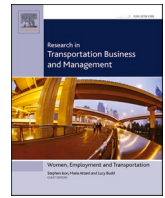


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Exploring the effects of congestion charge on relocation decisions under non-capital functions relieving strategy in Beijing

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ABSTRACT

A common problem with rapid urbanization is the associated infrastructure lag that fails to keep pace with an increasingly growing population. Lawmakers try to minimize this lag by implementing policies that can ameliorate the challenges faced by rapid urbanization. The Beijing government has implemented a “non-capital functions relieving strategy” to incentivize specific industries to relocate. Unfortunately, the willingness of business owners to relocate was too low, and the reasons remain unclear. Moreover, limited studies explored the long-term effects of a congestion charge, especially when combined with a government relocation strategy. The purpose of this research is to achieve a deeper understanding of the urban population's attitudes towards strategies that aim to mitigate the effects of over-populated cities. To accomplish this research, face-to-face surveys were conducted in six wholesale markets in four categories. The ordered logit model revealed there were seven types of influential factors that had a significant effect on the respondents' willingness to relocate. The results indicate that the relocation effect of a congestion charge may be weakened under such an urban strategy. This study empirically informs market managers and policymakers on how to incentivize merchants into resettling into areas outside of megacities to mitigate the adverse effects of overpopulation.

1. Introduction

The shift from agricultural to industrial based economics has led to a global trend towards urbanization. This trend has contributed to rapid inner-city growth and the formation of megacities. These massive population centers offer new production and tourism opportunities but also bring forth new challenges (Li et al., 2016; Mullins, 1991). The process of urbanization can be represented by an S-curve, which can be roughly summarized into three stages: the initial, the rapid development, and the steady stage (Northam, 1979). Rapid development occurs because there are enough resources and accommodations for the increase in population. However, during the steady stage, resources constrain additional growth, and many problems arise. Increased traffic congestion (Li, Ma, Cheng, van Genderen, & Shao, 2019; Wen et al., 2020; Zhao & Hu, 2019), environmental pollution (Calderón-Garcidueñas, Kulesza, Doty, D'Angiulli, & Torres-Jardón, 2015; Jain, Aggarwal, Sharma, & Kumar, 2016; Taksibi, Khajehpour, & Saboohi, 2020), freight distribution (Kin, Verlinde, & Macharis, 2017; Ros-McDonnell, de-la-Fuente-Aragón, Ros-

McDonnell, & Cardós, 2018; Vieira, Fransoo, & Carvalho, 2015), health and safety (Ardalan, Rad, & Hadi, 2019; Najmeddin, Keshavarzi, Moore, & Lahijanzadeh, 2018; Qiao, Zheng, & Zhu, 2011), emergency response services (Chen, Zhou, Ma, & Chen, 2019; Hasnat, Islam, & Hadiuzzaman, 2018) and increased prices (Chiang, 2016, Alam, 2018) are some of the many problems that occur in over-congested cities. The world metropolises such as Tokyo, Seoul, and New York have already faced this problem in the twentieth century and have successfully eased population pressure by various policy measures, which have been observed by Beijing (Bae, 2013; Bai, 2002; Ward & Zunz, 1997). The Beijing government has implemented a ‘Non-capital Functions Relieving’ policy since 2015. This policy aims at moving out industries which do not fit capital urban strategic positioning, which include (Adamowicz, Louviere, & Williams, 1994) general manufacturing industry, (Alam, 2018) regional logistics bases and wholesale markets, (Ardalan et al., 2019) several educational and medical organizations, and (Arentze & Timmermans, 2007) a host of administrative departments and non-profit service institutions (The People's Government

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of Beijing Municipality, 2015¹).

Among these industries, wholesale markets create severe traffic congestion due to a plethora of light commercial vehicles that enter market areas without restriction (Swamy & Baidur, 2014). By the end of 2016, the total number of wholesale markets in Beijing trading commodities such as agricultural and sideline products, building materials, clothing, small commodities, etc., was 781, containing more than 240 thousand stalls (Beijing Municipal Bureau of Statistics, 2018) and more than 300 thousand people (Zhang & Deng, 2017). Under the non-capital functions relieving policy, some of the wholesale markets are targeted for removal and others for renovation. Therefore, residential and workplace relocation is an immediate problem and is fertile for scholarly study. Currently, more than 70% of the wholesale market employees remain in Beijing and are unwilling to relocate (Annual Report on Economic Development of Beijing (2016–2017)), even though the government has built several new markets in nearby Hebei and Tianjin provinces to incentivize their relocation.

As an additional measure, the Beijing government has been discussing the implementation of a congestion charge since 2014 (Beijing Municipal Ecology and Environment Bureau, 2014). A congestion charge is an economic deterrent as it charges users in specified regions, thereby increasing the overall transaction cost to remain within the megacity (Morton, Lovelace, & Anable, 2017). Traffic policies, similar to the congestion charge, affect wholesalers' relocation decisions since travel costs are a critical factor for influencing residents' willingness to relocate (Van Ommeren, Rietveld, & Nijkamp, 1999a, 1999b; Kan, 2002, 2003). Several Dutch studies, using the stated preference approach, have shown that the congestion charge does positively affect the relocation of inhabitants (Arentze & Timmermans, 2007; Tillemans, van Wee, & Ettema, 2010). If the congestion charge were to be carried out, it would work in parallel with the non-capital functions relieving policy to provide a joint relocation incentive for those working in megacity wholesale markets.

The purpose of this research is to explore wholesalers' relocation decisions under the non-capital functions relieving policy and a hypothetical congestion charge scenario. This research aims to answer the following research questions: 1) What are the reasons for the wholesalers' relocation decisions under the non-capital relieving strategy? 2) What are the important and significant factors in the wholesalers' relocation decisions? 3) How will a congestion charge influence wholesalers' relocation behavior?

The answers to these critical questions are important towards achieving a clearer understanding of the factors influencing wholesalers' willingness to relocate, thereby providing lawmakers the ability to ease and manage population growth. Policymakers would benefit by crafting policy to match the incentives that drive relocation intention appropriately. For example, the government can build supporting facilities around the new markets based on wholesalers' individual and family needs to incentivize migration from megacities to relax population growth and congestion.

Within Beijing, the non-capital functions relieving policy is instituted and will continue for the next 10 years. Therefore, the long-term effect of the possible congestion charge in Beijing must be considered in the presence of the non-capital functions relieving policy. Respondents, in this case, face a more urgent choice than in previous times, which may lead to interactive effects. Hence, the combination of the two policies constitutes an unprecedented context for relocation behavior that requires further study to fully understand its consequences.

