

Determinants of Cross-Income Residential Location Decisions in the United States: The Case of Franklin County

Hee-Jung Jun*

교차소득 주거입지결정 요인에 관한 연구: 미국 오하이오주 프랭클린 카운티의 사례

전희정*

Abstract : This study examines why families move to neighborhoods at different levels of income. By analyzing a survey dataset of homeowners who sold and bought a house in 1999 in Franklin County, Ohio, in USA on their mobility decisions, this study examined the factors associated with cross-income residential location decisions. I categorized both survey respondents and neighborhoods into low-, middle-, and high-income levels and ran multinomial logit analyses for each of the low-, middle-, and high-income family groups to examine why families moved to neighborhoods at different levels of income. The analysis suggests that middle-income families moved to high-income neighborhoods because of school reputation and moved to low-income neighborhoods because of investment purposes.

Key Words : mobility, location decision, neighborhood, middle-income family

요약 : 이 연구는 가구소득수준과 이사간 지역의 소득이 일치하지 않는, 교차소득 주거입지결정 요인에 관하여 분석하였다. 연구대상지는 미국 중서부, 오하이오 주에 위치한 프랭클린 카운티로서 1999년 오하이오 주립대학에서 자가거주 가구들을 대상으로 실시한 주거입지선택 결정요인에 관한 설문자료를 바탕으로 분석하였다. 연구방법으로는 설문에 참여한 가구와 프랭클린 카운티 내의 근린지구의 소득수준을 저, 중, 고소득으로 나눈 후 각 가구계층별로 교차소득 주거입지결정 요인에 관하여 다항로지스틱 회귀분석을 실시하였다. 분석결과에 따르면 중산층 가구가 상위계층 지역으로 이주하는 이유는 학군과 관련이 있는 것으로 나타났으며 저소득계층 지역으로 이주하는 이유는 투자목적 때문인 것으로 나타났다.

주요어 : 이동성, 주거입지, 근린지구, 중산층

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* 성균관대학교 행정학과/국정전문대학원 조교수(Assistant Professor, Department of Public Administration and Graduate School of Governance, Sungkyunkwan University, hjun@skku.edu)

1. Introduction

Middle-income neighborhoods are important not just for middle-income families but also as a link in the housing ladder allowing lower-income families to move up and high-income families to locate if events (e.g., divorce and job loss) force a move downward. Middle-income families also play a critical role as a mediating force between the rich and poor (Dreier, Mollenkopf and Swanstrom, 2001) and provide role models for urban joblessness (Wilson, 1987, Watson, 2009).

Despite the importance of middle-income families and neighborhoods, the growing income inequality among both families and neighborhoods in recent decades has limited low-income families' access to middle-income neighborhoods and the associated amenities like decent schools and jobs and safe neighborhoods (Booza, Cutsinger and Galster, 2006, Jung, 2015, Ha and Lee, 2013). In this regard, Booza *et al.* (2006) make an interesting observation that "middle-income neighborhoods" are vanishing faster than "middle-income families" in the United States. One conjecture regarding Booza *et al.*'s (2006) observation is that middle-income families do not live in economically homogeneous neighborhoods but rather have moved to high- or low-income neighborhoods, not changing the neighborhood income-level significantly.

According to Tiebout's hypothesis (1956), households sort themselves into homogeneous communities with similar tastes for public services. Even at the neighborhood level, neighborhood attributes and public services provided by local governments vary across neighborhoods (Grubb, 1982, Watson, 2009). As income is correlated with willingness to

pay for public services and desirable attributes in a jurisdiction, households sort themselves into neighborhoods by income. We then reasonably expect that middle-income people are more likely to live in middle-income neighborhoods than in lower-, high-, or mixed-income neighborhoods. Yet, this common-sense expectation about residential sorting is at odds with the above-mentioned observation by Booza *et al.* (2006)—middle-income neighborhoods are vanishing faster than middle-income families.

Despite numerous studies about residential mobility and neighborhood change, little is known about why middle-income neighborhoods decline faster than middle-income families. In addition, mixed-income housing has been an important feature in U.S. housing policy (Schwartz and Tajbakhsh, 1997). Therefore, examining why families at different levels of income do not live in neighborhoods that match their income levels will have a significant implication in understanding economic mixing in U.S. urban neighborhoods.

Given that U.S. Census data do not include sufficient information about newcomers' income levels in a neighborhood, it is not easy to examine such questions as why middle-income neighborhoods are disappearing faster than middle-income families. Instead, this study examines why families move to neighborhoods that do not match their income levels—cross-income residential location decisions—by analyzing survey data on homeowners' location decisions in Franklin County, the main county of the Columbus Metropolitan Area, in Ohio. By examining why families make cross-income residential location decisions, this study will provide insights on why middle-income neighborhoods are disappearing faster than middle-income families do.

