



A joint analysis of residential location, work location and commuting mode choices in Hanoi, Vietnam



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ABSTRACT

The influence of land use policy on people's residential and travel choices may be overestimated because of self-selection effects. In the context of commuting, neighborhood and travel preferences may induce self-selection effects in choices about residential location, work location, and commuting mode. Presumably, such self-selection effects may vary across different job markets. To date, however, no study has been done in developing countries. Therefore, this study aims to fill this research gap by using data collected in Hanoi, Vietnam. A joint model with the above three choices is built by incorporating self-selection effects, where effects of land use attributes are emphasized. Choices of labor-intensive workers (11,344) and knowledge-intensive workers (12,360) are compared. The statistical significance of multiple self-selection effects is confirmed, which suggests that the joint estimation of the above three choices is a useful approach. As for the magnitude of influence of self-selection effects, self-selection seems to be more influential in knowledge-intensive workers' residential location and work location choices. As for land use attributes, different types of households, and labor-intensive and knowledge-intensive workers show different responses to different types of land in location choices (especially the work location choice). Effects of land use diversity and population density on the commuting mode choice are mixed. Additionally, the centralization of knowledge-intensive employment and decentralization of labor-intensive employment are captured. These findings may be useful for city planners in Hanoi in designing land use patterns in the future in order to keep knowledge-intensive workers working and living close together.

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1. Introduction

Traffic congestion and its resulting issues (e.g., waste of energy and emission of air pollutants) caused by commuting traffic are still a major concern of transport policy makers. If people could live close to their work locations and commute by environmentally friendly travel modes, the impacts of commuting traffic may be largely mitigated. In the early stages of urbanization in developing-country cities, it can be said that most people lived very close to their daily destinations and traveled less by motorized vehicles (Cervero, 2013). The increase of income and the resulting growth of car ownership have significantly improved people's quality of life. As people have become more affluent and enjoy basic economic and political rights, more people have been able to enjoy the benefits (privacy, mobility, choice, etc.) once reserved for wealthier people (Bruegmann, 2005, p. 109). At the same time, cities have grown bigger and bigger in both the size of population and the area of urbanized space, especially in developing countries. From the

perspective of the demand side, this phenomenon can be explained as the outcome of people's residential and travel choices. While it is a challenge to slow down the rate of urbanization and motorization in these cities, it is possible to consider ways to manage it better. One such way is to encourage people to live closer to their work locations and to commute by environmentally friendly travel modes.

Because of economic growth and improvements in housing and transport supply, people living in developing-country cities have more options for their residential location and travel mode than in the past. People may therefore not be choosing to live closer to their work locations and/or to commute by environmentally friendly travel modes because such choices would not meet their preference. Unfortunately, little is currently known about people's preferences regarding residential location, work location, and commuting mode in developing-country cities, which are targeted in this study. Coinciding with economic growth, there may be a shift in the structure of the labor market, from the labor-intensive sector (e.g. workers in agriculture, forestry, and fishery) to the knowledge-intensive sector (e.g., financial and banking services, scientific and technological activities). This may lead to changes in land use and transport systems.

In the context of commuting, people working in different job markets may have different preferences regarding their choice of residential

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location, work location, and commuting mode. Choice behavior is usually influenced by not only objective factors (e.g., land use patterns in the residential location and work location choices, and levels of travel services in the commuting choice) but also subjective factors (e.g., attitude, liking, or taste). If people like walking, they may choose to reside in an area with a better walking environment. Because of such a self-selection effect, the choices of residential location and daily travel mode may not be independent of each other. Recently, the self-selection effect has emerged as an important issue in the transportation field because it may create a spurious relationship between land use and transport. Therefore, researchers have tried to depict the true effect of land use variables on location choices and travel behavior by controlling for the self-selection effects. The main concern of existing literature is in preference-induced or attitude-induced self-selection, basically including preferences or attitudes regarding location and travel (Cao et al., 2009a; Mokhtarian and Cao, 2008). Such attitudes or preferences can be measured by directly asking people to report them. If such attitude data are not available, one has to reflect them in the choice modeling process by improving the structure of error terms. Additionally, existing studies on self-selection effects have mainly focused on the relationship between residential and travel behavior. In the context of commuting, a few studies consider self-selection with respect to work location, especially in developing-country cities where there may be a big shift in the structure of the labor market in the future.

Motivated by the aforementioned issues, the objective of this study is twofold. First, this study clarifies the interdependencies between residential location, work location and commuting mode choices in the context of Hanoi, Vietnam. Second, this study examines the role of land use attributes in the three choices for workers in two types of sectors, labor-intensive and knowledge-intensive. To this end, a joint choice model is built by explicitly reflecting the influence of multiple self-selection effects.

The remainder of this paper first provides a literature review, followed by a description of the joint choice model. Next, data used in this study are briefly explained. After that, the joint choice model is estimated, and effects of self-selection and land use attributes are examined. Finally, the study concludes with a discussion about its limitations.