The remainder of the paper is organized as follows. Section 2 reviews the pertinent literature about relocation decisions under the non-capital functions relieving policy and congestion charge scenarios. Section 3 describes the survey design, data collection, and model specification. Section 4 introduces the responses in focus group interviews. Section 5

reports both descriptive statistics results and the factors influencing relocation decisions under the relieving policy and the effect of the congestion charge, based on the results of an ordered logit model. Section 6 concludes with a further discussion of the results and implications for wholesale business and policies. Finally Section 7 summarizes the paper and looks forward to future research.

2. Literature review

2.1. Effect of the relieving policy on relocation decisions

Reducing congestion or relieving its effects is a normal process that megacities must undergo, and many examples illustrate this process. In 1959, the Tokyo government passed the "Industrial Control Law," which asked labor-intensive enterprises to relocate and controlled the new construction of large companies and universities. At the same time, several sub-centers in the suburbs were developed with specific functions to form a metropolitan region and aid in relocation efforts (Bai, 2002).

In 1971, the South Korean government ordered polluting companies to move out of Seoul through the Pollution Prevention and Control Law. The government constructed an industrial zone for these firms as a relocation site. Preferential tax policy was implemented simultaneously with heavy fines for new companies in downtown Seoul and reduced taxes for those companies moving out (Bae, 2013).

In the United States, government-led manufacturing and retail industry migration to the suburbs is the main power of suburbanization. For example, in order to encourage enterprises to move to the suburbs, the New York government implemented differentiated rent and tax policies. The suburbs had lower land rent and associated taxes as well as cheaper labor. This migration also brings large-scale commodity retail industries that promote more development in the suburbs (Ward & Zunz, 1997).

Although the non-capital functions relieving policy in Beijing may also have a considerable effect on residences' relocation decisions, the studies about its effect on citizens' willingness to move are quite limited. Xu, Wang, Liu, and Shen (2018) studied the willingness of young migrants to leave Beijing by a questionnaire survey among 446 migrants from 18 to 35 years old. They explored the effect of five influential factors, including demographic characteristics, human capital, career development, family status, and social capital. According to their results, only rural household registration had a significant positive effect on willingness to relocate. Zhang and Deng (2017) explored the relocation decisions of market stall entrepreneurs and their employees. They found that 68.3% of respondents did not want to leave Beijing. This research also found that the factors of income, age, and business ownership were significant. People who were of higher incomes, younger in age, or employees would be more likely to move out.

2.2. Effect of the congestion charge on relocation decisions

The congestion charge has proved to be an efficient way to alleviate congestion and diminish negative externalities caused by traffic congestion (Pigou, 1912; Vickrey, 1963; Small, 1992; Ubbels, Tillemans, Verhoef, & van Wee, 2008; Siddique and Choudhury, 2017). Many researchers have explored the short-term effect of the congestion charge on residents' travel routes, travel modes, and departure times (May, 1992; Tretvik, Nordtømme, Bjerkan, & Kummeneje, 2014; Ubbels & Verhoef, 2006; Yamamoto, Fujii, Kitamura, & Yoshida, 2000). The long-term effect of the congestion charge has also been studied, and it was found that people might also change their housing and working locations (Zhang & Kockelman, 2016). Broaddus (2015) calculated the probability of firms moving into or out of the congestion charge zone (CCZ), before and after the congestion charge was implemented, using 121,424 firms' microdata from the UK Business Structure Database. The results showed that sectors that are vulnerable to rising rents and costs,

¹ <http://www.beijing.gov.cn/ywdt/zwzt/sjfsdgn/>. Accessed Feb. 27, 2020.

such as retail and restaurants, had an increased probability of moving out of the CCZ.

Some researchers studied the relocation effect of congestion charge using simulations but had inconclusive results. For instance, Mattsson (2008) constructed an axisymmetric city and simulated the effect of the congestion charge on location choices of four daily activities covering working, housing, shopping, and public service. They found that the congestion charge led to the moving-out of residential and public service jobs, but it also attracted different sector shops moving in at the same time. Zhang and Kockelman (2016) came to a different conclusion. They studied the effect of different charge types on residential and job relocation efforts with monocentric and polycentric city structures separately. Their results illustrated that if the cordon toll is far from optimal, it may create an “edge” effect. That means firms near the CBD’s edge are encouraged to move just outside the cordoned area, and households may move just inside the cordon line in a monocentric city model. However, in a polycentric city model, the direction that people relocate depends on the charge type (for example, a cordon or vehicle-mile traveled toll), amount, and the various edges associated with a polycentric model.

Empirical studies on the relocation effect of congestion charge are quite limited, and only two papers were found that investigated the effect of the congestion charge on the relocation decisions. Arentze and Timmermans (2007) studied the long-term behavioral response of 395 car or train users under the congestion charge scenario through a stated adaptation experiment. They found that 1.2% of respondents would change their workplace closer to their house, and 8.6% of respondents would move their house to get closer to their workplace. Contrary to these results, Tillema et al. (2010), using the stated preference approach, indicated that only 5% of Dutch car users had a high probability of changing residential location because of the congestion charge, and about 13% of the respondents had a high probability of changing jobs.

Both of these research articles included three types of relocation options: 1) Moving the house location closer to the job, 2) Changing the job location closer to the house, or 3) not changing either location at all. Unfortunately, the literature does not illuminate on the different possibilities that may result in decision of inter-city relocation rather than intra-city relocation. In this research, the relocation for wholesalers may be between Beijing and other large provinces. Furthermore, in our research, job and residential relocation are likely to take place simultaneously, which was not discussed in the literature. Also, none of the literature combines urban policy, which could also affect relocation decisions, especially for developing countries that lack voluntary residential mobility (Dieleman, 2001).

Therefore, respondents’ relocation decisions are multi-faceted because they can still stay in Beijing (by changing to an online store or changing jobs); they can move to a new market in Hebei or Tianjin provinces, or they can move to a different province. The relocation decision of wholesalers in this study is challenging as they face the choice of moving both residence and workplace, with uncertainty about their income, disruption of their social network, and change in housing costs. The congestion charge may also have a more substantial effect on their daily lives, not only regarding their commuting trip but also impacting their freight costs and potential loss of customers. Thus, some new influential factors emerge, such as freight transport, main supplier’s location, and evaluation of new markets.

3. Survey design, data collection, and model specification

3.1. Survey design

In this paper, the stated preference approach was adopted to test the implication of the congestion charge on respondents’ relocation decisions. This is because the congestion charge is still under consideration and has not been implemented in Beijing, so there is no observed data of responses of the congestion charge that could be used. In this situation, the stated preference approach is preferred because it can explore

respondents’ expected change under simulative scenarios (Adamowicz et al., 1994).