2. Literature Review

The change in household location is a critical source for the changes in the neighborhoods, cities, and metropolitan areas as a whole (Clark, 2012). Therefore, understanding the determinants of residential mobility is important for preparing and contriving policy solutions when a community is expected to undergo critical changes. Although there are numerous theories and empirical studies on why families move, the most commonly used approach to explain residential mobility is the life-cycle approach. According to the life-cycle approach, families undergo changes such as a person leaving the parental home, starting his or her own family, having children, and eventually becoming empty nesters, which are linked with differential housing needs (e.g., housing size and tenure) and thus influences residential location decisions (Rossi, 1955, Morrow-Jones and Wenning, 2005, van Ham, 2012). Although it explains the general trend in residential mobility, the life-cycle approach is linear and deterministic (Clark and Dieleman, 1996). In particular, the life-cycle approach emphasizes upward movements, moving to larger houses from smaller houses and from renting to owning homes while the reality is that life paths can diverge (van Ham, 2012). As an alternative to the life-cycle approach that emphasizes age cohorts and the size of families, the life-course approach focuses on life events such as changing marital status and entering the workforce and thus is far from linear (Clark, 2012).

While the life-cycle and life-course approaches focus on individual households' demographic and socio-economic characteristics in their life stages, public choice theory incorporates desires for public

services and willingness to pay for public goods. In particular, Tiebout (1956), a well-known scholar in public choice theory, hypothesizes that "households vote with their feet." That means households choose their residences where their desire for public services matches their willingness to pay for public goods in a jurisdiction. In the process, households sort themselves into homogeneous communities based on households' desires for public services. Because income and tastes for a certain balance of taxes and services are highly correlated, households are often sorted by income (Watson, 2009).

Although the aim of Tiebout's hypothesis was to explain residential location decisions at the municipal level, it might also explain residential location decisions at the neighborhood level. Even within a political jurisdiction, neighborhood attributes such as age of housing stock, cultural amenities and the quality of public services (e.g., road maintenance and police protection) can vary by neighborhood (Grubb, 1982). As income and tastes for neighborhood attributes are often correlated as well, neighborhood-level sorting by income also can occur. As income is correlated with willingness to pay for public services and preferred amenities in a neighborhood, we can reasonably expect that middle-income people are more likely to live in middle-income neighborhoods than in low-income or high-income neighborhoods. Indeed, studies find that there was an increase in neighborhood-level sorting by income over recent decades (Watson, 2009, Massey and Fischer, 2003, Jargowsky, 1996). However, this trend counteracts Booza *et al.*'s (2006) observation that middle-income neighborhoods are vanishing faster than middle-income families, which means middle-income families do not live in middle-income neighborhoods.

Then, why do households make cross-income

residential location decisions? In Tiebout's (1956) world, households choose a community based on their desired public expenditure and tax levels. However, households may have other preferences such as the quality and size of housing and proximity to jobs (Grubb, 1982). Epple and Platt's (1998) finding also suggests that it may be because both income and tastes for neighborhood attributes are imperfectly correlated and so incomplete neighborhood-level sorting occurs. In other words, household tastes vary by households' specific characteristics (e.g., age, education, race, family type) in a whole range of neighborhood attributes rather than being perfectly correlated with income (Bayer and McMillan, 2012).

Amenity features such as good school quality, low crime rates, and accessibility to shopping areas have been additionally emphasized in residential location decisions (Jun and Morrow-Jones, 2011, Kim, 2010, Park, 2014). For example, Kim and Morrow-Jones (2005) find that school quality and seeking good investment or resale value played a critical role in residential location decisions of recent home buyers. In particular, given that school quality is often correlated with neighborhood income, those people who value high quality schools and move to neighborhoods for school reputation may move to higher-income neighborhoods.

The emphasis of age and family composition in both life-cycle and life-course approaches also has implications regarding the mismatch between household income and neighborhood income. Cross-income residential location decisions may occur when those households who have retired and paid off their mortgage loans live in higher-income neighborhoods with relatively lower incomes. Also, as families with school-aged children look for better neighborhood environments, they may move to high-income neigh-

borhoods where school quality and neighborhood environments are often nicer.

Growing traffic congestion on highways during rush hour may also have led to cross-income residential location decisions. As Muth's (1973) model predicts, a large number of people moved to the suburbs with increasing income and declining marginal transportation costs. However, traffic congestion limits people from moving further out and so becomes a factor objecting Muth's prediction that higher-income families live in outlying areas with a reduction in marginal transport cost and an increase in household income and lower-income families live in the city centers. Jun (2011) also found that the desire to be closer to work was positively related to both living in and moving to a denser neighborhood. Given that income-levels in neighborhoods near the central cities and in denser neighborhoods are often lower, higher-income households who want to be closer to their work places are likely to live in lower-income neighborhoods.

3. Data and Methods

1) Study Area and Data

The study area in this study is Franklin County, the main county of the Columbus Metropolitan Area, in Ohio. Franklin County had a population of 1,163,414 in 2010 and its population growth rates were 12% between 1990 and 2000 and 9% between 2000 and 2010 (US Census Bureau, 2014). As Columbus is the state capital of Ohio, government functions are concentrated in the city and the city is also characterized by having educational institu-

tions and real estate, finance and insurance industries (Morrow-Jones, Irwin and Roe, 2004). In the Columbus Metropolitan Area, population growth has been focused in outer suburbs since the 1990s, followed by the development of three large shopping centers outside of the outer-belt highway, Interstate 270, and the decline of some inner-city and inner-suburban shopping malls in the past decades (Jun and Morrow-Jones, 2011). Along with this trend, school quality in Columbus has been lower than that in both inner (e.g., Baxley and Upper Arlington) and outer (e.g., Dublin and Hilliard) suburbs in Franklin County (Kim and Morrow-Jones, 2011). Despite the challenges, Columbus' population has been growing (11% increase between 2000 and 2010) thanks to the city's active annexation policies. Also, several inner-city neighborhoods (e.g., German Village and Victorian Village) near the central business district have been economically doing well.

