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Residential mobility, urban preference, and human settlement: A South Korean case study

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ABSTRACT

Considering the theory of place attachment, we examine the relationship between residential mobility preference and socio-demographic characteristics, social ties, and environmental perceptions. Based on the application of this western theory to a different national and community-level context, social and economic factors that contribute to such mobility preference are considered. Categorical and multilevel models are employed using cross-sectional census and survey-based data collected from residents in seven South Korean cities. Economic condition, degree of education, transportation elements, social ties, environmental perception, and place-based characteristics were found to contribute to residential mobility preference.

1. Introduction

What makes some residents more likely than others to move from a community? Are push factors within the existing community responsible or are pull factors from another community the reason for mobility? In this article, we address empirically such questions using cross-sectional census and survey-based data collected from urban residents in South Korea. Such data are analyzed using a variety of appropriate modeling approaches.

Whereas residential migration refers to residents moving from one region (or area) to another, residential mobility encompasses the dynamic mechanisms involved in such residents making a move within the same region (Howley, 2009). In terms of distance, mobility is usually taken to imply short moves, while migration is long-distance mobility (Howley, 2009). Since residential mobility is dynamic through time, changes in the social and economic structure of urban areas can occur simultaneously. This mobility as a causal element of social and cultural change, especially for social relationships or networks (Oishi, 2010) is thus of central interest.

The effects of residential mobility can be affected by the degree of change in social relationships. Therefore, residential mobility associated with the well-being or opportunity of a social group is a fundamental indicator identifying how a city gains or loses its competitiveness or attractiveness for those contemplating relocation. Bramley and Power (2009) argue that the frameworks of geography of opportunity and place attachment should be considered in explaining the enhancement of urban competitiveness and attractiveness, presumably by affecting whether places attract and retain human capital. With respect to residential mobility from urban core to suburbs, Sen (1992) claimed that this mobility "might have been concealing deep inequality in human capabilities to flourish and prosper" (as cited in Israel & Frenkel, 2015, 580). Likewise, Niedomysl (2010) has also explored how mobility is configured by place attractiveness and regional economic structures.

Residential mobility is not something unique to any one region or country. Even in countries with traditional cultures (such as

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those in Asia), residential mobility occurs with great regularity. Koreans in southeastern Korea have shown dynamic residential mobility over time as individuals relocate to improve their quality of life in search of better employment, education, and a place to live. According to Lee and Lee (2008), as the newtown residential property redevelopment projects surrounding Seoul were initiated between 1996 and 2005, approximately 6% of residents living in Seoul had moved to adjacent areas in pursuit of an improved quality of life. Southeastern Korea contains two of the largest metropolitan cities in the country—Busan and Ulsan. These cities are located in close proximity to each other and have industries that are focused on technology, importing/exporting, petroleum, and manufacturing. Such an environment is ideal to examine the preference for urban residential mobility considering the theoretical framework of place attachment.

While determinants of residential mobility preference are often discussed in relation to socio-economic factors (Randall, Kitchen, & Williams, 2008), few studies explain residential mobility preference through the application of place attachment (Lewicka, 2005). Extensive research has been conducted to determine the causes and consequences of residential mobility preference, especially those focused on social and economic implications at the level of intra-urban mobility and in comparison to the migration between other cities. More importantly, our primary contribution is the application of western theories to a different national context and the focus on both individual- and community-level attributes in light of urban human settlement.

2. Residential mobility preference and urban settlement

Residential mobility can contribute to the transformation of land use, commuting, and traffic flow and often is a catalyst of social and economic change (Clark, 2005). Rather than the actual or unexpected mobility (de Groot, Mulder, Das, & Manting, 2011; Kan, 1999) and movement behavior from empirical research techniques (Buck, 2000; Coulter, van Ham, & Feijten, 2011), our work reported here explains the determinants of mobility preference by surveying residents at a particular point in time.

The association between residential mobility preference and social and economic status can be explained through mobility determinants. Residential mobility preference not only depends on residents' social status, such as home ownership and length of residence, but also the physical condition of the residence (Howley, 2009; Lewicka, 2010). As might be expected, the better a residents' social conditions, the lower the probability of residential mobility. For households and neighborhoods, household characteristics reflect personal and household attributes such as life-cycle stage, income, and ethnicity (van Ham & Feijten, 2008; Kley, 2011). In this sense, mobility preferences are an important topic worthy of further research for many of the reasons addressed here.

Numerous studies concerning residential mobility utilize various theoretical frameworks, such as invasion and succession, filtering, life-cycle models (Kim, Horner, & Marans, 2005; Oishi, 2010), life course or events models (de Groot et al., 2011; Kley, 2011), and trade-off models (Chen, Chen, & Timmermans, 2008). The relationship between residential mobility preference and diverse urban structure along with other phenomena (e.g., an evolving city, population segregation and housing choices, housing market, urban growth, and sprawling settlement), have been examined. Dynamic residential mobility preferences and determinants derived from a variety of spatial scale and socio-economic variables are associated with moving due to work or job changes (Howley, 2009), finding good schools or housing (Böheim & Taylor, 2002), and searching for safe surroundings or milieus (Keels, Duncan, Deluca, Mendenhall, & Rosenbaum, 2005).

These efforts to earn an opportunity for better social and economic conditions through relocating to a new area are central. The geography of opportunity—suggesting that places provide opportunities, inequality, and life outcomes as a result of spatial differences in access to good jobs, schools, safer streets, richer social networks, and other opportunities (Briggs, 2005, 17–41)—indicate that individuals experience profound changes if they move to environments that afford greater opportunities (Galster & Killen, 1995; Rosenbaum, 1995). As noted by Quillian (1999) and Briggs (2003), a weaker labor market status and a weaker employability can lead one to move into a poor neighborhood. As another example, by defining a new class of people (e.g., architects, engineers, scientists, educators, artists), Florida (2002) documented that such individuals are attracted to and stay in communities that create and maintain high-quality places and prefer active, authentic and participatory experiences. In this regard, the geography of opportunity speaks to the characteristics of places rather than those of people. People living in a very poor or dangerous neighborhood may prefer to move away. However, implicitly in any analysis of mobility preferences, a better place must exist for individuals to relocate. A pull, in addition to a push, must be present and the benefits of the former must outweigh those of the latter.