Before the survey questionnaire, focus-group interviews were employed to explore potentially influential factors and people’s behavioral responses to the relieving policy and the congestion charge scenarios. Once these possible unique factors were determined, they were combined with factors in related literature (Rabiee, 2004). This research develops a measurement scale of influential factors for Beijing wholesalers’ relocation decisions, covering seven categories and forty-nine sub-categories—including personal and household, residential and job-related, commuting and freight-related characteristics, attitudes towards policies, life cycle events, social inclusion, the and expectations of new markets (See Tables 3, 4, and 5).

According to the measurement scale, our questionnaire is designed as follows. The first part is about potentially influential factors that include personal and household, residential and job-related, commuting and freight-related characteristics, as well as life cycle events, social inclusion, attitudes towards policies, and the expected change of new markets in Hebei or Tianjin. In the second part of the survey, respondents were asked to indicate how likely they were to leave Beijing under only a non-capital functions relieving policy scenario. Next, the respondents were asked to indicate how likely they were to leave Beijing with the non-capital functions relieving policy and with the congestion charge scenario. The possibility is measured on a 5-point Likert scale ranging from “highly unlikely” to “highly likely.” Moreover, respondents were also asked their detailed relocation preference under the non-capital functions relieving policy scenario. This included different choices such as moving to new markets in Hebei or Tianjin, living in Beijing and moving to markets that have not been announced, living in Beijing and changing jobs, and living in Beijing and changing to an online-store.

With regard to the scenario design, the non-capital functions relieving policy scenario and the congestion charge scenario were conducted separately. The wholesale market relieving policy stated “The Beijing municipal government plans to release or upgrade 120 wholesale markets in the city by 2020, and your market is one of them.”, which is based on the real plan from the government website (The People’s Government of Beijing Municipality, 2015²). The congestion charge scenario stated that the government has also implemented the congestion charge at the same time. The charging mechanisms are shown in Table 1. Our research considered five main attributes: 1) Charging time, 2) Charging area, 3) Charging type, 4) Charging level, and 5) Charging object. The levels of each attribute were determined by our focus-group interviews, in which respondents thought their life could be affected if this kind of congestion charge was implemented.

3.2. Data collection

The target respondents of this study were people working in Beijing wholesale markets who were being or will be relocated. These people

Table 1
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 the center and a 2.5 km radius
Charging type	Cordon charge
Charging level	15¥ per crossing
Charging object	Private cars

² <http://www.beijing.gov.cn/ywtdt/zwzt/sjfsdgn/>. Accessed April 15, 2018.

included first-hand tenants who rented their stalls from wholesale markets directly, second-hand tenants who rented their stalls from first-hand tenants, and purchasing guides who are employed by first-hand or second-hand tenants. In order to ensure the breadth and validity of the questionnaire, we first conducted a field visit to the wholesale market to ensure that the respondents were only in areas that have yet to be relocated. Then, respondents from six different wholesale markets participated in the survey and the interview. The area included markets in Beijing's inner city, 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 2018. Three hundred fifty responses in total were collected, and among them, three hundred and twenty-one questionnaires were valid. Twenty-nine of the surveys were fragmented, or the respondents were not familiar with the non-capital functions relieving policy in Beijing; in either case, their survey was not included in the sample.

3.3. Model specification

The dependent variable, which was the respondent's proclivity to leave Beijing, is assigned from the same 5-point Likert scale of 1 as very unlikely to 5 as very likely. Since the respondents need to make relocation choices under two different scenarios: 1) The non-capital functions relieving policy, and 2) The non-capital functions relieving policy and congestion charge, a panel data fixed effect ordered logit model was employed (Chen, 2014). The model specification is as follows:

$$y_{ik}^* = \beta_1 X_{1ik} + \dots + \beta_7 X_{7ik} + \mu_i + \varepsilon_{ik} \quad (i = 1, \dots, 321; k = 1, 2) \quad (1)$$

where y_{ik}^* is the latent utility for an individual in policy scenario k . X_{1ik} to X_{7ik} are observable influential factors including 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. While μ_i is a scenario-invariant random term which is treated as a fixed effect, and random term ε_{ik} obeys logistic distribution.

According to multicollinearity tests between explanatory variables, some variables were removed. The final model is shown below:

$$y_{ik}^* = (\beta_1 Mag + \beta_2 EDU_3 + \beta_3 CD) + (\beta_4 BL + \beta_5 DT_1 + \beta_6 BJC + \beta_7 WD) + (\beta_8 CT + \beta_9 CDS + \beta_{10} CG + \beta_{11} B + \beta_{12} BG + \beta_{13} CC) + (\beta_{14} CC^* CT + \beta_{15} CC^* CDS + \beta_{16} CC^* CG + \beta_{17} CC^* B + \beta_{18} CC^* BG) + (\beta_{19} CJR + \beta_{20} CHF) + (\beta_{21} FLBJ + \beta_{22} CH) + (\beta_{23} GOOD + \beta_{24} MST) + \beta_{25} EV + \mu_i + \varepsilon_{ik} \quad (2)$$

The multicollinearity is well-controlled with the average VIF value of 2.72 (Min = 1.03, Max = 8.49), which did not exceed the value of 10 (Hair, Black, Babin, Anderson, & Tatham, 1998). The detailed explanation of each sample can be found in Table 6.

4. Focus group interviews

Focus group interviews allowed participants to discuss their concerns freely regarding the different scenarios. Focus group interviews stimulated creativity and imagination of respondents to obtain new ideas on specific problems (Kahan, 2001). In this study, the focus group interviews are used to obtain the attitudes towards the non-capital functions relieving policy and the congestion charge.

The four main topics in our focus group interviews included: 1) wholesalers' willingness to relocate under the non-capital functions relieving policy; 2) the impact of the non-capital functions relieving policy design and implementing the process on their willingness to relocate; 3) the impact of the different congestion charging policies, and;

4) other incentives and obstacles. Participants in this interview are from the clothing and small commodity wholesale markets in Beijing, because most of the wholesale markets, which have not been relocated, are clothing and small commodity markets (Zhang, 2017). The sample consists of 8 males and 11 females, aged between 21 and 50, including 10 first-hand tenants, 4 second-hand tenants, and 5 purchasing guides. We conducted three interviews in total, with 4–9 participants per interview (see Table 2).

4.1. The impact of relieving policy

4.1.1. General effect of relieving policy

Nearly half of the participants stated that if their current market is about to move, they are more willing to stay in Beijing and move to other markets that have not been subjected to move yet. Four people said they would like to move to new markets in Hebei or Tianjin, and four others said they would change jobs. There were only a small number of people who would change to an online store or go to other provinces outside Beijing-Tianjin-Hebei region. This result is consistent with the results presented in mass media and reports (Annual Report on Economic Development of Beijing (2016–2017)).