This study used the Homeowner survey dataset for Franklin County. The survey was conducted by the Ohio State University in 1999 for repeated homebuyers and asked the respondents about their mobility decisions.¹⁾ More specifically, the survey included questions on how important respondents felt that housing factors (e.g., age and size) and neighborhood factors (e.g., public services and school quality) were when selling and buying their homes. The survey focuses only on homeowners, but since a large portion of middle-income households are homeowners, it works well for this study's purpose.

A number of studies used this dataset but this study is distinguished from previous studies by focusing on neighborhood-level factors. For example, Kim and Morrow-Jones (Kim and Morrow-Jones, 2011) examined the factors associated with moving out of older, independent suburbs. Morrow-Jones (2007)

used this dataset to examine the differences between homeowners who bought a house in the central city and suburbs. Morrow-Jones and Wenning (2005) examined the factors associated with homeowners' decisions to move up or down in price using this dataset. Lee (2008) used deed transfer records, which were the basis of sampling survey respondents, and analyzed local spatial associations in housing transaction at the city level. Given that previous studies that used this dataset focused on residential mobility at the city or individual level, findings in this study that focus on factors at the neighborhood level are expected to have important implications for communities' efforts to remain stable or become more attractive.

One might be concerned with practicability of findings in this study as this study used a dataset obtained in the year of 1999. As this study needed to know to which neighborhood (a census tract in this study) a family moved, I needed to have a survey dataset and census data that were obtained at a similar time. There was no such survey dataset obtained around the year of 2010 and thus I had to utilize the 1999 survey dataset and 2000 census data. Also, as the mortgage crisis that occurred in the mid-2000 in the U.S. disturbed the housing market in a variety of ways, using 2010 census may not be more appropriate to examine the determinants of cross-income residential location decisions.

2) Methods

I analyzed the factors associated with making cross-income residential location decisions by running multinomial logit regression analyses for low-, middle-, and high-income families that moved to neighborhoods at different levels of income.²⁾ As an extension of logistic regression analysis, multinomial

logit regression analysis is used when the dependent variable has more than two discrete outcomes. Given that this study examines factors associated with moving to neighborhoods at different levels of income for families in each income group at low-, middle-, and high-income levels, multinomial regression analysis fits well for this study.

As in many other studies (e.g., Jun, 2013, Ellen and O'Regan, 2008, Rosenthal, 2008), census tracts were used as a proxy for neighborhoods.³⁾ Similarly to what Booza *et al.*' study (2006) undertook, middle-income families were defined as families whose income is between 80% (\$43,124) and 120% (\$64,686) of the median family income (\$53,905) in Franklin County in 2000.⁴⁾ As the survey reported the total family income with \$20,000 interval rather than an exact number, I selected the intervals (\$40,001 to \$60,000 and \$60,001 to \$80,000) that include 80% (\$43,124) and 120% (\$64,686) of the county median family income (\$53,905) to define the middle-income family group. Then, the respondents whose incomes were less than \$40,001 were assigned to the low-income family group and whose incomes were more than \$80,001 were assigned to the high-income family group.

The middle-income neighborhoods were determined using the 2000 census data at the tract level. As for the middle-income families, if the median

income of a neighborhood was between \$40,000 and \$80,000, the neighborhood was assigned to the middle-income neighborhood group. If the median family income of a neighborhood was less than \$40,000 or over \$80,000, the neighborhood was assigned to the low-income neighborhood group or high-income neighborhood group, respectively.

Table 1 shows the distribution of survey respondents who moved to neighborhoods at different levels of income.⁵⁾ Even though many families moved to the neighborhoods that match their income levels, there were also considerable cross-income movements. For the middle-income family group, although most middle-income families moved to middle-income neighborhoods (n=273), a relatively large number of middle-income families also moved to high-income neighborhoods (n=111). For the high-income family group, although more high-income families moved to high-income neighborhoods (n=272), a relatively large number of high-income families also moved to middle-income neighborhoods (n=196). For the low-income family group, larger numbers of families moved to middle- (n=90) and high (n=19)-income neighborhoods than low-income neighborhoods (n=11).

Figure 1 shows the distributions of neighborhood income in the three categories—low-, middle-, and high-income—in 2000. In general, neighborhood

Table 1. Distribution of Survey Respondents Who Moved to Neighborhoods at Different Levels of Income

	Moved to low-income neighborhoods	Moved to middle-income neighborhoods	Moved to high-income neighborhoods	# of Families
Middle-income families	16	273	111	400
High-income families	2	196	272	470
Low-income families	11	90	19	120

income gradually increases when going outward from the Central Business District (CBD) but there are some high-income neighborhoods in the city center, which were gentrified neighborhoods (e.g., German Village and Victorian Village - the high-income neighborhoods near the CBD), and some affluent, inner suburbs (e.g., Bexley and Upper Arlington).

