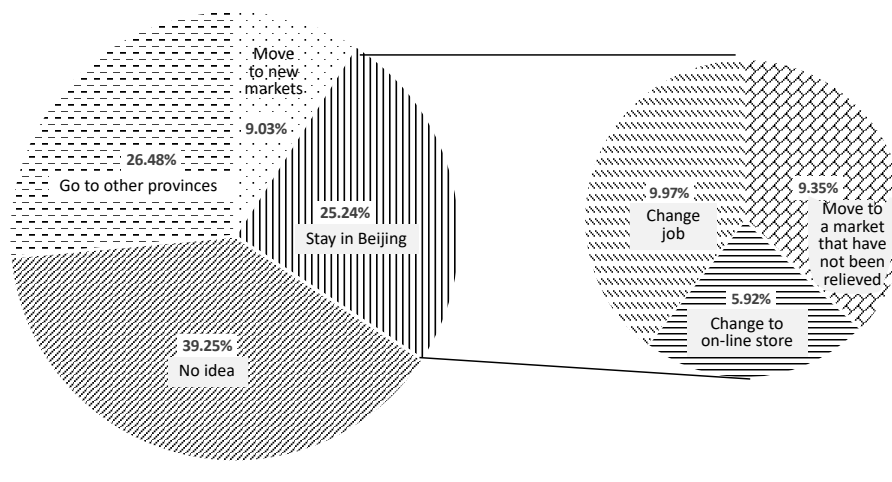


Fig. 3. Respondents' relocation type

5. Factors influencing relocation decisions

We conducted two ordered logit models (see Chen, 2014) to estimate respondents' possibility to leave Beijing under individual relieving policy and its combination with congestion charge separately. The dependent variable is their relocation possibility, expressed on a five-point Likert scale. The independent variables include factors about personal and household characteristics, residential and job-related characteristics, commuting and freight related

characteristics, attitudes towards policies, life cycle events, social inclusion and expected change in new markets, as shown in table 1.

5.1. Under individual relieving strategy scenario

Within "personal and household" characteristics, educational level, marital status, household registration, children still at home and whether they live out of Beijing have significant effect. Respondents have junior high school and below education are more likely to leave Beijing. It is harder and harder for them to find suitable job after more high-tech industries introduced in Beijing. Marital status has a strong positive effect on respondent's relocation possibility. Married people have higher possibilities to move out. The problems of attending school of their children, the uncertainty of job search and the increasing housing rent all raise their life stress in Beijing. Household registration is always important factors in Chinese relocation studies (e.g. Liu & Yan, 2007; Qi et al., 2018; Yu et al., 2014). Respondents whose registration is in Hebei or Tianjin are more reluctant to leave Beijing. In our further interview after the questionnaire, most of them think compared with Hebei or Tianjin, job opportunities are more and public services are much better in Beijing, though they are close to each other. Besides, they hardly move to other provinces out of Beijing-Tianjin-Hebei Region. Therefore, the relatively good choice is to stay in Beijing. The interaction item of the number of children still at home and whether they live in other cities beside Beijing also shows a significant effect. Results show that respondents who have two and more children (common phenomena in Chinese rural area) and their children don't live in Beijing with them, will be more likely to leave Beijing. These left-behind children brought up by their grandparent lack of parents' love and guidance for a long time, now also become a serious social problem in China. Consider this problem and their grandparent getting old, this group of respondents are more likely to relocate to other provinces. However, different from precious studies (Arentze & Timmermans, 2007; Tillema et al., 2010a), age and gender are no longer significant. This result shows that under such a strong policy intervention to households' relocation decisions, age and gender are no longer the main reason for the difference of people's relocation decision.

With respect to "residential and job-related" characteristics, the duration living in Beijing, the duration working in current wholesale markets, departure time and closing time, major suppliers and their location and major customers have significant influence. The longer time people living in Beijing or working in current wholesale markets for, the more reluctant they want to leave. These results show cumulative inertia effects. Longer living or working duration also means respondents have strong social and economic tie to the residence and job (Thomas et al., 2016), so they don't like to move and break their habits. Respondents who depart from 7:00 a.m. to 8 a.m. and who back home from 17:00 p.m. to 18:00 p.m. have a lower possibility to leave Beijing. This group of people has a more conventional working schedule, and they get used to and feel comfortable about current living status, so it is harder from them to change it. Major suppliers which are manufacturers will reduce respondents' relocation possibility. Some of respondents said most of these manufacturers were located in Beijing or nearby, so leaving Beijing means increasing their freight costs so that they don't want to leave. Although suppliers from all over the countries have significant positive influence, suppliers from Hebei or Tianjin have a stronger attraction to respondents. Because respondents could choose to relocate to the new markets built here and reduce their freight costs at the same time. In addition, due to the relative closer distance, some of their regular customer may also buy goods from them. Besides, respondents whose major customers are from other provinces besides Beijing, they are more likely to leave, especially for respondents whose major customers are from Hebei or Tianjin provinces