The influence of the relieving policy will also depend on the type of market. The unremoved wholesale markets can be divided into either large markets buying goods directly from factories, or small markets buying goods mainly from other large markets in Beijing. For the large market category, they stock by express logistics, so suppliers' locations will not influence their relocation decisions. On the contrary, the small markets, that need to buy goods from other large markets, would leave Beijing and move to Hebei province if their suppliers were affected by the non-capital functions relieving policy. This was due to longer travel distances, increase travel costs and time to buy their goods. Some of the questions and answers are shown below:

Q: Will your main supplier's location affect your relocation decision?

A1: We have our own factory, which is outside Beijing and will not be affected by the non-capital functions relieving policy.

A2: Yes, many big wholesale markets have been moved. (...) Now we drive to stock up.

Besides, for merchants whose main business type is retail, relieving policy has a greater impact on them. This is because most of their customers are residents around the markets. So, if they move to another place, they will lose most of their customers.

Q: Will your main customers' location affect your relocation decision?

A: Yes, of course. If I move away, customers who live nearby will be lost.

Above all, we know that major suppliers and their location, major clients' location, business type and the frequency of buying or delivering goods by car per week will affect wholesalers' relocation decisions. Therefore, we put these variables in our questionnaire and model.

4.1.2. Market relocating time

Two respondents stated that market relocating time will affect their relocation decisions. One of them said that if the market is going to relocate in the short term, they will move to the new markets in Hebei or Tianjin, but if there is still a long time before market relocation, they

Table 2
Focus group interviews' schedule.

Time	Market	Location	Participants
2018.3.27	Guanyuan Commodity Wholesale Market	West 2nd to 3rd ring road	4
2018.3.28	Bairongshimao Mall	South 2nd to 3rd ring road	9
2018.3.29	Dahongmen Clothing Market	South 3rd to 4th ring road	6

may have other plans. When there is still a long time before market relocation, they may have more time to compare the long-term benefit and cost between new markets in Hebei or Tianjin and markets in other provinces. Because moving to new markets in Hebei or Tianjin will be encouraged by the government, it is easier and cheaper to find a new booth in the markets in Hebei or Tianjin. Nevertheless, considering the future development and benefit, this convenient choice may not be the best long-term choice. This example is illustrated based on five participants stating that they would relocate as soon as possible after the relocation time is announced because they believed they could gain market share and cultivate loyal customers.

4.1.3. Government designate an ingoing new market

Six participants indicated that if the relocation decision was made for all market participants versus the individual level, it would change their perspective. Compared to making a relocation decision by themselves (which is current practice), they will be more likely to move to the new markets in Hebei or Tianjin, if the government can designate a new market for all merchants in their market. This is to say, the traders in the current market could move to another new market as a whole. They think this measure could, to a certain degree, avoid customer churn after the relocation.

Q: If all of you move to a new market as a whole, will you prefer to move to new markets?

A1: Of course, I will! (...) Because our market is mature, each merchant has regular customers, and total customers will be more when adding everyone's regular customers together (like Industrial cluster effect).

However, one participant prefers to decide where to relocate by himself.

A2: No, I prefer to make a choice a new market by myself. If that market is not good enough, then I will get caught. (...) I need to investigate each market.

4.1.4. Expectation of new markets

Seven participants stated that the public transport infrastructure around the new market, especially the development of logistics, is one of the main factors affecting their relocation decision. Income was also a very important factor for most of the participants. Since the category of urban space and local socio-economic household characteristics will affect the customer flow and market attractiveness (Gonzalez-Feliu & Peris-Pla, 2017; Nuzzolo & Comi, 2014), the expected income for the new market located in the less developed cities is more uncertain. Most of the participants are reluctant to go to the new market because they are not optimistic about the future development of new markets in Hebei or Tianjin. They believed that there are fewer customers in Hebei and Tianjin, and they also thought the consumption level and moral qualities of local customers are lower than in Beijing.

Q: Which aspect of the new market will influence your relocation decision?

A: Any other obstacles could be tolerated except income. Income is the key.

Q: Why are you not willing to move to the new markets?

A: Because of the location and the number of customers. At the very least, there should be a considerable economic income, because the expenses in all aspects are particularly large.

In addition, some participants thought the level of local public services, such as schools and hospitals, and rent also needs to be considered. That is because the level of public service in Hebei and Tianjin is much lower than in Beijing. A move to new markets may also mean a drop in living standards. However, the house rent in Hebei or Tianjin is lower than in Beijing.

4.1.5. Feedback of new markets

Some participants who are willing to move to the new markets said that some of their friends have already relocated to new markets in

Hebei or Tianjin and most of them had a good business state. However, some other participants said that he/she has heard some merchants have a poor business interaction in the new markets and move back to Beijing. Given this negative feedback, they are not willing to move to the new markets.

Q: Why don't you want to move to the new markets?

A: Lose money, someone has lost fifty to sixty thousand yuan in the new markets.

Q: Have they moved back to Beijing?

A: Yes, lots of merchants who moved to Tianjin has come back.

4.2. The impact of the congestion charge

Before the interviews, participants were shown some congestion charge scenarios with different charging times, charging types, charging areas (a circular region with their market as the center with different radiuses), and charging levels. Participants were allowed to ask questions about the congestion charge to make sure they understood the different scenarios.

4.2.1. Charging time and charging area

Most participants believed that charging different rates at different times will influence behavior to relocate. Five participants stated that levying congestion charge in peak hours would have the most significant effect on their daily travel. The other two participants said that charging for the whole day would have a more significant impact. One participant stated that working time from 7:00 a.m. to 19:00 p.m. may be a specific choice.

Most participants did not think the size of the charging area would affect them because most of them live nearby and walk or bike to work. Two participants stated that the congestion charge would influence their relocation decisions based on the increase in travel costs.

Q: Will congestion charge affect your daily life?

A1: No. I walk to the market in 10 min and I can't drive a car.

A2: Yes, a congestion charge would affect everyone, even if they don't drive cars.

4.2.2. Charging type and charging level

After explaining the difference of a cordon charge and a distance charge, almost everyone agreed that a cordon charge would have a more significant effect. Three participants stated that they could not spend more than 1000¥ per month on the congestion charge. When the monthly expenditure is more than 500¥, their daily lives would be adversely affected, but not enough to relocate. For a cordon charge, 15¥ per crossing could have a noticeable effect. The highest price that they could accept for distance charge is 2–3¥ per kilometer. If the charging level is higher than that, they may move out of the charging area.