The association between residential mobility preference and place attachment can be supported by two potential dimensions of attachment—rootedness (e.g., length of residence, home ownership, and expectations to remain in the same residence) and bondedness (Hay, 1998). From the rootedness and bondedness perspective, residential mobility preference can be linked to place attachment in that long-term relationships and perceptions among residents lead to a stable and vibrant neighborhood (Randall et al., 2008). A number of studies have been conducted that use socio-demographic characteristics, social ties, and environmental perception characteristics to explain residential mobility preference for place attachment. The demographic or economic drivers include information on resident age and educational level (Howley, 2009), gender and home ownership (Kley, 2011), residence duration and household size (Lewicka, 2010), housing price (Clark, Deurloo, & Dieleman, 2000), household market (Ferreira, Gyourko, & Tracy, 2010), marital status, presence of children and children's ages and ethnicity (Clark & Huang, 2003), religious status (Theodori, 2001), race (Myers, 1999), and family ties (Zorlu, 2009).

In addition, physical and social factors pertaining to resident perception and satisfaction about neighborhood amenities encompass building size or structure (Howley, 2009), safety precautions and sense of security (e.g., crime, disaster), access to material resources (Lewicka, 2010), neighborhood ties (Kley, 2011; Lewicka, 2010), and public services along with direct or indirect economic opportunities and financial situations (Hui & Yu, 2009). Clark and Huang (2003, 323) claim, "… neighborhood satisfaction plays an important role in predicting residential mobility." Lewicka (2005) points out that civic activity is also correlated with residential mobility preference. In this vein, our work reported here utilizes place attachment to explain residential mobility preference and addresses the linkage between socio-demographic characteristics, social ties, and environmental perception characteristics. Furthermore, since residential mobility relates to "… the householders themselves, the characteristics of houses and housing market, and access to amenities …" (Winstanley, Thorns, & Perkins, 2002, 814), this study will be useful in addressing the urban planning and policy concerns that involve low social ties among neighbors and community, low accessibility to social service assets, dwellers of substandard quality, disrupted family life, and mental and physical ill health.

With respect to mobility preference, this theoretical framework is diametrically opposed to the geography of opportunity approach.

Theoretically, geography of opportunity acts on the premise that individuals and/or households are motivated to move based on opportunities present in both the sending and receiving region. The place attachment theoretical framework, on the other hand, is based on the premise that locational attributes keep people in place. Geography of opportunity is logically positively associated with residential mobility while place attachment suggests an inverse relationship. This study posits an exploratory framework rather than engaging in a comprehensive analysis.

3. Research design and method

3.1. Analytical framework

To address the theoretical justification and empirical evidence for southeastern Korea, a binary logit model was used to account for factors related to migration within the entire study area (i.e., a place-pooled model). Given the nested sources of variability (residents in communities), multilevel analysis was employed with primary and secondary sources within a selected metropolitan city (i.e., Busan) as a second place-specific model. The framework represents the determinants of residential mobility preference and is proposed to identify relationships among socio-demographic metrics, economic characteristics, social ties, environmental perception, and environmental characteristics with intra-urban mobility for geography of opportunity and place attachment.

Measures for geography of opportunity and place attachment were constructed to determine which factors contribute to residential mobility preference. Ommeren, Rietveld, and Nijkamp (2000) found various demographic, educational, income, and residential characteristics were related to residential mobility preference. Among these characteristics, environmental perception characteristics, including various transportation and environment status, were estimated by residents' preference. Attributes of geography of opportunity correspond to socio-economic status (Galster & Killen, 1995). The characteristics of place attachment included place identity, dependence, and rootedness. In addition, social and economic status including socio-demographic attributes, social ties, and environmental perception characteristics are associated with a residential mobility preference.

3.2. Study area and data collection

Since 2008, southeastern South Korea (with its numerous port cities) has been designated as one of four supra-economic regions, called the 'Dongnam Region,' due to its numerous port cities (Choe, 2011). The intent of this designation was to promote regional economies in line with the new regional economic policies that include interregional cooperation, competition, and decentralization (Choe, 2011). As illustrated in Fig. 1, the area is comprised of two metropolitan cities (i.e., Busan and Ulsan) and four small to medium-sized cities (i.e., Changwon, Yangsan, Miryang, and Gimhae). The Busan metropolitan area, second in population behind Seoul, has a population of approximately 3.6 million individuals. It is the largest port city in South Korea and the fifth largest port in the world, handling up to 13.2 million twenty-foot equivalent unit shipping containers per year. Busan is divided into 16 administrative jurisdictions (including 15 'gu's and one'gun'). A South Korean geographical hierarchical category, the 'gu' and 'gun' is equivalent to the 'county' in the United States (Choi, Kim, Woosnam, Marcouiller, & Kim, in press). This spatial level was used to address the effect of community characteristics on residential mobility preference along with individual effects with an emphasis on socio-economic, social ties, and environmental issues.

The Ulsan metropolitan area, South Korea's seventh largest city with a population of over 1.1 million individuals, neighbors Busan to the south. In addition, Ulsan is the industrial powerhouse of South Korea, forming the heart of the Ulsan Industrial District, which is home to the world's largest automobile assembly plant, shipyard, and oil refinery. Changwon, the eighth most populous city in South Korea, is known for its heavy industry. Gimhae and Yangsan have many manufacturing firms which have the potential to trigger residential mobility from adjacent Busan. Similar to the neighboring cities of Changwon, Gimhae, and Yangsan along with Busan to the south, Miryang is roughly equidistant from Daegu, the third largest city in South Korea. Busan is connected to both cities by rail and expressways. This geographical proximity and spatial connectivity between the cities, especially in social and economic contexts, provides potential to increase residential mobility.

Similar to the western cities, Busan and other Korean cities have diverse urban planning and public policy issues that include urban sprawl, traffic congestion, segregated residential choices (see Appendix 1[1]), unbalanced local economic growth, educational inequality involving access to schools or school districts, barriers to job access, spatially-concentrated crime, lower-quality housing and services, and unequal access to amenities. Results in our work reported here suggest the importance of higher place attachment, especially in the urban areas that have lost their attractiveness. In this sense, urban planners could act more effectively by implementing appropriate residential mobility incentives to enhance future urban attractiveness by "making more systematic metropolitan plans that encompass land-use, transportation, and environmental dimensions" (Waddell, 2000, 247). For instance, knowing that younger residents are more likely to move from one particular urban neighborhood would be useful information, planners and policymakers could seek to ascertain what these individuals deem important in a community and develop actions to develop such locally provided services and regional amenity endowments.

Together with survey data from selected residents of the six cities listed above, cross-sectional data were collected involving social, economic, and educational conditions and the degree of residents' preferences for neighborhood living conditions concerning educational settings, transportation, and the natural environment. In 2010, roughly 2.2 million households existed across the six cities. Considering the sampling frame of households from the Korean Statistical Information Service (KSIS), 3375 households were randomly selected to represent the survey population. More importantly, in order to get more accurate estimates in different parts of the study areas and reduce sampling error (Dillman, Smyth, & Christian, 2008), stratified sampling was designed in accordance with the population randomly sampled in proportion to population density stratum in each study area.