Table 6. Regression results for Ordered Logit model

Relieving policy			Relieving policy & Congestion charge		Relieving policy			Relieving policy & Congestion charge	
Coef.	P> z		Coef.	P> z	Coef.	P> z	Coef.	P> z	
<i>Personal and households' characteristics</i>					<i>Commuting and freight related characteristics</i>				
EDU1	0.679247	0.062*	0.7155199	0.062*	CG1	1.083107	0.006***	0.9777581	0.021**
EDU2	0.401115	0.218	0.6249698	0.062*	CG2	0.763551	0.026**	0.0601166	0.861
Mag	0.9745396	0.010***	1.26715	0.001***	CG3	-0.6230552	0.102	-0.8794853	0.026**
BJ	0.4421329	0.415	0.8589412	0.162	CDelay1	-0.2472306	0.394	-0.2318698	0.431
HT	-0.5748335	0.088*	-0.296132	0.403	BG0	-0.9962892	0.055*	-0.7158424	0.216
EHM2	-0.2216326	0.405	-0.3310653	0.226	BG1	-1.43895	0.002***	-1.162307	0.019**
INC	0.1634209	0.293	0.3182049	0.045**	DG	0.7683002	0.064*	0.7412174	0.103
INCP	-0.0626895	0.627	-0.3175119	0.020**	<i>Life cycle events</i>				
CA2	0.3298039	0.239	0.3455791	0.221	MBR	-0.387512	0.332	0.1080825	0.797
CD#CIO					CJR	0.1832692	0.673	-0.4149996	0.336
0 1	1.00406	0.109	0.0434564	0.945	CJF	0.1238935	0.767	-0.0676591	0.864
1 0	0.0373645	0.92	0.0786892	0.83	CHF	1.024839	0.012**	1.741504	0.000***
1 1	-0.3759522	0.417	-0.0075082	0.987	SIB	0.2405518	0.459	0.6196427	0.071*
2 0	-0.2763821	0.536	0.4944402	0.281	<i>Social inclusion</i>				
2 1	1.291684	0.005***	1.420224	0.003***	FLBJ	-0.3113864	0.088*	-0.2755321	0.152
<i>Residential and job-related characteristics</i>					CH	0.3279547	0.033**	0.493042	0.002***
BL	-0.879843	0.000***	-1.455876	0.000***	CJO	-0.8619596	0.079*	-0.5426847	0.296
WM1	0.3393199	0.475	0.2961864	0.542	CJ1	-0.7457006	0.1*	-0.9946431	0.041**
WM2	0.2537033	0.486	0.0294868	0.936	<i>Attitudes towards policies</i>				
WM3	-0.5851565	0.075*	-0.8210037	0.012**	GOOD	0.3970012	0.519	1.477289	0.018**
DR	0.1748247	0.631	-0.2608577	0.492	BAD	0.1642089	0.553	-0.4292018	0.134
SG	0.5634588	0.144	-0.0482003	0.907	SAME	1.013795	0.023**	-0.1684265	0.717
SP	0.1228689	0.712	-0.3830971	0.254	PS1	-0.7093463	0.094*	-1.095447	0.012**
FR	0.2958035	0.292	0.2927749	0.309	PS3	-0.4608454	0.185	-0.9542964	0.01***
DT2	-1.587005	0.001***	-1.523383	0.003***	SF1	0.1613413	0.706	0.5449095	0.221
DT3	-0.3318146	0.334	-0.2028303	0.575	SF2	-0.0909771	0.811	-0.364069	0.363
BT1	0.5777926	0.341	0.5269468	0.409	CS2	0.876373	0.023**	0.5059007	0.182
BT2	-0.5960089	0.074*	-0.1995537	0.561	CS3	0.7201685	0.016**	0.6765061	0.026**
F	-0.5238294	0.091*	-0.5507447	0.098*	MST1	1.344151	0.008***	1.743642	0.001***
W	-0.3403633	0.328	-0.1639716	0.655	MST2	1.042552	0.003***	1.409188	0.000***
BJS	0.8102667	0.084*	1.013985	0.037**	MST3	0.8514316	0.004***	1.129637	0.000***
HTS	1.089815	0.083*	0.9441634	0.153	DIM	0.3942207	0.126	0.3839437	0.15
CHS	0.8642742	0.082*	1.191326	0.018**	<i>Expectation of new markets</i>				
HTC	1.343062	0.014**	1.266058	0.020**	FI	0.1307761	0.337	0.0746928	0.587
CHC	0.6900775	0.016**	0.8011565	0.009***	EV	0.1908268	0.132	0.3980727	0.003***
<i>Commuting and freight related characteristics</i>					PL	-0.0034696	0.98	-0.204062	0.144
D	1.083511	0.019**	0.63266	0.185	LG	-0.2664855	0.038**	-0.2986645	0.022**
W	1.186769	0.001***	0.2876303	0.453	Log likelihood -402.53624				
CT	-0.5537415	0.014**	-0.7624211	0.001***	LR chi2(71) 199.7				
CDS1	-0.9487924	0.093*	-1.567012	0.007***	Prob > chi2 0				
CDS2	-1.023324	0.023**	-1.450011	0.002***	Pseudo R2 0.1988				
								254.8	0
								0.2545	