5. Results

5.1. Descriptive statistics

5.1.1. Basic information

The demographic breakdown of the 321 respondents is shown in Table 3. Though a higher percentage of females have been surveyed in this study, it is also found in other papers (e.g. Zhang & Deng, 2017) and it is in line with our observation during the investigation.

5.1.2. Attitudes towards policies

In the focus-group interview, it was discovered that respondent's relocation decisions were impacted by how far ahead the markets publicized a firm's relocation time. This finding is similar to that of Goetgeluk (1997): the urgency of the move will partly affect people's willingness to substitute the most preferred dwelling for a less-preferred one. Based on previous research and our focus-group interview, this question was added to the survey: "Suppose your markets will be

Table 3
Basic information of respondents.

Factors	Items	No.	Pct.
Gender	Male	105	32.7%
	Female	216	67.3%
Age	≤25	59	18.4%
	26–35	145	45.2%
	36–45	72	22.4%
	≥46	45	14.0%
Education	Junior high school and below	82	25.6%
	High school	155	48.3%
	Junior college and above	84	26.2%
Family register	Beijing	33	10.3%
	Hebei/Tianjin	48	15.0%
	Other cities	240	74.8%
Personal monthly income	≤5000 ¥	111	34.6%
	5000 < X ≤ 10,000 ¥	131	40.8%
	10,000 < X ≤ 20,000 ¥	48	15.0%
	≥20,000 ¥	31	9.7%
Car availability	Never	158	49.2%
	Sometimes	104	32.4%
	Always	59	18.4%
House ownership	Tenant	250	77.9%
	Owner	71	22.1%
Duration living in Beijing	≤5 years	82	25.6%
	6–10	101	31.5%
	11–20	87	27.1%
Commuting mode	≥20	51	15.9%
	Car	45	14.0%
	Public transport	106	33.0%
Commuting distance	Cycling/walking	170	53.0%
	≤1 km	72	22.4%
	1 < X ≤ 5	125	39.0%
	5 < X ≤ 15	80	24.9%
Congestion situation around current market	>15	44	13.7%
	Serious congestion	53	16.5%
	Moderate congestion	97	30.2%
	Mild congestion	65	20.3%
	Basic smooth	65	20.3%
	Smooth	41	12.8%

relocated. How long in advance should you be notified if you were to leave Beijing?”

This research found that approximately 70% of respondents needed at least 1 year. Unfortunately, most wholesale markets provide 2 months of notice, which has caused merchants' dissatisfaction and grave challenges to their business.

It seems that merchants are also very worried about the potential income loss if they relocate to the new markets in Hebei or Tianjin provinces. This is due to the industrial agglomeration effect, which is broken if each merchant makes relocation decisions separately. Therefore, we also asked survey respondents: “Do you prefer the government to designate an ingoing new market for your wholesale market?” As shown in Table 4, more than 60% of the respondents hoped the government would designate a new market for them, ensuring that the brand of the old market would not be diminished, and the sales volume would be more secured. Respondents' appraisal of the relieving policy and the congestion charge are low. Most of them are not supportive of these two policies and not satisfied with the implementing process of the relieving policy (see Fig. 1).

Table 4
Attitudes towards policies.

Attribute	Level	Pct.
Whether prefer government designate an ingoing new market	Yes	60.4%
	No	39.6%
Minimal preparation time for relocating	2 months	7.8%
	Half a year	22.7%
	1 year	36.1%
	3 years	33.3%

5.1.3. Expectation of new markets

Respondents were also asked to grade new markets' potential income, working environment, local price level and convenience of logistics according to their expectation, from 1 (much worse) to 5 (much better). The arithmetic mean of each item was also calculated. As presented 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% believe their income will be much worse if they relocate to the new markets. Moreover, 40.2% thought the price level in Hebei or Tianjin will also be lower. Overall, the trend is clear that respondents see the relocation as a negative, which is shown in the total row. However, the working environment evaluation is viewed as an improvement in the event of relocation. About 25% anticipate the working environment will be better than current markets.

5.1.4. 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 functions relieving policy. This result is very different from the investigation in 2016, in which the number was less than 20%. That may be due to the wholesale markets' relieving policy being in the middle and late stages of implementation, and some respondents have already been relocated to the current market. This means that certain parties are facing a second relocation decision. Though they can also choose to stay in Beijing and move to another market, this choice becomes more difficult because fewer markets and options are available. Consequently, their probability of leaving Beijing likely increases (see Fig. 2). After adding the congestion charge scenario, the proportion of people who thought they are “very likely” to leave Beijing does not change. However, the proportion of “very unlikely” decreased slightly due to some merchants thinking that other stalls will relocate after the congestion charge implementation and they will face less competition.

We also ask their relocation destinations after markets areas are relieved. As shown in Fig. 3, though most respondents can leave Beijing, the proportion of respondents desiring to leave and go to other provinces is just 35.5% (9.03% move to new markets in Hebei or Tianjin and 26.48% go to other provinces besides Beijing, Hebei and Tianjin). 39.3% have not made a decision. 25.2% also want to live in Beijing, of which 10% will change jobs, 9.4% move to markets that have not been relocated, and 5.9% will change to an online-store.

5.2. Factors influencing relocation decisions

5.2.1. Personal and household characteristics

Across “personal and household” characteristics (marital status, educational level, and the numbers of children at home) have a significant effect on relocation possibility. Among them, marital status has a strong positive effect on respondent's relocation possibility, which is different from previous studies (Turban et al. 1992; Qi, 2014). In China, household registration will affect whether children can attend the local schools, which may be the reason for this different outcome (Qi, Fan, Sun, & Hu, 2018). For most wholesalers, who do not have Beijing household registration, are faced with numerous challenges: 1) pay extra money for their kids, 2) the school not allowing their kids in the school, or 3) high schools limited students are limited to the college entrance examination within the province that they reside. The educational level also has a negative effect on respondents' relocation intentions. Respondents having junior high school and higher education are less likely to relocate. Contrary to previous studies (Arentze & Timmermans, 2007; Tillema et al., 2010), age and gender were not significant in our research.