Only those aged 18 years or older were invited to participate in the survey. The initial mailing of the questionnaire began July of 2010 and was followed by a postcard reminder and telephone calls to increase response rates. A total of 2700 residents comprised the final sample, yielding an effective response rate of 75%. Overall, the survey instrument contained four sections. The first three sections included questions concerning residential mobility preference (i.e., "At this point, would you like to leave your current residential area?"), the satisfaction with the residential environment (i.e., "Are you satisfied with your current neighborhood environment considering accessibility to workplaces, schools, open spaces, and transportation facilities and natural surroundings?"), and

[1] Based on the urban spatial structure within Busan (including urban core, inner suburbs, and outer suburbs) applied in the work of Choi et al. (in press), we attempted to address inequality of residential mobility by estimating both perceived and actual residential mobility trends.

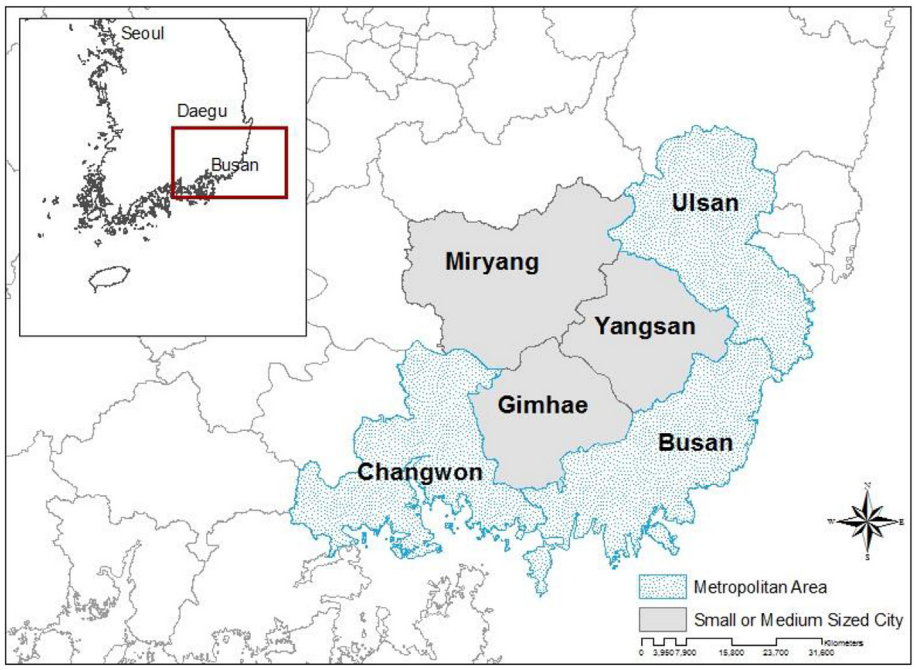

Fig. 1. Study area.

movement between adjacent regions (i.e., "How often do you visit adjacent cities such as Ulsan or Changwon within a month?"). The second section included questions on place attachment asking individuals about their expectation to remain in the same residence and to what extent they felt part of their neighborhood. The last section of the questionnaire contained items pertaining to socio-demographic characteristics and social ties (e.g., educational attainment, income, age, gender, dwelling duration and frequency of visiting other regions).

To address the cross-level effect between residents and communities in residential mobility preference within Busan and reflect time lag available to influence residents' attitude, census-based secondary data were collected from the KSIS and each community's administrative official website in 2009 (relative to the last study period). Varied community characteristics encompassing social and economic attributes such as land value, housing supply, and rent and environmental characteristics such as crime rate, natural disaster damage, and park area were measured at a sub-city scale.

3.3. Model specification

A binary logit model was used to isolate the determinants of residential mobility preference. As illustrated in Table 1, the dependent variable was *Mobility* (a binary variable coded as 1 = individual migrated and 0 = individual remains in the same location). Multivariate analysis was used to isolate the effects between mobility preference and observable characteristics. Socio-demographic characteristics, such as gender (*Gender*), age (*Age*), educational attainment level (*Education*), and income level (*Income*) and social ties, such as length of residence (*Residence*), visitation frequency of other cities (*Visit*) were included to consider the influences of social and economic status on *Mobility*. In addition, environmental perception characteristics including feelings of sense of place in residential environment (*Attach*), satisfaction with safety living in residential areas (*Security*), satisfaction with accessibility to facilities such as schools (*School*), transportation (*Traffic*), open space (*Nature*), leisure (*Leisure*), and health (*Welfare*) were included to address the effects of geography of opportunity and place attachment on residents' preference for leaving.

In the presence of simultaneity or endogenous regressors, ordinary least squares may result in biased and inconsistent estimates (Newey, 1987). Such bias is overcome when the dependent variable is continuous by using appropriate instrumental variable estimation techniques, such as two-stage least squares (2SLS). When the dependent variable is dichotomous with continuous regressors, a two-stage probit least square (2SPLS) model is appropriate (Engle & McFadden, 1994; Newey, 1987) instead of 2SLS. Whether a simultaneous relationship between y_1 and y_2 exists can be addressed as the following model:

$$y_1 = \gamma_1 y_2^* + \beta_1' X_1 + \varepsilon_1 \tag{1}$$

$$y_2^* = \gamma_2 y_1 + \beta_2' X_2 + \varepsilon_2 \tag{2}$$

where y_1 denotes a continuous endogenous variable, y_2^* is a dichotomous endogenous variable, which is observed as a 1 if $y_2^* > 0$, and 0 otherwise; X_1 and X_2 indicate matrices of exogenous variables, β_1' and β_2' are vectors of explanatory variables; γ_1 and γ_2 denote the parameters of the endogenous variables, and ε_1 and ε_2 indicate the error terms. To explore endogeneity, simultaneity or reverse causality of the variables, in particular the length of time spent at a residence *j* and preference of residents *i* to move to other areas can be elaborated as follows:

$$\begin{aligned} Residence_{ij} = f\big(&Mobility_{ij}, Gender_{ij}, Age_{ij}, Educa_{ij}, Income_{ij}, \\ &School_{ij}, Traffic_{ij}, Leisure_{ij}, Welfar_{ij}, Securit_{ij}, \\ &Attach_{ij}, Nature_{ij}\big) \end{aligned} \tag{1}'$$

$$\begin{aligned} Mobility_{ij} = g\big(&Residence_{ij}, Visit_{ij}, School_{ij}, Traffic_{ij}, Leisure_{ij}, \\ &Welfar_{ij}, Securit_{ij}, Attach_{ij}, Nature_{ij}\big) \end{aligned} \tag{2}'$$

In equations (1)′and (2)′, the length of residence ($Residence_{ij}$) variable indicates a continuous endogenous variable where

Table 1
Descriptive statistics.