Variables to analyze why families make cross-income residential location decisions were selected from theories and empirical studies on residential mobility. Based on the life-cycle and life-course approaches that focus on household characteristics, I included the presence of school-aged children, years of education, and age variables. Based on the public choice theory that suggests residential location deci-

sions are made based on the levels of public services and taxes, I included a variable of how important the respondents felt “local services” are. Although the survey included a question about the importance of tax levels but the question was not considered in the analysis because the importance of the tax levels variable was highly correlated with the importance of local services variable.⁶⁾

Whereas scholars find amenity features are important in residential location decisions, households may have different tastes about neighborhood characteristics and thus move to neighborhoods that do not match their income levels. Thus, I included how important the respondent felt about “school reputation,” “want[ing] better access to public transit,” “want[ing]

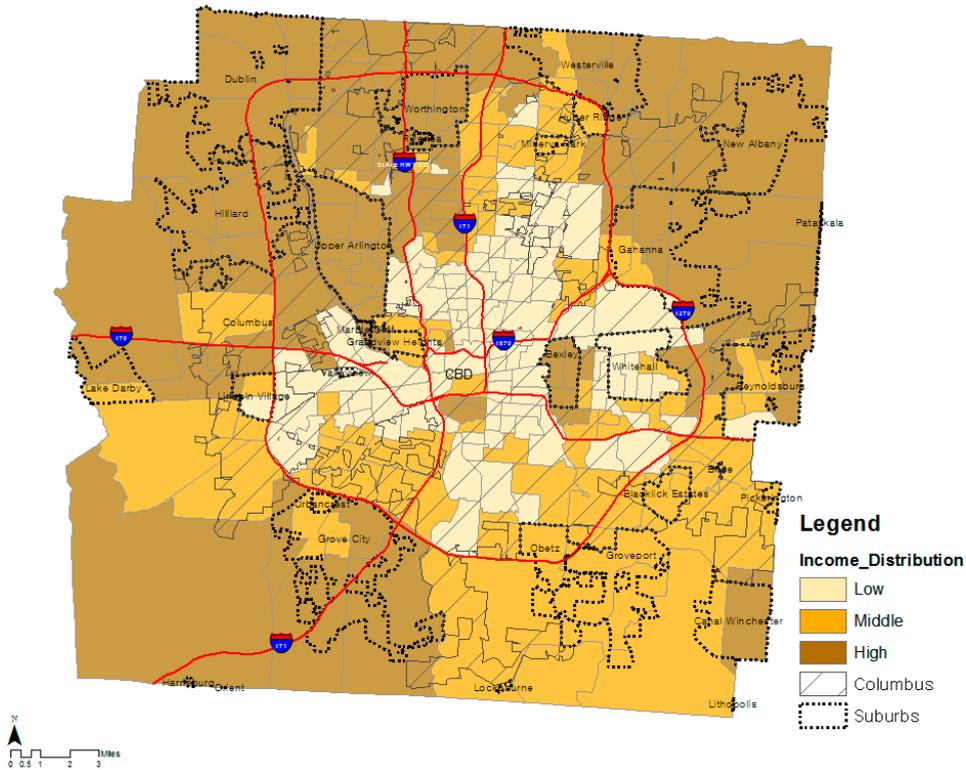


Figure 1. Distribution of Neighborhood Income in 2000

better shopping areas,” the “safety of the neighborhood,” “want[ing] to be closer to work,” and whether the property is a “good investment”.⁷⁾

4. Results

Appendices 1, 2, and 3 show t-test analyses of families in each income level that moved to neighborhood at different levels of income.⁸⁾ As can be seen the appendices, families in each income group have different reasons of making cross-income residential location decisions. For example, middle-income families that moved to high-income neighborhoods are distinguished from those that moved to middle-income neighborhoods in the importance of school reputation.

To explore further why families make cross-income residential location decisions, I ran multinomial logit analyses. The dependent variable is the neighborhood income level that individual households chose. Although the primary focus of this study is on middle-income families and neighborhoods, I ran three models to see the differences with other income groups: a model of middle-income families that moved to low-, middle-, and high-income neighborhoods; a model of high-income families that moved to low-, middle- and high-income neighborhoods; and a model of low-income families that moved to low-, middle- and high-income neighborhoods.

Table 2 shows model estimates for middle-income families that moved to neighborhoods at different levels of income. The reference group is middle-income families that moved to middle-income neighborhoods.

According to the multinomial logit analysis, the

variable “good investment” was statistically significantly related to the movement of middle-income families to low-income neighborhoods. According to the model, middle-income families that value a good investment are more likely to move to low-income neighborhoods. At first glance, it is unlikely that middle-income families move to low-income neighborhoods for a good investment. However, it may be because of investment potential in low-income neighborhoods. In particular, Columbus has been growing and many older neighborhoods in the city, such as German Village and Victorian Village, have been redeveloped (unlike many U.S. central cities), thanks to gentrification and the annexation of surrounding land (Rusk, 1999). Figure 2 supports this conjecture by displaying the low-income neighborhoods that middle-income families moved to are mostly in Columbus and those tracts include Clintonville (the low-income neighborhood below Worthington)—an older neighborhoods containing housing units of a variety of architectural styles—, and the area near the Ohio State University (the low-income neighborhood above the CBD) where there are strong investment potentials.