5.2.2. Residential and job-related characteristics

Concerning “residential and job-related” characteristics, the

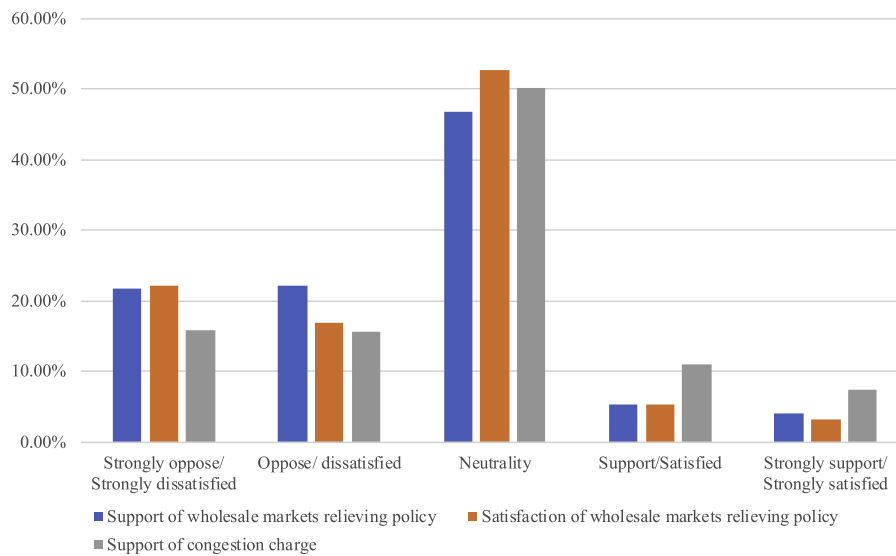


Fig. 1. Support and satisfaction of policies.

Table 5
Expectation of new markets.

	Much worse 1	A little worse 2	Almost the same 3	A little better 4	Much better 5	Mean
Income	43.3%	30.2%	15.9%	7.2%	3.4%	1.97
Working environment	12.5%	17.8%	36.5%	24.9%	8.4%	2.99
Price level	14.3%	40.2%	33.6%	9.4%	2.5%	2.45
Convenience of logistics	18.7%	29.0%	34.6%	10.6%	7.2%	2.59

duration of living in Beijing, departure time, major clients' location, and working days per week were found to be significant factors in the relocation decision. The intention of leaving Beijing is significantly reduced if respondents have lived in Beijing longer. This result shows cumulative inertia effects introduced by Thomas, Stillwell, and Gould (2016). Respondents have strong social and economic ties to their residence and job. Additionally, respondents' major customers are from Beijing, and moving would jeopardize these relationships. Respondents who need to work 7 days per week are reluctant to leave Beijing. Approximately 74% of our respondents needed to work 7 days per week. Among these three variables, major clients from Beijing have the largest negative influence.

5.2.3. Commuting and freight-related characteristics

In this group of "commuting and freight-related" characteristics, commuting time, the congestion situation around the current market, the commuting mode, and the frequency of the buying suppliers have significant effects. Respondents who go to work before 7:00 a.m. have a significantly higher possibility to leave Beijing. These respondents may own houses in peripheral areas. However, commuting time shows the opposite effect; that is, people who have longer commuting times have a higher resistance to leave Beijing. This is because a longer commuting time generally relates to living in the city center where congestion is the worst, which requires longer commutes. Considering the high level of public service in Beijing, moving out to another province may lead to a large disutility. Also, heavy congestion around wholesale markets could impel people to leave. Respondents who commute by public transport are significantly less likely to move under the relieving policy. The frequency of buying supplies by car has a significantly positive effect on people's leaving possibilities. This result is in line with what we

obtained from the focus group interview. After implementing the non-capital functions relieving policy, the suppliers in the suburb will be relocated to Hebei or Tianjin, and suppliers in nearby cities will not be affected. That means moving to new markets in Hebei or Tianjin will be closer to their suppliers. This will reduce their travel cost and then will promote them to relocate outside Beijing.

The congestion charge itself does not show a significant effect on wholesalers' relocation decisions, and the interaction with commuting variables does not show significant influence. These results are different from previous studies, but it is plausible. For wholesalers who need to both relocate their residence and business, the congestion charge is only a small part of their consideration.

5.2.4. Life cycle events

As shown in previous studies, both recently changing jobs (Kan, 2002; Liu & Yan, 2007) and planning to move from the current house (Tillema et al., 2010) have a significant effect on respondents' relocation decisions. People who have changed jobs recently will be less likely to move. Most of the respondents who have changed their job recently moved from other markets, and they are more reluctant to move again.

5.2.5. Social inclusion

According to "social inclusion" characteristics, the 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 the possibility that they will leave. On the contrary, frequencies of changing houses after coming to Beijing have a positive effect. People who have changed houses more times will be more likely to move out of Beijing. These results show that people who have lower social inclusion will be more likely to leave and vice versa. Because high social inclusion also means high transfer costs, people with high social inclusion will be less likely to leave (He & Qi, 2014).

5.2.6. Attitudes towards policies

Within "attitudes towards policies" characteristics, friends' feedback of new markets and the minimum preparation time for relocating were statistically significant. If the respondents hear that "the new markets in Hebei or Tianjin are better than 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, 2004). Conversely, if their peers or friends told them that the conditions

Table 6
Regression results for ordered logit model.

		Coefficient	Z-test
Personal and households' characteristics			
Mag	Marital status (married = 1)	0.731***	3.87
EDU3	Education (junior college and above = 1)	-0.471***	-2.62
CD	Children still at home (0 = 0, 1 = 1, $\geq 2 = 2$)	0.309***	2.74
Residential and job-related characteristics			
BL	Duration living in Beijing (continuous variable, be standardized)	-0.522***	-5.99
DT1	Departure time (before 7 a.m. = 1)	0.678***	3.63
BJC	Major clients' location (Beijing = 1)	-0.700***	-4.28
WD	Working days per week (7 days = 1)	-0.549***	-3.11
Commuting and freight-related characteristics			
CT	Commuting time (continuous variable, be standardized)	-0.381**	-2.07
CDS	Commuting distance (continuous variable, be standardized)	0.189	1.11
CG	Congestion situation around current market (smooth 1 to serious congestion 5)	0.263***	3.08
B	Commuting mode (public transport = 1)	-0.628**	-2.40
BG	The frequency of buying supplies by car per week (continuous variable, be standardized)	0.231**	2.21
CC	Congestion charge (with congestion charge = 1)	-0.0875	-0.21
CT*CC		0.0273	0.11
CDS*CC		0.137	0.58
BG*CC		-0.0475	-0.41
B*CC		0.575	1.57
BG*CC		-0.00642	-0.04
Life cycle events			
CJR	change job recently (yes = 1)	-0.412*	-1.65
CHF	plan to move house in the next 2 years (yes = 1)	0.878***	3.45
Social inclusion			
FLBJ	Friends or relatives living in Beijing (continuous variable, be standardized)	-0.463***	-4.57
CH	Times of changing house in Beijing (continuous variable, be standardized)	0.203**	2.44
Attitudes towards policies			
GOOD	Feedback of new markets (better than current markets = 1)	1.319***	3.64
MST	Minimize prepare time for relocating (2 months = 0.2, half a year = 0.5, 1 year = 1, 3 years = 3)	-0.365***	-5.05
Expectation of new markets			
EV	Working environment (much worse 1 to much better 5)	0.214***	3.12
Cut1		-1.549	
Cut2		-0.097	
Cut3		1.627	
Cut4		2.681	
Log likelihood		-870.83388	
Wald chi2(Kin et al., 2017)		213.14	
Prob > chi2		0	
Observations		642	
Individual		321	

Note: *** $p < .01$, ** $p < .05$, * $p < .1$.

were worse in new markets they would be less prone to moving. In our focus group interviews, some participants stated they would be more likely to move if the markets could give them longer preparation time. However, the results show that people who need longer preparation time would be less likely to move.