Variable name	N of items	Obs	Mean	S.D	Min	Max	Cronbach's α	Coding scheme/measurement
Dependent variable: *Mobility preference*								
Mobility*		2,700[a]	0.26	0.44	0	1		0 = not move out, 1 = move out
Independent variables								
Individual characteristics								
Socio-demographic characteristic variables								
Gender*		2700	0.50	0.50	0	1		1 = male, 0 = female
Age		2700	2.65	1.18	1	5		1 = less than the twenties, 2 = the thirties, 3 = the forties, 4 = the fifties, 5 = more than the sixties**
Education		2700	2.59	0.65	1	4		1 = less than middle school, 2 = high school, 3 = college, 4 = graduate school**
Income		2700	5.90	2.56	1	10		1 = less than 990,000 won (about 1100 won is 1$), 2 = 1,000,000 to 1,490,000, 3 = 1,500,000 to 1,990,000, 4 = 2,000,000 to 2,490,000, 5 = 2,500,000 to 2,990,000, 6 = 3,000,000 to 3,490,000, 7 = 3,500,000 to 3,950,000, 8 = 4,000,000 to 4,450,000, 9 = 4,500,000 to 4,990,000, 10 = more than 5,000,000**
Social ties characteristic variables								
Residence		2700	10.67	10.81	0	65		Length of current residence (in years)
Visit		2700	2.35	1.20	1	5		1 = nothing, 2 = once to twice, 3 = three to four times, 4 = five to six times, 5 = more than seven times**
Environmental perception characteristic variables								
School	3	2700	2.98	0.63	1	5	0.71	1 = very dissatisfied, 2 = dissatisfied, 3 = neither dissatisfied nor satisfied, 4 = satisfied, 5 = very satisfied**
Traffic	3	2700	3.18	0.82	1	5	0.83	
Leisure	3	2700	2.99	0.74	1	5	0.66	
Welfare	2	2700	2.91	0.70	1	5	0.62	
Security	2	2700	3.06	0.70	1	5	0.67	
Attach	2	2700	3.25	0.70	1	5	0.71	
Nature		2700	3.38	0.87	1	5		
Independent variables								
Community characteristics[b]								
Socio-economic characteristic variables								
Tax		16[b]	9.57	19.85	0.91	78.95		Tax burden rate, 2009[c]
Low income		16	0.04	0.01	0.02	0.07		Percentage of low income population, 2009
Rent		16	0.07	0.01	0.03	0.11		Percentage of housing renter, 2009
Land value[a]		16	0.50	0.51	0	1		0 = negative land value rate, 2005–2009 1 = positive land value rate, 2005–2009
Business		16	0.44	0.34	0.15	1.32		Number of workers per capita, 2009 (person)
GRDP		16	23,564	27,892	6202	118,539		GRDP per capita (one billion won, about 1100 won is 1$), 2009
Housing supply		16	112.18	16.67	91.9	157.6		Percentage of housing supply, 2009
College		16	0.28	0.03	0.22	0.33		Percentage of high school student who admitted to college, 2009
Environmental characteristic variables								
Crime		16	0.05	0.03	0	0.12		Number of crime per capita, 2009
Disaster		16	4.58	9.93	0	36.21		Per capita natural disaster damage cost, 2009 (one billion won, about 1100 won is 1$)
Residential area		16	0.25	0.17	0.04	0.63		Percentage of residential area, 2009 (100 m^2, %)
Park		16	0.03	0.07	0.003	0.22		Percentage of park area, 2009

Note: [a] Number of survey respondents in the whole study area. [b] Number of 'gu' within Busan. [c] Year relative to the last study period. Units in parentheses. * dummy variable, ** reference category.

willingness to leave ($Mobility_{ij}$) is a dichotomous endogenous variable. In an effort to "take account of the variability concerned about each level of nesting," multilevel analysis can be used (Snijders & Bosker, 1999, 1). More importantly, this model can adjust for the lack of independence within the clusters (in this case, residents clustered within communities) (Raudenbush & Bryk, 2002). Given the response variable *Mobility* is dichotomous, a multilevel logistic regression model (two-level GLM, Generalized Linear Model) is appropriate to estimate the cross-level effects (Snijders & Bosker, 1999). In terms of resident preferences for household (individual) i in county (community) j to move to other cities ($Mobility_{ij} = 1$), the second place-specific model is described:

$$\begin{aligned} Mobility_{ij} = {} & \alpha_{0j} + \alpha_{1j}Gender_{ij} + \alpha_{2j}Age_{ij} + \alpha_{3j}Education_{ij} \\ & + \alpha_{4j}Income_{ij} + \alpha_{5j}Residence_{ij} + \alpha_{6j}Visit_{ij} \\ & + \alpha_{7j}School_{ij} + \alpha_{8j}Traffic_{ij} + \alpha_{9j}Leisure_{ij} \\ & + \alpha_{10j}Welfare_{ij} + \alpha_{11j}Security_{ij} + \alpha_{12j}Nature_{ij} \\ & + \gamma_{ij} \quad (\text{Level} - \text{one model}) \end{aligned} \tag{3}$$

$$\begin{aligned} \alpha_{0j} = {} & \delta_{00} + \delta_{01}Tax_{1j} + \delta_{02}Lowincome_{2j} + \delta_{03}Rent_{3j} \\ & + \delta_{04}Landvalue_{4j} + \delta_{05}Business_{5j} + \delta_{06}GRDP_{6j} \\ & + \delta_{07}Housingsupply_{7j} + \delta_{08}College_{8j} + \delta_{09}Crime_{9j} \\ & + \delta_{010}Disaster_{10j} + \delta_{011}Residentialarea_{11j} + \delta_{012}Park_{12j} \\ & + \mu_{0j} \quad (\text{Level} - \text{two model}) \end{aligned} \tag{4}$$

Whereas the level-one model represents the dependent variable, $Mobility_{ij,}$ as a function of the level-one explanatory variables, the level-two model presents the random intercept and random slope as functions of one or more level-two contextual variables (Raudenbush & Bryk, 2002). In this study, this method allows estimates of (3) the overall relationship between individual characteristics (factors selected from survey in 2010) and community characteristics (factors selected from census-based data in 2009) and (4) the variation between community characteristics that cannot be accounted for by community characteristics.