Regarding the middle-income families that moved to high-income neighborhoods, the model estimates show that education and age are positively related to the movement of middle-income families to high-income neighborhoods. As expected, it may be because education enhances mobility and thus middle-income people can live in higher-income neighborhoods with expected income growth and stability of their jobs. The positive sign of the age variable may be because middle-income families have accumulated their assets and have paid off their mortgage loans as they grew older, and so can afford to buy housing in higher-income neighborhoods although their income

Table 2. Model of Middle-Income Families

Variable	Moved to low-income neighborhoods		Moved to high-income neighborhoods	
	Coefficient	SE	Coefficient	SE
Presence of school-aged children	0.07	0.66	0.39	0.28
Year of education	-0.29	0.19	0.30***	0.07
Age	-0.02	0.03	0.022*	0.01
Local services	0.43	0.25	0.07	0.10
School reputation	-0.23	0.16	0.18*	0.10
Wanted better access to public transit	-0.26	0.32	-0.13	0.13
Wanted better access to shopping areas	-0.12	0.16	-0.08	0.08
Safety of the neighborhood	-0.43	0.33	-0.07	0.14
Wanted to be closer to work	0.12	0.17	0.23***	0.80
Good investment	0.64*	0.34	0.16	0.11
Intercept	0.31	3.85	-8.51***	1.61

Number of observations: 400

Initial -2 log likelihood: 596.161

Final -2 log likelihood: 535.758

Prob > chi²: 0.000

Degree of freedom: 20

Pseudo R²: cox&snell = 0.140 Nagelkerke=0.181 McFadden=0.101

***p < .01, **p < .05, *p < .1

levels are relatively lower.

The model estimates also show that the variable “school reputation” is statistically significantly related to the movement of middle-income families to high-income neighborhoods. As expected, school reputation was an important factor for middle-income families in moving up to high-income neighborhoods. As school quality is often correlated with neighborhood income, middle-income families who value school quality high may move to high-income neighborhoods. Figure 3 shows the high-income neighborhoods that middle-income families moved to. Among these neighborhoods, the neighborhoods that a larger number of middle-income families moved to (shown as dots in Figure 3) are located in Baxley, Upper Arlington, and Dublin where school quality is greater. In this case, those families that

moved to high-income neighborhoods for school quality may experience difficulties such as a greater housing cost burden.

The model estimates also suggest that the more middle-income families want to be closer to their jobs, the more likely middle-income families move to high-income neighborhoods. This was unexpected as the inner-city neighborhoods in central cities are mostly poor in the U.S. This may be because of the newly developed business districts (e.g., Polaris and Easton) in outlying areas near affluent neighborhoods and affluent and gentrified neighborhoods near the inner city in Franklin County such as German Village. This may be also because middle-income families can save on commuting costs and thus are able to live in higher-income neighborhoods.

Figure 3 High-Income Neighborhoods that

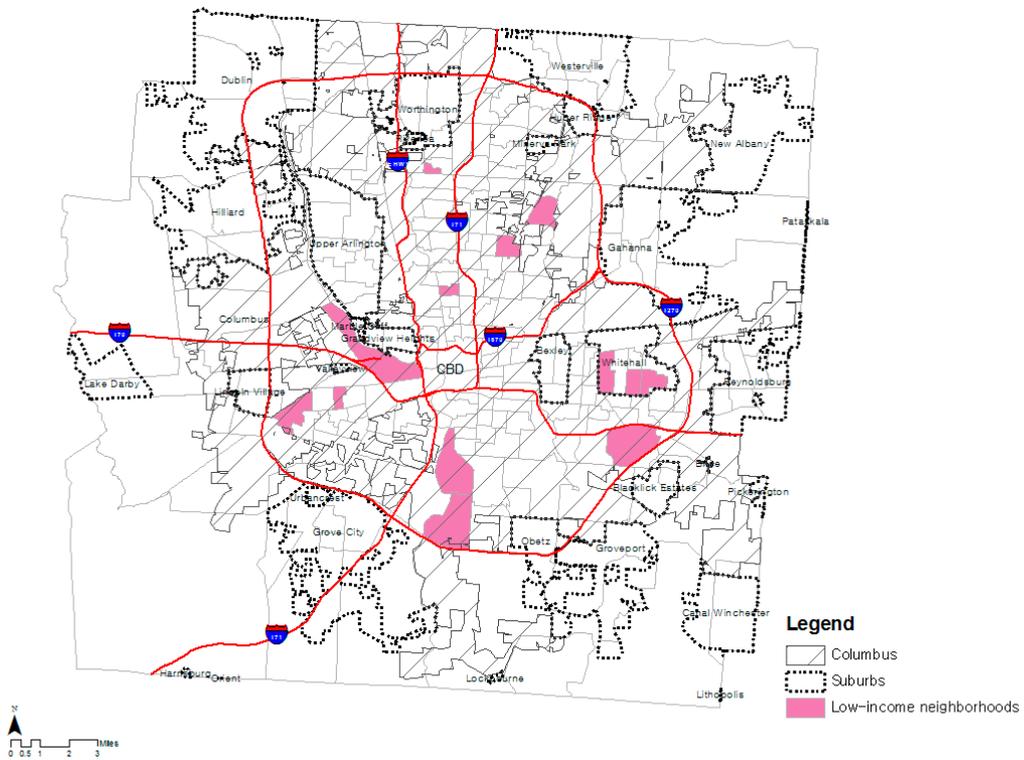


Figure 2. Low-Income Neighborhoods that Middle-Income Families Moved to

Middle-Income Families Moved to Table 3 shows the model of the high-income families that moved to different levels of income. Since only two of the high-income families moved to low-income neighborhoods, those choices were excluded from the model. Thus, I only analyzed the movements to middle- and high-income neighborhoods by running a binomial logit analysis and the reference group was the high-income families that moved to high-income neighborhoods.

