Trip making of older adults in Seoul: Differences in effects of personal and household characteristics by age group and trip purpose

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ABSTRACT

Korea is experiencing a rapid increase in the number and proportion of the older population aged 65 and older. This study investigated personal and household characteristics affecting trip making of older adults (65 years and older) using data from the 2010 Household Travel Survey in Seoul. It was tested if the effects of characteristics were the same for the 65+ and the under 65 groups, and if the effects for older adults were the same for the 65–74 and the 75+ groups. Trips were also classified into mandatory and discretionary trips and models estimated for the 65+ group for those two trip purposes. The investigation was done with a heteroskedastic ordered logit model to account for age differences in unobserved variance.

The analysis showed that the effects of personal and household characteristics on trip making varied significantly between the under 65 and 65+ groups, and between those 65–74 and those 75+. This further confirms the risk of viewing all older adults as similar to each other or to younger individuals. The study found heteroskedasticity due to age for the youngest (under 41) and the oldest (75+) groups but not for those 41–64-years-old.

Specific results showed that men 65 or older have a lower probability of making more trips than women, especially mandatory trips, suggesting transportation policy needs to consider the genders differently. Having a driver's license and an automobile was linked to more trips for those 65–74 and for mandatory trips but not for those 75+ and not for discretionary trips of those 65+. Higher income was linked to more trips for older adults, especially mandatory trips.

The results show the development of transport policies needs to consider the variance among the aged, such as gender, income, driving licensure and automobile ownership.

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1. Introduction

The world is experiencing an unprecedented population aging. Korea is also experiencing a rapid increase in the number and proportion of the older population aged 65 and older. The magnitude of this demographic change is striking. Korea became an aging society in 2000 (defined as a society with 7% or more of the population aged 65 and older), and Korea is projected to become an aged society (14% or more of the population aged 65 and older) in 2018 and a post-aged society in 2026 (20% or more of the population aged 65 and older) (Statistics Korea, 2014). While major developed countries (France, Germany, Italy, Japan, and the United States) are expected to take 62 years to become aged societies and 25 years to become post-aged societies on average; the projection is that it will only take 18 years for

Korea to become an aged society and 8 more years to become a post-aged society (Kinsella and He, 2009).

The effect of an aging society on the economy, health care, and retirement systems has received significant attention (Buehler and Nobis, 2010), and there is growing research on the effect of aging on transportation (Alsnih and Hensher, 2003; Pisarski, 2003; Arentze et al., 2008; Schwanen and Páez, 2010; Kim, 2011) although much remains to be investigated. An aged population tends to travel less compared to a younger population (Páez et al., 2007), but current cohorts of older adults make more trips out of the home than the aged population in the past (Currie and Delbosc, 2010; Hjorthol et al., 2010; Kim et al., 2014). Various factors such as individual characteristics, household characteristics, and built environment characteristics combine to affect older adults' trip behavior (Hildebrand, 2003; Kim, 2003; Schmöcker et al., 2005; Hough et al., 2008; Kim et al., 2014). Moniruzzaman et al. (2015a) explored the walking distance of low income older adults and found variations based on lifestyle and culture. They called for more research on trip frequency of older adults.

The literature on travel behavior suggests that individual, household, and environmental characteristics affect the trip making of the older population. Age is negatively correlated with trip making for older adults (Tacken, 1998; Golob and Hensher, 2007; Páez et al., 2007) but trips are noted as being important for healthy aging (Mollenkopf et al., 2005). The travel characteristics of older adults differ significantly from those of the younger population (Collia et al., 2003; Kim and Ulfarsson, 2004; Schmöcker et al., 2005; Zhang et al., 2007). Travel characteristics even vary within the older adult group (Mollenkopf et al., 2005; Newbold et al., 2005; Hjorthol et al., 2010; Schwanen and Páez, 2010), and it is necessary to divide the older adult group into different age groups to analyze their trip characteristics separately (Alsnih and Hensher, 2003). This research will investigate if there is such a difference between age groups in Seoul.

The older population exhibits varying trip characteristics depending on individual lifestyle (Hildebrand, 2003) and whether the individual can drive (Evans, 2001; Siren and Hakamies-Blomqvist, 2004). Research suggests that car availability is a result of people's way of life and not a cause of mobility (Scheiner, 2006) but that car availability is nonetheless important for older adults' wellbeing (Nordbakke and Schwanen, 2015). This research will therefore include information on driver's license and automobile ownership as possibly important factors for trip making.

There are conflicting views on the effect of gender on trip making of older adults, and it is difficult to conclude that one gender always makes more trips than the other (Tacken, 1998; Schmöcker et al., 2005; Golob and Hensher, 2007; Páez et al., 2007). However, women have also been found to have reduced mobility compared to men (Siren and Hakamies-Blomqvist, 2004). It is therefore important to include gender as a variable to investigate the gender difference of older adults in Seoul.