5.2.7. Expected change in new markets

The working environment of the new markets in Hebei or Tianjin has a significant positive effect, and will further increase respondents' relocating possibility. The expected income, which was highlighted by the majority of participants in our focus group interviews, did not have a significant influence on respondents' relocation decisions.

6. Discussion

This study provides valuable insights into the relocation decision of merchants in Beijing wholesale markets under the relieving policy and its combination with the congestion charge. There were seven kinds of influential factors: 1) personal and households' characteristics, 2) residential and job-related characteristics, 3) commuting and freight-related characteristics, 4) life cycle events, 5) social inclusion, 6) attitudes towards policies, and 7) expectation of new markets that can significantly affect the relocation decision of practitioners working in wholesale markets. For wholesale markets' managers and the government, who both want to promote the outflow of population, these results can provide guidance to help them improve current policies and design new complementary policies. Additionally, this study examined the congestion charge's influence on wholesalers' relocation decisions under the non-capital functions relieving strategy. This research found that the long-term effect of the congestion charge differed from previous studies. These findings make an important contribution to the business, policy, and scholarly research within this field, which will be the primary focus of this discussion.

Exploring the behavioral response of practitioners working in wholesale markets is important for providing a timely and in-depth understanding of the first stage of the non-capital functions relieving strategy. Wholesale markets cover more than three hundred thousand workers and cause pressures on both traffic and social governance (Xing, Zhang, & Wang, 2016 & Deng, 2017). According to the previous report, only 30% of them want to leave. However, according to our results, 70% of our samples, from six main wholesale markets, are planning to relocate. This response rate illustrates the effectiveness of current policies. The government's efforts over the past 2 years, which include but not limited to policy advocacy, dispute resolution, and compensatory policies (e.g. rent reduction), have effected people to relocate. Our research surveyed a large group that was also diverse in people from multiple markets and market categories. More respondents from all kinds of markets should be investigated in future studies, to improve the representativeness and explanatory power.

Introducing respondents' attitudes towards policies and expectations of new markets provides direct insights for both market managers and policymakers. At the business level, there are several approaches that wholesale markets can use to promote more merchants to move to the new markets in Hebei or Tianjin. First, the merchants' willingness to relocate largely depends on their friends or relatives' valuation of new markets in Hebei or Tianjin. If their friends, who have already moved into the new market and had a positive experience, the merchant would be more likely to move. This result provides insights for new market managers. That is, new markets managers should pay attention to the feedback of merchants who have recently moved and try to make their experience as pleasant as possible. Secondly, though some merchants claim that they do not have enough time to prepare, market managers that give merchants too much time before relocating result in a decrease in the willingness of the merchants to move. Thirdly, for new markets in Hebei or Tianjin, the working environment is the primary draw for merchants. Most wholesale markets in Beijing were built 10 or even 20 years ago. Therefore, the new markets with better working environments will significantly attract merchants.

The government should pay attention to the construction of supporting facilities around the new markets. Schools seem to be a significant consideration. Local household registration and restrictions on residence and school play a major role in people's relocation decisions. The government should consider using tax policies to make sure the measures are high enough to offset the temporary low economic vitality in the new markets. In addition, for other authorities who are planning to carry out a similar policy in the future, there are two considerations. First, it may be not necessary to relocate all kinds of wholesale markets. For example, some small markets, whose customers are mainly from Beijing and especially some elder people living around, may not induce

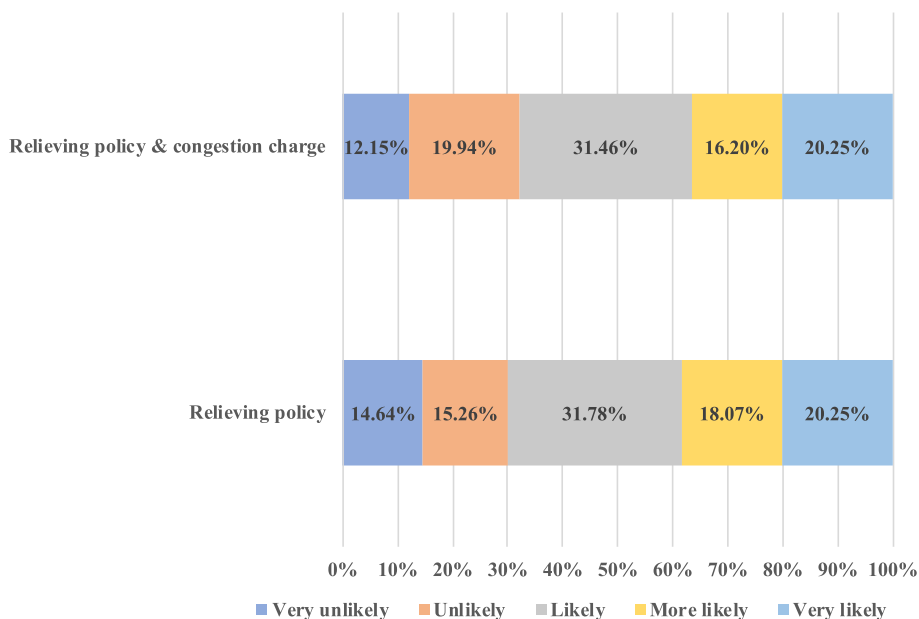


Fig. 2. Respondents' relocation possibility under different policy scenarios.