The model estimates show that the movement of high-income families to middle-income neighborhoods is associated with the variables year of education, “school reputation,” and “safety of the neighborhoods.” The probability that high-income families move to middle-income neighborhood declined with

the years of education. As in the model of middle-income families, the model estimates suggest that education is a major factor for living in high-income neighborhoods. Also, high-income families are less likely to move to middle-income neighborhoods if school reputation was important in buying a home. The result coincides with the increasing probability that middle-income families move to high-income neighborhoods if the respondents felt school quality was important in buying a home. That is, school quality was a great motivation to live in high-income neighborhoods for high-income families. The probability that high-income families move to middle-income neighborhood also declined with the “safety of the neighborhood” variable. That is, high-income

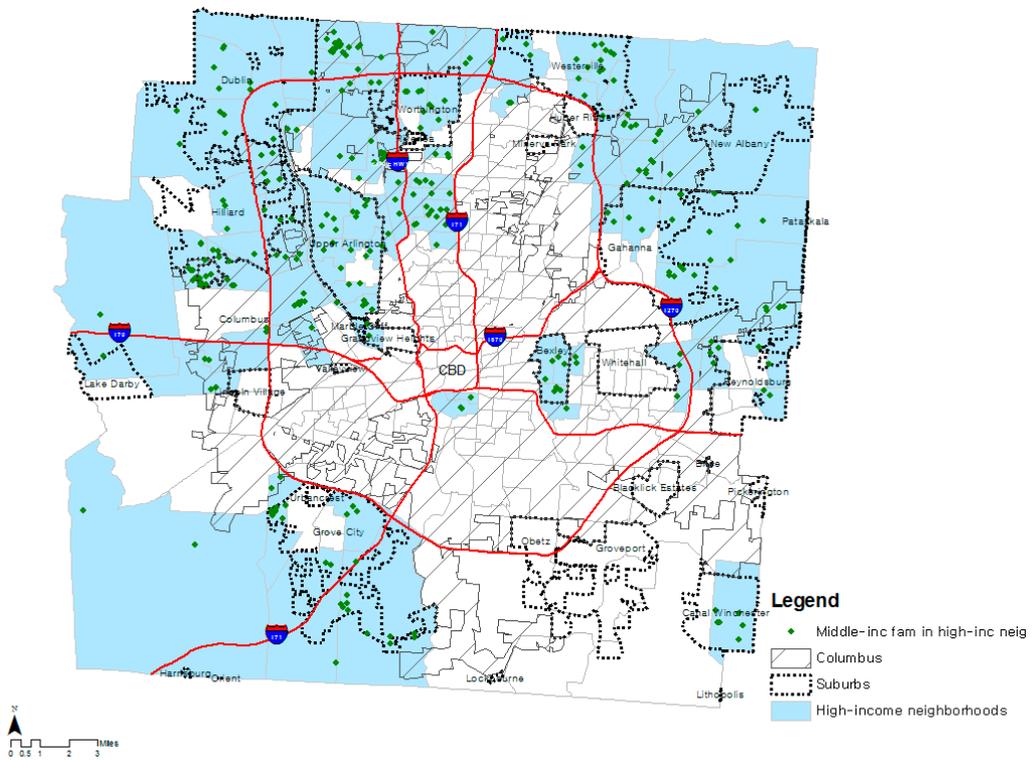


Figure 3. High-Income Neighborhoods that Middle-Income Families Moved to

Table 3. Model of High-Income Families

Variable	Moved to middle-income neighborhoods	
	Coefficient	SE
Presence of school-aged children	-0.08	0.20
Year of education	-0.11*	0.06
Age	-0.01	0.01
School reputation	-0.13*	0.07
Local services	0.04	0.08
Wanted better access to public transit	-0.13	0.10
Wanted better access to shopping areas	0.06	0.07
Safety of the neighborhood	-0.23**	0.11
Wanted to be closer to work	0.01	0.07
Good investment	-0.04	0.10
Intercept	3.64***	1.30

Number of observations: 468
 Initial -2 log likelihood: 636.389
 Final -2 log likelihood: 618.556
 Prob > chi²: 0.058
 Degree of freedom: 10
 Pseudo R²: cox&snell = 0.037 Nagelkerke= 0.050

***p < .01, **p < .05, *p < .1

families that felt safety was important in buying a home were less likely to move down to middle-income neighborhoods. Indeed, Kim (2009) found that crime rate was correlated with economic deprivation in Columbus, Ohio.

Finally, I ran a multinomial analysis for the low-income families that moved to neighborhoods at different levels of income. However, none of the variables were statistically significant and thus I did not report the result here.