In terms of selected variables in the Level-two model, socio-economic characteristics, such as tax rates of communities (*Tax*),

percentage of low income population (*Low income*), ratio of renting in housing tenure (*Rent*), change of land value relative to 2005 (*Land value*), number of employed workers (*Business*), per capita gross regional domestic product (*GRDP*) adjusted for inflation in 2009, percentage of housing supply (*Housing supply*) to reduce the shortage of housing units, and percentage of high school students admitted to college (*College*) are involved in considering the influences of community social and economic status on residential mobility preference. Community environmental attributes encompassing number of crimes committed (including murder, rape, theft, robbery) per total residents (*Crime*), cost of natural disaster damage such as flooding and typhoon (*Disaster*) adjusted for inflation in 2009, percentage of entire community classified as residential area (*Residential area*), and park area (*Park*) were selected to address the effects of community environmental characteristics on the residents' willingness to leave.

3.4. Descriptive analysis

Descriptive statistics for the variables, Cronbach's α results, and the coding scheme used in this analysis are summarized in Table 1. Reliabilities for each of these multi-item measures were assessed and found to range from 0.62 to 0.83. With respect to mobility preference, less than a quarter of all respondents preferred to move to another area. More specifically, about 50% of the respondents had an educational attainment between high school and college and made as much as about three million won per month.[2] Most of the respondents were long-term residents (having lived in the area for more than 10 years) who visited other cities once or twice per month. In addition, most of the respondents were likely not to feel high satisfaction with neighborhood environmental characteristics including sense of place in residential environment, safety living in residential areas and accessibility to facilities such as school, transportation, open space, leisure, and health. In terms of selected community (within the Busan metropolitan area) characteristics from census-based data in 2009, social and economic attributes including GRDP and housing supply are somewhat higher than the national average. According to the KSIS (2009), whereas the level of GRDP and housing supply in this study area was highest among the other study areas and was fourth place among six metropolitan cities in South Korea, the employment rate (*Business*) was the lowest among other metropolitan cities. With regard to community environmental attributes, the communities had somewhat lower levels of percentage of park areas and cost by natural disaster damage reduces the GRDP by 0.02 percentage.

Regarding mobility preference socio-demographic characteristics, social ties, and environmental perception characteristics across each study city, 29.0% of respondents living in three cities Yangsan, Gimhae, and Miryang adjacent to Busan, preferred to move, compared to 17.0%, 14.4%, and 12.9% in Busan, Ulsan, and Changwon, respectively. Such a result suggests that residential mobility preference is higher in small-to medium-sized cities as compared to larger cities. Concerning the extent of satisfaction with social ties and environmental perception characteristics, residents in Busan reported the highest level of satisfaction with *School*, *Traffic*, *Leisure*, and *Welfare*, whereas residents in Yangsan, Gimhae, and Miryang showed the lowest degree of satisfaction. In accordance with the geography of opportunity, this finding suggests that Busan, the second largest city in South Korea, had more desirable social ties, environmental perception characteristics, social and economic opportunities when compared with small-to medium-sized adjacent cities (especially in relation to education, transportation, leisure, and social and health facilities).

In order to examine the relationship between preferences for residential mobility, social ties, and environmental perception attributes, pair-wise correlations between *Mobility* and social ties and environmental perception attributes were tested using the Kendall's tau-b statistic. This non-parametric statistic is appropriate to use when one or both variables are ordinal-level measures. The majority of investigated independent variables, such as *School*, *Traffic*, *Leisure*, *Welfare*, *Security*, and *Attach* were significantly negatively related to *Mobility*, where $p = <0.001$ (Kendall's tau-b with a range of −0.1338 to −0.0494). *Nature*, to the contrary, was significantly positively related to *Mobility* (Kendall's tau-b = 0.0657 at the 99% confidence level). This finding suggests that better social ties and environmental perception status will lead to a low likelihood of residential mobility preference.

4. Results

In an attempt to examine the relationship between residents' preferences for residential mobility and social ties and environmental perception attributes, the binary logistic regression model was employed. In this model, the coefficients odds ratio of the independent variables allowed us to see the likelihood that a variable was related to preference for moving to another residential area.

In the case of Busan, *School* and *Attach* were significant predictors of residential mobility preference (see Model 1 (1) and (3) of Table 2). For instance, results for satisfaction with *School* indicated that residents who were less than very satisfied with *School* are as likely to move to another residence as respondents who are very satisfied with the current school their children attend (see Model 1(3)). This result is consistent with Lewicka (2010) who claimed that greater preference for educational settings contributes to lower residential mobility preference. Similarly, results suggest that residents not satisfied with attachment are more than a half as likely to move to other areas as those who are very satisfied with the existing place attachment characteristics (see Model 1(3)). This finding suggests that residents are more likely to stay in their region than move to other areas if their primary focus is on place attachment. Additionally, with respect to socio-demographic attributes, the variables *Gender*, *Age*, *Education*, and *Visit* were significant factors influencing the decision for residential mobility at the 95% significance level (see Model 1 (3) of Table 2). This estimated finding suggests that younger females with higher educational attainment and lower incomes were more likely to move to other regions than stay in their current residential area. Particularly, this result concerning education and age have been supported in previous work conducted by Howley (2009), Kley (2011), and Lewicka (2010), who document that younger residents with higher educational attainment have greater potential to move.

On the other hand, resident' mobility preference in Ulsan indicated that *Traffic* and *Attach* were strong predictors of residential mobility preference as illustrated in Model 2 (4) of Table 2. Those residents that were dissatisfied with transportation were more likely to move to another region than those who were satisfied with transportation. In addition, similar to Busan, in terms of the *Attach* variable at the 95% significance level or better, those residents with a lower degree of place attachment were more likely to move to another region than those with a higher degree of place attachment. Given that residents often migrate from other regions to seek a new job (due to Ulsan being a South Korean industrial powerhouse), this study posited that many residents in Ulsan have a much lower degree of place attachment than those in other regions. In the context of socio-demographic characteristics, as shown in Model 2 (5) and (6) of Table 2, only *Age* was a significant factor of

[2] For rough equivalency, using the exchange rate of one US dollar equal to 1100 won, this equates to nearly $2750 US (2015) per month.