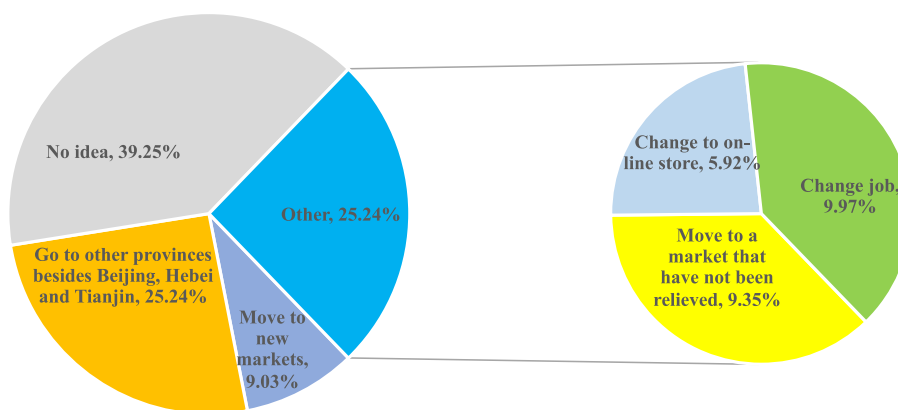


Fig. 3. Respondents' relocation destinations.

serious congestion problems. However, if these small markets were relocated, it could cause considerable inconveniences to nearby residents and create greater congestion due to larger travel distances to reach needed merchants. Secondly, another way to improve merchants' willingness to relocate is by moving all merchants in the current market as a whole to a specific new market outside of Beijing. This way can better keep the market's regular customers.

This research found that merchants with different characteristics also have different responses to the non-capital functions relieving policy. Merchants with higher educational levels, living in Beijing for a longer time, commuting by public transport, have more relatives in Beijing, and have changed jobs recently are more reluctant to leave Beijing. Merchants who were married, have more children at home, have already planned to move houses in the next 2 years, depart earlier, and facing more severe congestion during the commuting trip have a higher possibility of leaving Beijing. Because these people have a higher living burden and moving to other provinces with low house rent, low education costs, and low transport costs are more affordable and manageable. These findings not only corroborate the assertion that individual commuting characteristics, which are always used in the studies about the long-term effect of a congestion charge (Arentze & Timmermans, 2007; Tillema et al., 2010), but also that social inclusion characteristics

play an important role with regard to respondents' willingness to relocate. This factor is not new in the population mobility literature (He & Qi, 2014; Piachaud, Bennett, Nazroo, & Popay, 2009). The social inclusion characteristics should be considered especially when we estimated residents' relocation decisions in megacities, which attract large migrant populations all over the world each year. It is important to find out whether the urban policy could reasonably guide them to develop their career in a suitable region (Xu et al., 2018). At a minimum, the influential factors from all these categories should continue to be used as controls in future research. Moreover, additional research could refine the variables used in each category and have a more in-depth examination of their effect.

This research also contributes to a more holistic understanding of the long-term effect of the congestion charge under a non-capital function relieving strategy. Although scholars in this area often suggest that congestion charge could help incentivize residents to move house or change jobs, this research has found that implementing the congestion charge just slightly decreases the proportion of choosing "very unlikely to relocate." However, the congestion charge does not have a significant positive effect on merchants' willingness to relocate in general. That means when facing such forced industry transfer policy, and the congestion charge only plays a minor rule in merchants' relocation

decisions, who need to relocate both their residence and business. Since we only use a specific congestion charge scenario in this study, further research should consider different congestion charge scenarios and compare their effectiveness.

7. Conclusion

It is essential for megacities to properly adjust the urban orientation and spatial structure according to the process of urbanization. One common way to accomplish this is to relocate industries and then interrelated population (Bae, 2013; Bai, 2002; Ward & Zunz, 1997). Hence, residents' willingness to relocate is the key to the success of urban structural optimization. The policies, which serve the entire population, should be based incentivizing the merchants' willingness to relocate and help proactively guide them to a successful new venture in a new area. This study provides an opportunity for business managers and policymakers to have a more comprehensive and deeper understanding of population relocation at the individual level, by examining the influential factors from seven key categories related to wholesalers' willingness to leave Beijing. The study also contributes to the researches about the long-term effect of the congestion charge in Beijing by examining the respondent's willingness to relocate under both non-capital functions relieving policy and a congestion charge scenario.

In total, the findings from this research demonstrate that personal and households' characteristics, residential and job-related characteristics, commuting, and freight-related characteristics, life cycle events, social inclusion, attitudes towards policies, and expectation of new markets all play important roles in the relocation decisions of wholesalers. For the new markets in Hebei or Tianjin provinces, this suggests that feedback from friends and working environment are two important factors that will significantly affect merchants' willingness to relocate. The primary implication for wholesale markets is that it is beneficial to develop strategies to improve the feedback of merchants who have already settled in. These merchants will be natural advertisements and help markets' managers to call on their friends and relatives to choose the new markets. In addition, improving the working environment is also useful to attract more merchants to settle in. To this end, the peer feedback and the indicators of a good working environment can be examined in further detail in future research.

This research also examined the role of a detailed implementation scheme of non-capital functions relieving strategy on merchants' relocation willingness decisions. The findings show that relocating all merchants to a same market can better incentivize merchants to move. Unlike the current implementation scheme, which asks merchants to relocate separately, all merchants in the current market relocate together could keep the market brand and the regular customers. Moreover, this research examined the relocation effect of the congestion charge with the background of the non-capital functions relieving strategy. Although the results did not show that the congestion charge can influence residents' willingness to relocate, it does not mean the congestion charge will not affect residents' behavior at all. Since the non-capital functions relieving strategy will continue to play a role in the next decade, it is necessary to control the effect of this strategy in future studies which aim to explore the influence of congestion charge in Beijing.

As with any research, this study has some limitations. However, these limitations set directions for future research. First, since we only focus on the case of Beijing, the generalizability of this research could be enhanced if future research is conducted in other cities suffering from rapid urbanization. Second, this research used samples from wholesale markets, which is only one specific part of the non-capital functions. Relocation decisions of individuals working in other non-capital function industries such as universities and administrative departments could be considered in future studies to help the government have a comprehensive understanding of residents' behavioral responses. Third, this research only uses one congestion charge scenario, which is a

cordon charge with specific charging time, area and level to private car users. According to previous studies, different congestion charge mechanisms may have different effects on respondents' decisions (Li & Hensher, 2012; Ubbels & Verhoef, 2006). The congestion charge attributes, such as charging use, could affect individuals response and should be considered in future research (Wang, Wang, Xie, & Zhou, 2019). Thus, future studies can employ various and more detailed congestion charge scenarios and compare their influence on respondents' behavior under non-capital functions relieving policy.

CRedit authorship contribution statement

Kexin Geng:Software, Data curation, Writing - original draft, Formal analysis.**Yacan Wang:**Conceptualization, Supervision, Funding acquisition.**Dick Ettema:**Methodology, Validation.**Jason R. Anderson:** Writing - review & editing.

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