5. Summary and Conclusion

In the beginning of this study, I asked why families move to neighborhoods at different levels of income. By analyzing the survey dataset for recent homebuyers in Franklin County, Ohio, this study examined the factors associated with cross-income residential decisions. Although most studies on residential mobility are based on people's stated preferences in housing and neighborhoods, this study examined the determinants of cross-income residential location decisions by using the data of households' revealed preferences. Thus, this study provides a stronger basis on cross-income residential location decisions in housing and neighborhoods. This study also has limitations such as using data obtained only from homeowners and for a county. Future studies will need to include renters and expand the study area for generalizability of the findings in this study.

This study found that school reputation was a factor for middle-income families' cross-income movements. The model estimates showed that the probability of moving to high-income neighborhoods increases with the importance of school reputation

for middle-income families. Along with this fact, the importance of school reputation was negatively related to high-income families' movements to middle-income neighborhoods. That is, high-income families who consider school reputation to be important will not move to middle-income neighborhoods. This finding suggests that, particularly for low-income neighborhoods, improving school quality is critical in attracting middle- and high-income families. Specialized programs such as providing extra resources to low-income neighborhoods so that schools in low-income neighborhoods can hire high-quality teachers may be an alternative to enhance school quality in low-income neighborhoods. In addition, given that high-income families that greatly value neighborhood safety are less likely to move to middle-income neighborhoods, enhancing actual safety or correcting misperceptions about safety in middle- and low-income neighborhoods will allow high-income families to move into lower-income neighborhoods, thereby promoting income mixing.

This study also found that the importance of a good investment is positively related to middle-income families' movement to low-income neighborhoods. The importance of distance to family members' jobs was positively related to middle-income families' cross-income movement to high-income neighborhoods. These findings suggest that low-income neighborhoods that have investment potential, for example, through being closely located to urban centers and containing historic homes, will attract middle-income families. Given that middle-income families who felt proximity to their jobs is important are more likely to move to high-income neighborhoods, we can see the close relationship between transportation costs and housing affordability. This finding also suggests that location affordability,

considering both transportation costs and housing affordability, is a critical part in residential location decisions.

While education was positively related to moving to high-income neighborhoods in the model of middle-income families, it was negatively related to moving to middle-income neighborhoods in the model of high-income families. This finding suggests that educated people—both middle- and high-income people—are sorted into high-income neighborhoods. It may be because middle-income families with a higher educational level can expect that they will earn more over time. As studies find that educated people are more likely to be involved in community activities (Haurin, Parcel and Haurin, 2002, Rosenthal, 2008), high-income neighborhoods are likely to supply a high level of social capital. Age was another factor associated with moving to high-income neighborhoods in the model of middle-income families. As middle-income class people grow older, they accumulate their assets and so could afford to buy housing in high-income neighborhoods even though their income is relatively lower than other families' incomes. This finding suggests that there should be sufficient facilities such as sidewalks and public transportation for older people who live within limited budgets so that older people can save on transportation costs.

At the beginning of this study, I addressed the issue that middle-income families do not live in middle-income neighborhoods. Due to the data limitations, I was unable to examine such questions as why middle-income neighborhoods are disappearing faster than middle-income neighborhoods. Rather this study provides some insights to the question, which seems to be hard to answer. This study found that middle-income families move to low-income neighborhoods for investment purposes and move to high-income

neighborhoods for advantages such as better school quality. Low-income homeowners' opportunity to move up can be significantly limited by a lack of middle-income neighborhoods (Booza *et al.*, 2006). The disappearance of middle-income families and neighborhoods and rising economic inequality can threaten healthy democracy (Dreier *et al.*, 2001) and erode the nation's socioeconomic and political stability (Booza *et al.*, 2006). However, not many studies have focused on middle-income families and neighborhoods over the poor and affluent. Thus, continued studies about why middle-income neighborhoods are disappearing should be undertaken to maintain middle-income families and neighborhoods.

Notes

- 1) In 1998, the Ohio State University's Center for Urban and Regional Analysis acquired deed transfer records for homes sold in 1998 in the seven counties in the central Ohio area. Researchers at the center matched the buyer and seller names in the dataset, thereby creating a population of households who had sold one house and purchased another within that year. They then sent a mail survey to a sample of these households. A total of 4,300 surveys were mailed out to randomly selected homeowners and 2,080 surveys (48%) were returned. To reduce outliers on mobility such as moving to rural, low density neighborhoods, I only used the survey responses from homeowners that moved within Franklin County, the central county of the Columbus Metropolitan Area. This left 1,067 surveys to analyze.
- 2) All statistical analyses in this study (i.e., t-test and multinomial regression analyses) were undertaken by using SPSS Statistics 23.0.
- 3) Census tract is the most commonly used unit of neighborhood in the U.S. for empirical analyses. A census tract includes 4,000 people on average (Geolytics, 2003).
- 4) Booza *et al.*(2006) defined low, middle, and high-income families as families whose income is less than 80%, between 80% and 120%, and over 120% of the area median family income, respectively. This method allows controlling for differences in living cost varying by metropolitan area and effects of inflation over time.

Thus, researchers can readily compare families at different levels of income with those in other metropolitan areas and decades.