Table 2
Pooled-place model for residential mobility preference within metropolitan areas and integrating city.[a]

Variable	Model 1			Model 2			Model 3		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Intercept	2.18**	−2.49**	0.58	0.13	−0.75	0.37	1.81**	−1.22*	1.54*
Socio-demographic characteristics									
Gender		0.62** (1.86)	0.71** (2.04)		−0.006	−0.02		0.29* (1.33)	0.30* (1.35)
Age		−0.17* (0.83)	−0.18* (0.83)		−0.29** (0.74)	−0.27** (0.76)		−0.32*** (0.72)	−0.28** (0.74)
Education		0.28	0.33* (1.39)		0.01	0.03		0.05	0.07
Income		−0.05	−0.04		0.01	0.01		−0.06** (0.93)	−0.07** (0.92)
Social ties characteristics									
Residence		0.01	0.006		−0.02	−0.01		0.02	0.01
Visit		0.02** (1.25)	0.21** (1.23)		0.13	0.11		0.23*** (1.26)	0.21** (1.24)
Environmental perception characteristics									
School	−0.38* (0.68)		−0.40* (0.66)	0.14		0.13	−0.26* (0.76)		−0.26* (0.76)
Traffic	−0.06		−0.64	−0.25* (0.77)		−0.20	0.02		0.003
Leisure	−0.16		−0.26	0.01		0.03	−0.31** (0.73)		−0.28** (0.75)
Welfare	0.04		0.10	0.03		0.005	−0.08		−0.08
Security	−0.05		−0.04	0.03		0.01	0.01		−0.05
Attach	−0.39** (0.67)		−0.34* (0.70)	−0.31* (0.72)		−0.29	−0.52** (0.58)		−0.43** (0.64)
Nature	−0.02		−0.55	−0.05		−0.04	0.20* (1.22)		1.19* (1.21)
Number of Obs	501			499			900		
Log likelihood	−272***	−274**	−260***	−271	−269**	−266**	−474**	−471**	−454**
Pseudo R^2	0.04	0.04	0.08	0.01	0.02	0.03	0.04	0.04	0.08

Note: [a] Dependent variable: mobility, odds ratio in parentheses, Model 1 is for Busan, Model 2 is for Ulsan, Model 3 is for Changwon. * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

the preference for residential mobility.

In the case of Changwon, as illustrated in Model 3 (7) and (9) of Table 2, significant determinants of residential mobility preference included *School*, *Leisure*, *Attach*, *Nature*, *Gender*, *Age*, *Visit*, and *Income*. Most notably, those residents that were dissatisfied with *School* and *Leisure* were more likely to indicate they wanted to move from Changwon. Contrary to these findings, as described in Model 3 (7) and (9), residents in Changwon who were satisfied with environmental conditions were more likely to move to another region than those who were not satisfied. This result reflects that, despite Changwon's various parks and green spaces, residents' preferences for natural environments or facilities do not appear to have been met. On the other hand, regarding *Income*, *Leisure*, and *School*, this finding reveals that it can be difficult for Changwon to meet residents' preferences for social and economic environments or facilities. Similar to Busan and Ulsan, *Age* was found to significantly predict the likelihood of residential mobility. This result suggests that younger residents were more likely to move to other regions than stay in their current residential area.

Logistic regression output for residential mobility preference among residents of the small-to medium-sized cities of Gimhae, Yangsan, and Miryang is presented in Table 3. Results suggest that residents in these cities were more likely to move to other regions or cities than stay in their region as specified by the *Nature*, *Traffic*, and *School* variable results With regard to geography of opportunity, those residents in Miryang have a high preference for residential mobility (odds ratio = 0.37) in search of better educational opportunities (*School*) (see Model 6 (7) and (9) of Table 3). Contrary to the basic assumption that a city or region that is older and endowed with cultural heritage contributes to higher place attachment due to residents' pride in their area, residents in Miryang indicated a lower degree of place attachment (odds ratio = 0.36) and thus were more likely to move to other regions than stay in their present locality (see Model 6 (9)). Similar to Busan and Ulsan, younger residents in Gimhae, Yangsan, and Miryang were more likely to move to other regions than stay in their current residential areas (see Model 4 (3), 5 (6), and 6 (9) of Table 3). Interestingly, Yangsan residents that travel more frequently to other regions throughout the month and are highly educated were more likely to indicate they would not prefer to move.

As described in equations (2)′ and (3), based on the appropriate result of diagnostic test to check for endogeneity of instrumental variables (Wald test of exogeneity = 6.90 at the 95% confidence level) (Newey, 1987), the 2SPLS estimation was employed (see Table 4). The first-stage regression employs ordinary least square to estimate the continuous variable Residence. The predicted value from the first stage least squares replaces the *Mobility* variable in the main probit regression. The result of the two-stage probit model suggests that the magnitude of the coefficient on preference for residential mobility changes only slightly after controlling for the endogeneity of *Residence*. The two-stage probit findings for *Visit* and *Attach*, at the 95% confidence level, also indicated similar or increased values in the parameter on *Residence* after controlling for endogeneity. This estimated result suggests that whereas socio-demographic characteristics do not play a major role in the probability of residential mobility in the metropolitan areas, households having stronger preference for social ties and environmental perception conditions (i.e., such as higher place attachment or sense of place and low visitation frequency to other areas) will have a negative influence on preference for residential mobility. In an effort to estimate the intra-urban preference for residential mobility in accordance with individual characteristic effects and community characteristic effects within a large metropolitan area (Busan), the second specific-place and multilevel model was used (see Table 5). In the overall relationship between individual effects and community effects at the 95% significance level described in the Models of Table 5, whereas *Tax* and *Disaster* variables are found to significantly predict the likelihood of residential mobility preference, *Age*, *School*, *Business*, *GRDP*, and *Park* variables are estimated for those not preferring to move. As a whole, this finding suggests that community economic and environmental characteristics have some influence on residents' socio-economic and environmental perception in deciding whether or not move.

5. Summary, conclusions and policy implications

In this work, we examined empirically the relationship between residential mobility preference and socio-demographic characteristics, social ties, and environmental perceptions using cross-sectional census and survey-based data collected form urban residents in seven South Korean cities. These data were analyzed using

Table 3
Pooled-place model for residential mobility preference within small or medium-sized cities.[a]