Within "commuting and freight related" characteristics, commuting mode, commuting time, commuting distance, congestion situation around current wholesale market, frequency of buying goods by car per week and frequency of delivering goods by car per week have significant effects. However, different travel modes don't show significant divergent effect on respondents' relocation decisions. No matter commuting by car or walking to the market, respondents have the possibility to leave Beijing under non-capital relieving strategy. People who has a longer commuting time or distance, will be more reluctant to leave. They fall into the trap of sunk cost. The more effort they have spent on current job, the lower possibility they could give up easily. Heavy congestion around wholesale markets could impel people to leave. Respondents who think the congestion situation around their wholesale markets is moderate and serious congestion, will be more likely to move. The frequency of buying good by car per week has a negative effect on people's leaving possibility. Respondents who have no need to buy goods by car or just one to three times per week will be more reluctant to move out of Beijing. Buying goods by car for one to three times per week has a larger negative effect. Because their suppliers are mostly in Beijing or nearby cities, so their suppliers' location also limit their relocation possibility. However, the frequency of delivering goods by car per week has a positive effect.

Respondents who have to deliver goods by car more often, will be more likely to move out. That may be because people who deliver goods by car mostly are the renters of the stall. Their job mobility is lower than purchasing guides, so it is harder for them to find suitable jobs in Beijing in a short period of time after wholesale markets being relocated. Therefore, leaving Beijing is a better choice for them.

Within "attitudes towards policies" characteristics, friends' feedback of new markets, support of wholesale markets relieving policy and congestion charge, and the minimize prepare time for relocating have significant effect. If respondents hear that "the new markets in Hebei or Tianjin are as same as the old markets in Beijing" from their friends who have already moved to a new market, they will have a higher possibility to move out of Beijing. This result shows the peer effects in behavioral economics, which exist when people's behaviors are influenced by their interaction with peers (Winston & Zimmerman, 2003). The interaction between respondents and their friends also working in wholesale markets. Besides, supports of policies are very important for people's relocation decision. Respondents who strongly oppose wholesale markets relieving policy will be more reluctant to leave, which shows their conflict psychology to this policy. They prefer to stay in Beijing through changing jobs, operating online shops or moving to other markets which haven't been relieved rather than relocating to other provinces. However, people who take a neutral attitude to or oppose congestion charge, will be more likely to move. Because congestion charge increases their living costs and people who don't support it always be more sensitive to the toll, so they would like to leave. In addition, markets inform respondents its determinate relocating time in advance, no matter how long in advance, will help increasing their relocating possibility. However, the less prepare time they need, the higher possibility they choose to leave Beijing after markets relocated. Therefore, people who just need two months to prepare are more likely to move than people needing one year or three years.