- 5) The total number of respondents that answered the total family income question was 990 out of a total sample of 1,067. Given that this survey dataset is from homeowners that are likely to be at higher income than renters, the respondents of the survey include a relatively large share of high-income families compared to middle- and low-income families.
- 6) The correlation coefficient between the two variables, how important local services and tax levels were in buying the current home, was 0.60 ($p < 0.001$).
- 7) The variables of moving reasons are on scale of 1 to 7. Education and age are coded as number of years. If the households have school-aged children who live with them more than 50% of their time, a dummy variable (=1) was assigned.
- 8) As shown in Appendix 2, high-income families that moved to low-income neighborhoods were excluded from the analysis because of a very small number ($n=2$) of high-income families that moved to low-income neighborhoods.

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- Correspondence: Hee-Jung Jun, Department of Public Administration & Graduate School of Governance, Sungkyunkwan University, 25-2, Sungkyunkwan-ro, Jongno-gu, Seoul, 03063, Republic of Korea, Tel: 82-2-760-0369, E-mail: hjun@skku.edu
- 교신저자: 전희정, 03063 서울특별시 종로구 성균관로 25-2, 성균관대학교, 행정학과/국정관리대학원, 전화: 02-760-0369, 이메일: hjun@skku.edu
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Appendix 1. T-Test Analyses of Middle-Income Families

	Moved to low-income neighborhoods	Move to middle-income neighborhoods	Move to high-income neighborhoods	T-test (between moved to low- & middle- income)	T-test (moved to middle- & high-income)
Variable	Mean (SD)	Mean (SD)	Mean (SD)	T-ratio	T-ratio
Presence of school-aged children	0.31 (-)	0.37 (-)	0.41 (-)	-0.44	-0.86
Year of education	13.44 (1.59)	14.08 (1.62)	14.94 (1.75)	-1.54	-4.63***
Age	43.13 (8.74)	42.78 (10.43)	44.46 (13.04)	0.13	-1.21
Local services	5.44 (1.15)	4.87 (1.48)	5.12 (1.48)	1.50	-1.49
School reputation	4.96 (4.96)	5.48 (5.48)	5.90 (1.34)	-0.94	-2.49**
Wanted better access to public transit	1.89 (0.96)	2.05 (1.10)	1.98 (0.95)	-0.59	0.56
Wanted to better access to shopping areas	3.27 (2.37)	3.51 (1.65)	3.48 (1.71)	-0.44	1.20
Safety of the neighborhood	6.06 (0.85)	6.06 (1.01)	6.13 (1.05)	0.00	-0.56
Wanted to be closer to work	3.24 (1.87)	3.03 (1.51)	3.62 (1.63)	0.53	-3.40***
Good investment	6.38 (0.89)	5.77 (1.33)	6.05 (1.15)	1.79*	-2.07**

***p < .01, **p < .05, *p < .1

Appendix 2. T-Test Analyses of High-Income Families

	Move to middle-income neighborhoods	Moved to high-income neighborhoods	T-test (between moved to middle- & high-income)
Variable	Mean (SD)	Mean (SD)	T-ratio
Presence of school-aged children	0.43 (-)	0.46 (-)	-0.84
Year of education	14.85 (1.97)	15.11 (1.76)	-1.50
Age	42.64 (10.52)	42.36 (9.49)	0.30
Local services	4.97 (1.51)	5.11 (1.38)	-1.02

School reputation	5.59 (1.57)	5.98 (1.42)	-2.82***
Wanted better access to public transit	1.92 (1.04)	1.84 (0.91)	0.86
Wanted better access to shopping areas	3.22 (3.38)	1.63 (1.49)	-1.05
Safety of the neighborhood	5.85 (1.11)	6.12 (0.98)	-2.68***
Wanted to be closer to work	3.01 (1.51)	3.06 (1.50)	-0.29
Good investment	5.92 (1.22)	6.05 (0.96)	-1.28

***p < .01, **p < .05, *p < .1

Appendix 3. T-Test Analyses of Low-Income Families

	Moved to low-income neighborhoods	Move to middle-income neighborhoods	Move to high-income neighborhoods	T-test (moved to low-&middle-income)	T-test (moved to middle-& high-income)
Variable	Mean (SD)	Mean (SD)	Mean (SD)	T-ratio	T-ratio
Presence of school-aged children	0.25 (0.40)	0.15 (0.36)	0.37 (0.50)	0.85	-1.80*
Year of education	12.82 (3.71)	13.40 (1.78)	13.76 (1.60)	-0.51	-0.82
Age	54.70 (12.60)	56.88 (14.85)	54.20 (15.07)	-0.47	0.71
Local services	4.82 (1.54)	5.40 (1.69)	5.64 (1.53)	-1.08	-0.58
School reputation	4.92 (1.25)	5.49 (1.31)	5.65 (1.83)	-1.39	0.45
Wanted better access to public transit	2.82 (1.83)	2.52 (1.57)	2.48 (2.00)	0.59	0.09
Wanted better access to shopping areas	3.30 (1.47)	3.85 (1.87)	3.69 (1.92)	-1.08	-0.58
Safety of the neighborhood	5.55 (1.29)	6.14 (1.10)	6.37 (0.59)	-1.64	-0.91
Wanted to be closer to work	2.51 (1.24)	3.23 (1.29)	3.18 (1.44)	-1.76*	0.16
Good investment	4.81 (1.60)	5.63 (1.66)	6.11 (1.05)	-1.56	-1.19

***p < .01, **p < .05, *p < .1