Variable	Model 4			Model 5			Model 6		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Intercept	−0.68	−1.85	−1.89	3.21**	−2.00*	1.86	3.85	−1.37	3.14
Socio-demographic characteristics									
Gender		0.62** (1.87)	0.70** (2.02)		−0.10	−0.07		0.50	0.33
Age		0.32** (0.71)	−0.27** (0.75)		−0.25** (0.77)	−0.29** (0.74)		−0.48** (0.61)	−0.50** (0.60)
Education		0.42	0.45		0.52** (1.69)	0.55** (1.73)		0.14	0.01
Income		0.01	0.02		0.02	0.02		−0.03	0.03
Social ties characteristics									
Residence		0.07	−0.07		−0.09	−0.09* (0.90)		−0.001	0.05
Visit		0.03	−0.002		0.25** (1.29)	0.25** (1.28)		0.28* (1.33)	0.30
Environmental perception characteristics									
School	−0.20		−0.21	−0.21		−0.14	−0.96* (0.37)		−0.99** (0.37)
Traffic	0.06		0.02	−0.52** (0.58)		−0.62** (0.53)	−0.24		−0.30
Leisure	−0.25		−0.10	−0.23		−0.21	−0.34		−0.13
Welfare	0.34		0.28	0.21		−0.24	0.26		0.27
Security	0.31		0.32	0.52** (1.68)		0.50** (1.65)	0.39		0.53* (1.7)
Attach	0.08		−0.04	−0.60** (0.54)		−0.44* (0.64)	−0.84* (0.42)		−1.01** (0.36)
Nature	−0.34* (0.70)		−0.35* (0.69)	−0.04		−0.12	0.08		0.09
Number of Obs	300			300			200		
Log likelihood	−182**	−176**	−172**	−172	−172**	−157**	−101**	−105***	−91**
Pseudo R^2	0.02	0.05	0.07	0.08	0.08	0.15	0.13	0.10	0.22

Note: [a] Dependent variable: mobility, odds ratio in parentheses. Model 4 is Gimhae, Model 5 is for Yangsan, Model 6 is for Miryang. * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

Table 4
Specific-place model estimating residential mobility preference within two metropolitan areas.[a]

	Second stage		First stage	
	Model 7[b]	Model 8[c]	Model 9[b]	Model 10[c]
Intercept	2.92 (0.77)	0.65 (0.76)	2.75 (0.64)	0.28 (0.41)
Potentially endogenous variables or Dependent variables				
Mobility	−0.58 (0.84)			+
Residence		−0.07 (0.26)	+	
Socio-demographic characteristics				
Gender	0.29 (0.20)		0.18 (0.13)	0.18* (0.08)
Age	−0.10 (0.12)		−0.02 (0.12)	−0.12* (0.04)
Education	−0.14 (0.17)		−0.21* (0.12)	0.12 (0.08)
Income	0.02 (0.03)		0.03 (0.02)	−0.01 (0.01)
Social ties characteristics				
Visit		0.08* (0.04)	−0.05 (0.06)	0.08** (0.04)
Environmental perception characteristics				
School	−0.20 (0.15)	−0.08 (0.26)	−0.16 (0.13)	−0.07 (0.08)
Traffic	0.19 (0.11)	−0.05 (0.08)	0.23* (0.09)	−0.06 (0.05)
Leisure	−0.31* (0.15)	−0.07 (0.11)	−0.27** (0.13)	−0.07 (0.08)
Welfare	0.11 (0.14)	0.03 (0.09)	0.10 (0.13)	0.02 (0.08)
Security	0.15 (0.11)	0.01 (0.08)	0.16 (0.10)	−0.02 (0.06)
Attach	−0.06 (0.19)	−0.20** (0.07)	0.04 (0.11)	−0.18** (0.07)
Nature	0.03 (0.10)	−0.02 (0.05)	0.05 (0.09)	−0.03 (0.05)
Number of Obs	1000	1000	1000	1000
R^2	0.02		0.02	
F(12, 987)	1.84*		1.84*	
Log likelihood		−545.95		−534.73
LR Chi^2 Pseudo R^2		32.75** 0.02		55.20** 0.04

Note: [a] Busan and Ulsan, [b] ordinary least square, [c] probit regression, standard errors in parentheses. * $P < 0.05$, ** $P < 0.01$.

categorical data analysis, multilevel model, and two-stage estimation. Results suggest that economic condition, degree of education, transportation elements, social ties, environmental perception, and place-based characteristics were found to contribute to residential mobility preference.

Similar to findings of previous research (cf. Briggs, 2005; Randall et al., 2008), education and transportation elements among other residential mobility preference determinants significantly contribute to higher mobility in the intra-urban context and in comparison to other cities. This result which shows spatial concentration and inequality of residents with regard to opportunities for education and transportation, suggests loss of urban competitiveness and attractiveness in other urban areas, including higher preference for residential mobility. For this reason, these results suggest that establishing better educational settings (e.g., facilities and faculty) and better transportation infrastructure (e.g., road conditions and lowered transportation fees) could likely lead to an improvement in urban competitiveness and attractiveness, thus minimizing potential for residential mobility. Furthermore, in the context of sustainable urban development and settlement (including economic development, quality of life, and social justice and equity, interaction between the natural environment and urban areas), these results are useful for planners in developing coherent metropolitan plans and policies and for policymakers in preparing alternative policy initiatives or infrastructure choices, along with linkages between urban and rural human settlement.

Our work suggests several theoretical implications. First, quality of life in urban settlement such as good housing, employment opportunity, access to education, and higher security suggests that residents will experience profound changes if they move to other

Table 5
Specific-place and multilevel model estimating residential mobility preference within a metropolitan area.[a,b]

	Model 11	Model 12	Model 13
Intercept	4.20 (3.63)	1.05 (1.02)	1.37 (1.14)
Fixed effects			
Individual characteristic variables (Level-one)			
Socio-demographic characteristics			
Gender	0.25* (0.12)	0.24* (0.12)	0.21* (0.10)
Age	−0.35** (0.11)	−0.23** (0.10)	−0.23** (0.10)
Education	0.35** (0.19)	0.36* (0.19)	0.34* (0.19)
Income	−0.22 (0.20)	−0.21 (0.19)	−0.22 (0.20)
Social ties characteristics			
Residence	0.01 (0.05)	−0.001 (0.05)	0.01 (0.05)
Visit	0.01* (0.05)	0.01* (0.05)	0.01* (0.05)
Environmental perception characteristics			
School	−0.45** (0.21)	−0.47** (0.21)	−0.46** (0.21)
Traffic	−0.11 (0.15)	−0.08 (0.15)	−0.10 (0.16)
Leisure	−0.12 (0.20)	−0.20 (0.20)	−0.16 (0.19)
Welfare	0.07 (0.21)	0.10 (0.21)	0.07 (0.20)
Security	−0.15 (0.16)	−0.11 (0.16)	−0.13 (0.16)
Attach	−0.29* (0.27)	−0.27* (0.25)	−0.25* (0.25)
Nature	−0.19 (0.12)	−0.15 (0.12)	−0.17 (0.13)
Community characteristic variables (Level-two)			
Socio-economic characteristics			
Tax	0.17** (0.08)		0.15* (0.10)
Low income	−0.0005 (0.0005)		−0.0004 (0.0005)
Rent	−7.15 (9.19)		−7.25 (8.98)
Land value	0.49 (0.41)		0.35 (0.32)
Business	−0.0002** (9.06e-06)		−0.0001* (9.25e-06)
GRDP	−0.001** (0.00005)		−0.002* (0.00004)
Housing supply	−0.009 (0.02)		−0.007 (0.02)
College	0.0001 (0.00002)		0.0003 (0.0002)
Environmental characteristics			
Crime		5.75 (6.90)	5.75 (6.85)
Disaster		0.02* (0.01)	0.01* (0.02)
Residential area		0.11 (0.15)	0.09 (0.12)
Park		−0.21* (0.20)	−0.28* (0.25)
Random effects			
Community characteristic level	5.81e-08** (0.14)	0.16** (0.19)	0.02** (0.16)
Number of obs/groups	501/16	501/16	501/16
Log likelihood	−258.91	−264.61	−267.43
Wald Chi^2	42.78**	35.14**	31.22**