Income also has a close relationship with the trip making of older adults. Those that drive themselves tend to make more and longer trips (Tacken, 1998; Schmöcker et al., 2005; Páez et al., 2007). Income has been found to affect both mode choice and trip length of older adults (Moniruzzaman et al., 2013). Income is therefore included in this study.

Public transportation affects the trip making of older adults to a certain extent. In some research it has not been found to affect the mobility of older adults (Evans, 2001; Adler and Rottunda, 2006; Silvis and Niemeier, 2009) or has been noted as a replacement for non-motorized modes not private automobiles (Schwanen et al., 2001). On the other hand, high-quality public transportation service has been found to improve the mobility of older adults (Kim and Ulfarsson, 2004; Schmöcker et al., 2008; Buehler and Nobis, 2010; Peck, 2010; Kim, 2011; Haustein, 2012; Nordbakke, 2013; Kim et al., 2014). Reducing the distance to public transit stops and improving transit connections to destinations have been found important for older adults (Nordbakke and Schwanen, 2015). These studies show that depending on the level of service provided by public transportation, it may or may not serve as effective means of transportation for older adults. In Seoul, public transportation is readily available, the distance to transit stops is generally low, and public transit is greatly used by older adults. Subways in Seoul are free for those 65 years old and older.

Previous studies have examined socio-economics and the trip characteristics of older adults (Stern, 1993; Franklin and Niemeier, 1998; Rosenbloom and Morris, 1998; Kim and Ulfarsson, 2004; Wilson, 2001; Seo et al., 2006; Lucas et al., 2007; Kim et al., 2014; Moniruzzaman et al., 2015b). However, even within the same age group, the trip making of the older adult population is expected to be more influenced by each individual's health and physical condition compared to the middle-age population. This can make the older population more likely than the middle aged to have differences in their unobserved variance, called heteroskedasticity, which most models assume to be nonexistent. To account for the age-effect of unobserved individual characteristics such as psychological disposition and health, this paper will therefore use a model that accounts for heteroskedasticity due to age.

Korea is preparing for the rapid aging of its population in various fields including housing, finances, and transportation. For successful implementation of transportation policies in an aging society, it is necessary to understand the travel characteristics of the older population. This study therefore investigates how personal and household characteristics of older adults affect trip making in general and separately for mandatory and discretionary trips in order to help the development of evidence-based transportation policy for this aging society. Specifically, it is tested if the coefficients on personal and household characteristics varied overall for the age groups based on the null hypotheses: 1) that the effects of personal and household characteristics are the same for those under 65 and 65+; and 2) that they are the same for those 65–74 and 75+.

2. Data description

Data from the 2010 Household Travel Survey in Seoul were used. The survey was sent to a random sample of 105,974 households, sampled from a total of 3,520,505 households in Seoul. The data is based on one midweek-day's travel, and is collected by an interviewer who visits the survey participants the day after the surveyed day. The survey response rate was 83.9% (Korea Transportation Institute, 2011) leading to 88,912 households with 238,923 individuals of all ages. There were 18,890 households in the 65+ year group with 23,912 individuals. Households are asked to record information on all household members six years old and older and their trip information for the day before the interview, with adults filling out information for the children. Survey questions involve personal characteristics (age, gender, driver's license, employment status, occupation type, etc.), household characteristics (number of household members, number of preschoolers, vehicle ownership, housing type, monthly income, etc.), and trip characteristics (trip purpose, characteristics of origin and destination, etc.). To account for the characteristics of the destination on the trip making of the older adult population, the number of shopping facilities (department stores, large shopping malls, etc.) was surveyed for each of the 423 traffic analysis zones (TAZ) in Seoul. The analysis was restricted to facilities within 800 m radius of a subway station in the destination TAZ to study the effect of public transportation accessibility on trips to shopping facilities.

The observed total average number of trips per day was 2.39 trips per person for people age 65 and older and 2.53 trips per person for those under 65 years old. A trip is defined as any trip out of a location for longer than 10 min total time. For example, a bicycle trip for exercise (home to home) is considered a trip with a leisure purpose if it takes > 10 min. If a trip for one trip purpose requires multiple transport modes, then each travel mode leg is considered an individual trip. When the trips were categorized into mandatory trips (going to work, going to school, other necessary business) and discretionary trips (shopping, leisure, dining out, visiting relatives, etc.), the average number of mandatory trips per day was 1.39 trips per person and the average number of discretionary trips was 1.79 trips per person 65+ years old in 2010. For the younger than 65 group, the number of mandatory trips per day was 1.53 trips per person and the number of discretionary trips was 2.28 trips per person. Table 1 presents the data description of the explanatory variables used in the analysis.

3. Methods

The objective of this work is to investigate the effects of personal and household characteristics on trip making of older adults in Seoul. To achieve this end, each individual is viewed as being able to choose how many trips they will make during the day. The participants were classified into five groups for those that made one trip, two trips, three trips, four trips, and five or more trips. The model framework therefore becomes a choice model. Since these trip groups have an order from the least to the greatest number of trips, an ordered choice model is suitable (McKelvey and Zavoina, 1975). It has been noted in the introduction