2. Literature review

Commuting is an outcome of not only location decisions regarding work and residence but also decisions about transport modes (Wang and Chai, 2009). In the field of transportation research, the joint analysis of residential location choice and commuting mode has been done. For instance, Lerman (1976) made an initial attempt to deal with households' joint choices of residential location, housing type, auto ownership, and commuting more by grouping them as a mobility bundle and then estimating the bundle choice based on a multinomial logit model, where correlations among different choices were ignored. Similarly, Pinjari et al. (2011) estimated a joint model of residential location, auto ownership, bicycle ownership, and commute mode choice decision but used a mixed logit model, which incorporates self-selection effects, endogeneity effects, correlated error terms, and unobserved heterogeneity.

In the context of commuting, whether or not work location should be jointly modeled with residential location and commuting mode has long been a controversial topic. Some existing studies assume that work location is an exogenous variable to residential location and commuting mode choices. This assumption is rooted in early studies of urban economics, which assumed that all jobs were located in city centers (Alonso, 1964). However, such an assumption has been questioned by numerous researchers because of the decentralization of jobs in both developed and developing cities. In the field of urban economics, Siegel (1975) built an extended Alonso model that allows people to choose residential location and work location simultaneously. The estimation results indicated that both residential location and work location are

responsive to each other, implying that the decentralization of jobs may result in the decentralization of residences. Similarly, Simpson (1980) argued that workers also choose work locations from predetermined places of residence. Fundamentally, Simpson's argument is that the job turnover rate in an urban area is expected to exceed the rate of residential relocation because the costs of employment relocation are expected to be smaller than the costs of residential relocation. Such a hypothesis has been supported by actual data. Annually, approximately 10% of the population changed residences, and approximately 20% of employed workers changed work locations, within the same metropolitan area in many US and European cities (Kim, 2008). In Asia, the continuing trend of high job turnover rate has been highlighted in numerous studies (Lim, 2012; Spector et al., 2007; Zheng and Lamond, 2010). In the field of transportation research, Waddell (1993) empirically confirmed that the assumption of exogenous work location choice in residential location does not hold. Waddell et al. (2007) further confirmed the interdependence between residential location and work location. Furthermore, Gordon et al. (1989) proposed a co-location hypothesis to explain patterns of residential and workplace relocation. Such a hypothesis argues that residents and workers will change their residence or work location or both to adapt to worsening congestion (Kim, 2008). The co-location hypothesis has been empirically confirmed in various transportation studies (e.g., Kim, 2008; Lau and Chiu, 2013; Loo and Chow, 2011; Zhao et al., 2011). Taking self-selection issues into account, the co-location phenomenon may be explained as an outcome of people's lifestyles and travel preferences. In other words, workers co-locate to meet their lifestyles and travel preferences. For instance, people with a preference for travelling by train may live and work closer to railway stations (Van Wee, 2009). Residential location and work location choices may be represented as a sequential choice process. In fact, both residential location and work location choices have been treated as a long-term decision target (e.g., Paleti et al., 2013). Some individuals may first decide the residential location and then choose their work location—for example, those who choose to work in the city where they reside—while others may do the converse or make joint decisions—for example, those businesspersons who want to work at a city different from their original residence. Thus, it is, in fact, problematic how to decide the sequential structure, considering the potential existence of such heterogeneities. Furthermore, as pointed out by Paleti et al. (2013), such a sequential decision process may overestimate the mutual influences of these choices. Based on the above literature review, work location will be jointly modeled with residential location and commuting mode in this study.

It is expected that various behavioral aspects related to residence, work, and commuting behavior are interdependent. One such interdependence may involve the issue of residential self-selection, defined as “the tendency of people to choose location based on their travel abilities, needs and preferences” (Litman, 2011; Mokhtarian and Cao, 2008). By extending the scope of self-selection, Van Wee (2009) redefines self-selection as “the tendency of people to make choices that are relevant for travel behavior, based on their abilities, needs and preferences”. In the context of commuting, we define self-selection as “the tendency of people to make residential location, work location, and commuting mode choices based on their abilities, needs, and preferences”.

In existing literature on self-selection, the joint-equation modeling framework has been widely used (Bhat and Guo, 2007; Biying et al., 2012; Pinjari et al., 2008; Pinjari et al., 2007) because of two main reasons. First, from the behavioral viewpoint, self-selection may be caused by both lifestyle and possible structural effects (Paleti et al., 2013). As argued by Paleti et al., households preferring the use of transit tend to reside in transit-oriented neighborhoods, and therefore, good transit services may further influence mode choices. This suggests that choices of residential location and travel modes should be jointly modeled. Second, from a methodological viewpoint, the self-selection issue may consist of two aspects: omitted variables and nonrandom assignment (Herick and Mokhtarian,

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