Note: [a] Dependent variable: mobility, standard errors in parentheses, [b] Busan, * $P < 0.05$, ** $P < 0.01$.

residential areas providing different opportunities than the areas from which they moved supports the work of Galster and Killen (1995). For this reason, preference for residential mobility (particularly in the form of social and economic status) can be determined by characteristics of geography of opportunity. However, it should be noted that household income factored into preference for residential mobility in only one instance (i.e., Changwon). Perhaps individuals, by and large, were satisfied with their current income and do not see the need to relocate for economic purposes. Second, the linkage between residential mobility preference and place attachment is addressed through rootedness and bondedness in relation to social and economic perspective, as alluded to by Randall et al. (2008). For this reason, place attachment attributes have a negative influence on preference for residential mobility, in that better social ties and environmental perception conditions (including higher place attachment) leads to less residential mobility. Unlike the findings of Lewicka (2005) and Theodori (2001), length of residence did not factor into residential mobility preference in any of the study cities (except for Yangsan). One potential explanation for this may be that the degree of relationship between residents living in a neighborhood could explain a lower residential mobility.

Although our work reported here does suggest important insights with respect to the empirical findings of determinants of residential mobility preference and the theoretical linkages among residential mobility, geography of opportunity, and place attachment, it has many limitations. Similar to other studies focused on cross-sectional survey data, this work only tells the story at a "snapshot in time." As a result, it is hard to employ such data to estimate migration flows of residents into and out of an area over time. As suggested by de Groot et al. (2011), future research should include longitudinal and spatially explicit data based on a survey of residents' perceptions or secondary data concerning the preference for residential mobility. In addition, since this work is primarily focused on residents' preferences, we note an important caveat that results do not address actual regional economic conditions or change. Of particular note is that housing markets can potentially influence mobility.

Our work fails to reflect the theory that residential mobility is associated with households 'matching' themselves to housing vacancies. Future research should involve the interplay between mobility and the housing market or vacancy utilizing longitudinal data. Since much of the interpretation of our findings is likely to be framed as if it was actual residential mobility being studied, this will be a problem in the case that even if many residents have a preference for mobility, they in reality, do not move. As suggested by the works of Buck (2000) and Coulter et al. (2011), future research should include the relationship between moving expectations and actual moving behavior along with panel survey and longitudinal data analysis.

Due to the limited study area focusing on southeastern South Korea, some would argue that generalizing the empirical results to other locations is problematic. In response, our geographic frames provided examination of highly variable social and economic

characteristics (e.g., racial and ethnical segregation, housing mortgage policy, and housing choice voucher program) within similar economic and political systems (Varady & Walker, 2007). Indeed, this research accepts the notion that the configuration of residential mobility preference could be different from this study. For this reason, future studies should encompass additional geographies that include U.S. and European cities or non-western cities that would allow for cross-national comparisons. Furthermore, this study primarily considers socio-economic driving factors in residential mobility preference following the work of Bramley and Power (2009), Murray (2011), and Niedomysl (2010). Therefore, future studies should include locational endowments of diverse determinants such as cultural, environmental, and religious amenities that involve alternative political structures.

Although we attempted to address intra-urban residential mobility preferences within the study area, we were constrained by urban spatial structure. Future research needs to investigate the influence of urban form transition or urban sprawl on residential mobility preference over time. Despite these limitations, these findings suggest a series of determinants for residential mobility preference based on the frameworks of geography of opportunity and place attachment along with the claim of Briggs (2005, 17) that "… location matters … the value of a given location as a place to live, work, invest, or go to school can shift profoundly over time as communities grow and their makeup changes."

South Korea, like many rapidly developing places, is currently experiencing severe urban and regional disparities due to the overly-extended concentration of economic, educational, and cultural activities and population in Seoul (as a capital city and the largest city in South Korea). As noted earlier, perceived or actual residential mobility addressed in our work can be an important factor in identifying urban and regional disparity and uneven economic development at the national scale. In this sense, understanding residential mobility in the place attachment and geography of opportunity perspectives can be a key to the health of metropolitan regions through city-suburban integration. Further, our work can be helpful for urban planners and public policymakers in diagnosing how a city gains or loses its competitiveness and in more effectively addressing sustainable patterns of human settlement.

Appendix 1. Perceived and actual residential mobility by urban spatial structure in Busan.

Year	Urban core[a]	Inner suburbs[b]	Outer suburbs[c]
Survey-based measure			
Perceived residential mobility population (percentage of willingness to move)[e]			
2009	24 (38.1)	51 (21.8)	54 (26.4)
Secondary resource-based measure[d]			
Actual residential mobility population trend (percentage of out-migration)[f]			
2009	33,525 (7.54)	100,321 (6.13)	108,030 (7.38)
2010	33,677 (7.56)	104,565 (6.38)	106,160 (7.15)
2011	31,897 (7.18)	101,905 (6.26)	105,205 (7.10)
2012	30,242 (6.85)	93,687 (5.77)	98,518 (6.68)
2013	30,559 (6.99)	94,546 (5.88)	99,079 (6.68)

[a] Urban core area includes Busanjin-gu and Jung-gu.
[b] Inner suburbs include Buk-gu, Dongnae-gu, Haeundae-gu, Sasang-gu, and Sahagu.
[c] Outer suburbs include Geumjeong-gu, Seo-gu, Suyeong-gu, Dong-gu, Yeonjegu, Nam-gu, Yeongdo-gu, Gijang-gun, and Kangseo-gu.
[d] Based on KSIS resource.
[e] Divided by total survey respondents.
[f] Divided by total residents registered in each 'gu' and 'gun' administrative office.

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