In regard to "life cycle events" characteristics, people who already have the plan to move house in two years, have a higher possibility to move out. That is in line with the results showed in Tillema et al. (2010). According to "social inclusion" characteristics, number of friends and relatives living in Beijing has a significant negative effect. The more friends and relatives the respondents have in Beijing, the lower possibility they will leave. In the contrary, Times changing houses or jobs after coming to Beijing have positive effect. People who has changed houses for more times, will be more likely to move out of Beijing. However, people who has changed jobs less than three times after they coming to Beijing, will be prefer to keep staying in Beijing. These results show that high social inclusion also means high transfer costs, so people with high social inclusion will more likely to leave. According to "expected change in new markets" characteristics, respondents who expect that the logistics around new markets are more convenient, however, will be less likely to move out of Beijing. That is because high convenience of logistics around new markets also means the electronic-business is better in that area, which could be their main rivals. Considering competitors like Amazon, Taobao or Jingdong, respondents expect their income will be decreased, so they wouldn't like to move out of Beijing.

5.2. Adding congestion charge scenario

After adding congestion charge scenario, respondents need to make their relocation decision considering both relieving policy and congestion charge. In this situation, the significance of some influential factors has changed comparing with the individual relieving policy scenario. Within "personal and household" characteristics, educational level, marital status, children still at home and whether they live out of Beijing also have significant effect. However, people with higher education, who has been to high school, also have the possibility to leave Beijing. The coefficients of marital status and the interaction item of children still at home and their location increase markedly. So, married respondents have a higher possibility to leave after adding congestion charge. They are more sensitive to congestion charge than unmarried people. And people who have two and more children living in other cities will be more likely to move after their living costs increased by congestion charge. In addition, personal monthly income and their proportion of the whole family income, now, become significant. Personal income has a significant positive effect. Respondents who have higher income will be more likely to move. That is contrast to our original assumption. In our further interview with these respondents, they told us that one of the main reasons that they didn't want to move is the

deposit dispute with markets. Merchants who are wealthy don't care about it too much. They started planning to leave Beijing very early. The ratio of personal income to family income (just include family members who working in Beijing), however, has a negative effect. Respondents whose income occupy a large proportion of family income, will be more likely to keep living in Beijing. That may be because people who living alone in Beijing (i.e. the proportion is 100%), are always young adults just coming to Beijing and always working as purchasing guides, who could find a new job in Beijing more easily. Whereas, households' registration is not significant again. It isn't as important as before after adding congestion charge scenario.

Within "residential and job-related" characteristics, closing time is no longer significant, but departure time from 7 a.m. to 8 a.m. also has a negative effect. That shows congestion charge has a bigger influence on morning commuting, which is more inelastic. Besides, the coefficients of the duration living in Beijing and the duration working in current wholesale markets are smaller than before. It is to say, people show more place attachment and more unlikely to move if congestion charge are implemented at the same time. However, major suppliers which are manufacturers has a less negative effect, and major suppliers from Beijing has a bigger positive effect on promoting merchants to move out. But major suppliers from Hebei or Tianjin doesn't have significant attraction as before. That may be because, suppliers from Hebei or Tianjin could be their competitors if the respondents relocate to the new markets. In this situation, respondents' income may decrease, so they are unlikely to relocate to the new markets in Hebei or Tianjin. In addition, major customers from other provinces besides Beijing also has significant positive influence.

In regard to "commuting and freight related" characteristics, commuting mode is no longer significant, but commuting time and distance also have negative effects. We can see that after the total living costs increased by congestion charge, travel mode is not an important factor related to people's relocation decision. However, the negative effects of long commuting time and distance on respondents' leaving possibility become larger. The congestion charge could further increase respondents' loss aversion. The congestion situation around current wholesale market also has significant effect. Respondents who think there is serious congestion around their markets will be more likely to move. But the coefficient is slightly lower than before. They may think the congestion will be alleviated by congestion charge to a certain extent, so their relocation possibility also decreases. The negative effect of buying goods by car for one to three times per week, decreases slightly after considering congestion charge at the same time. That shows the increasing travel costs' influence on promoting people to relocate.

Within "attitudes towards policies" characteristics, friends' good feedback of new markets shows a significant positive effect. Respondents show higher possibility to move if their friends tell them the new markets are better than current markets they working in. People who strongly oppose wholesale relieving or just are neutral will be more likely to move out of Beijing than before after implementing congestion charge. When considering the real implementation of congestion charge, people who oppose this policy don't show significant preference to leave Beijing unlike just implementing relieving policy. They may overestimate the effect of congestion before its' implementation and increase their accessibility to it after being carried out. People who are neutral to congestion charge also have higher possibility to leave Beijing but it's slightly lower than before. That may be due to less congestion around wholesale markets alleviated by congestion charge. Minimize prepare time for relocating has a larger effect on people's relocation decision. Respondents who need shorter prepare time are more likely to move out after adding congestion charge.

In regard to "life cycle events" characteristics, the positive effect of people who already have the plan to move house in two years become larger. What's more, respondents planning to send their children to Beijing local schools are more likely to leave Beijing. The tuition fee is already a heavy burden for these family but the congestion charge further increases their living costs and become the last straw that make them decide to leave Beijing. According to "social inclusion" characteristics, the number of friends or relatives living in Beijing is no longer significant. However, the times changing houses and the times changing jobs have larger positive effects. That also means people who have lower social inclusion will be more likely to leave after adding congestion charge. With regard to "expected change in new markets" characteristics, the convenience of logistics also has a negative effect. The influence is basically the

same as before. In addition, the working environment shows a significant positive effect when implementing congestion charge at the same time. The better the working environment, the more likely respondents want to relocate to other provinces.

6. Conclusion and discussion

This paper studies the relocation decision of people working in Beijing wholesale markets using a stated preference experiment. And by conducting two ordered Logit model, we analyze and compare the influential factors of their willingness to leave Beijing, under individual markets' relieving policy and congestion charge separately. This paper enriches studies about the long-term effect of congestion charge and explore its relocation effect under Beijing urban strategy.

The results confirm the possible contribution of congestion charge on Beijing non-capital functions relieving strategy. First, it could expand the population planning to leave Beijing, because people with higher educational level and higher income could also be affected after adding congestion charge scenario. Second, it could increase the relocating possibility of merchants who have already planned to relocate in future two years. Besides, people who have lower social inclusion will be more likely to leave Beijing after adding congestion charge, which further increases their living burden. In addition, merchants who have lower support and satisfaction of relieving policy could also be likely to move out of Beijing after implementing congestion charge. However, it also has negative effect which could decrease some respondents' leaving willingness. First, people who living in Beijing or working in current markets for a longer time will be more reluctant to leave. And second, people who have longer commuting time and distance will be not likely to move. Both of these show that respondents' current habit will be more difficult to break, and people will show a more serious place attachment and loss aversion after implementing congestion charge. Therefore, before carrying out congestion charge, the government should not only consider its short-term effect on commuter's travel behavior, but also need to consider its effect on households' relocation decision and even the urban land use pattern. It is necessary to study its effect under the non-capital relieving strategy.

To promote the process of wholesale markets' relieving policy, there are also some other factors need to be noticed. For markets planned to be relocated, it is necessary to increase merchants' support and satisfaction of the relieving policy. Due to our results, merchant who have a higher evaluation of the relieving policy will be more likely to leave Beijing, fitting the government's expectation. One way is to enhance the publicity of the relieving policy. In our investigation, we found many merchants are reluctant to talk about this policy, or just respond "I have never heard about it" but show negative attitude. So, markets should make more an effort let merchants face the policy squarely and plan ahead. In addition, the minimize prepare time plays an important role no matter adding congestion charge or not. It is better to inform merchants the determined relocating time at least one year ahead, so that merchants could manage their stock more elastically. And it is also better for them to rent a stall in new markets in advance to court new customers. For new markets in Hebei or Tianjin, the working environment is the primary draw of merchants, especially when implement congestion charge at the same time. And if it is convenient for their children to enter schools, migrant merchants may be more likely to move in. What's more, new markets should pay attention to the feedback of merchants who have already settled in. According to our results, their feedback will affect their friends' relocation decision. Therefore, it is better to listen carefully to their suggestions and give them more preferential policies to encourage more merchants to settle in.

For further researches, relocation decisions of people working in other non-capital function industries could be studied, such as the undergraduate part of universities or administrative departments. Respondents in these industries have higher educational level, so we could also test their response to complex and different congestion charge scenarios, which are difficult for merchants who have low educational level to understand and compare. All in all, it is important to study the potential effect of congestion charge in Beijing under non-capital relieving strategy. We believe our study provides valuable insights into the relocation decision of merchants in Beijing wholesale markets

under the relieving policy and its combination with congestion charge. And researches include broader respondents and various congestion charge scenarios should be carried out.

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