Generation Uphill: Housing Cost, Migration, and Commuting Time of the Young in South Korea

Chulhee Lee and Elliot Kang

This study investigates how an increase in housing cost during a major real estate boom affected migration decisions of workers in South Korean cities. We also examine how geographic relocation driven by increased housing price changed the commuting time and distance of migrants. We used 10% samples of micro censuses and found that increases in housing costs in a district are positively associated with the probability of migration out of the district. The effect of increased housing price is significantly larger for the young than for those aged 40 years and above. We also found that migrations driven by increased housing expenses increased commuting time and distance, particularly for young movers. Our results suggest that "forced migrations" driven by housing booms can intensify mismatch between workers (places with affordable housing) and jobs (workplace).

Keywords: Migration; Commuting time; Housing cost; Locational mismatch

JEL Classification: R23; R21; R31

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I. Introduction

With superior quality education and ease of access to it, the contemporary young may be the best-educated generation ever in human history. However, their current economic circumstances and future prospects are generally gloomier than what their less-educated parents enjoyed several decades ago. The "generation lost" around the world is suffering from high unemployment rate, decline of marriage, and waning hope of upward social mobility. Moreover, placing many of the best-educated generation into joblessness is a terrible waste of human resources. Youth unemployment is detrimental to human capital development over the life course as well. A sharp decline in marriage and fertility poses a threat to the future of society and the family. Evidently, such a trend emerged as one of the most important scholarly and policy issues on what caused socioeconomic hardships of the generation with the highest level of human capital.

An explanation for the prevalence of "generation jobless" is the increase in a mismatch between the human capital possessed by the young and skills required by preferable jobs. That is, even if the young are highly educated, they may not have acquired the necessary skills that incumbent employees look for. In this respect, this type of mismatch results mainly from inefficiencies or inflexibilities in educational institutions.

Another account is that the younger generation's economic adversity results partially from the increasing mismatch between places with affordable housing and those with labor-market opportunities. At present, large metropolitan cities in numerous countries have emerged as desirable places to live, offering well-paying jobs, proximity to human networks, and a wide variety of amenities. However, as a greater mass begins to populate cities, housing prices in urban centers subsequently start to increase. Consequently, only those who can afford to pay high housing costs can take advantage of the increasing urban opportunities. For low-income city dwellers, including the majority of young people, living close to central areas became increasingly difficult because of prohibitively high rent.

The primary aim of this research is to investigate empirically if the quality of matching between jobs and workers (young workers in particular) worsens because of the increasing property prices

in South Korean cities. In particular, we examine how changes in housing price in the Seoul Metropolitan Area during a major real estate boom affected the migration decisions of young residents, and how geographic relocations driven by increasing rents changed migrants' commuting time and distance. Our study exclusively focuses on the Seoul Metropolitan Area, where over half of the entire South Korean population is concentrated. Remarkably, approximately 25 million people reside in the region smaller than the area of Connecticut. For our study period, we focus on the five years between the two census years of 2005 and 2010, when the housing prices in South Korea soared and the bubble started to accumulate (Kim and Cho, 2018). For robustness check, we look for the alternative period and other cities outside the Seoul Metropolitan Area.

This study is related to several strands of the previous literature. The first strand concerns the effects of changes in housing price on migration rate. Some studies have focused on the sending side of migration and suggested a positive relationship between the change in housing price and migration rate. Homeowners are less likely to move from a region that experienced a decline in housing price (Donovan and Schnure, 2011). The possible reason for this positive relationship is that homeowners owe more on a mortgage than they can manage by selling their property (Stein, 1995; Chan, 2001; Ferriera *et al.*, 2010). By contrast, other studies have focused on the receiving side of migration and suggested a negative relationship between the change in housing price and migration rate. Migration to booming regions decreases because the increase in housing price increases the entire cost of living in the region (Cameron and Muellbauer, 1998; Jeanty *et al.,* 2010; Cameron et al., 2013;). In a slightly different perspective, a recent study has explored the reason for housing price upsurge in urban centers. Edlend *et al.* (2017) indicated that the demand shock for high-skilled workers is the significant driver of the recent housing price surge near the city center.

The second strand of literature concerns the heterogeneous effects of changes in housing prices on fertility, education, and marital status across socioeconomic status. Thus, the increase in housing price affects favorably those whose status is high, while it affects adversely those with low status. Only a few studies have suggested that an increase in housing price increase homeowners' fertility through the channel of wealth shock (Lovenheim and Mumford, 2013; Dettling and Kearney,

2014). However, some studies have suggested that an increase in housing price lowers renters' fertility in South Korea (Seo, 2013; Lee, 2018). Moreover, the young has been suggested to reduce their years of schooling during housing booms and face high unemployment the subsequent housing bust (Laeven and Popov, 2016). Lastly, Farnham *et al.* (2011) and Kang (2017) found the asymmetric effects of change in house price on the probability of divorce or new marriage across the status of homeownership.

The contributions of our study are as follows. First, we utilize micro-level census data for millions of individual observations to investigate the effects of a housing price increase. The micro-level census provides a variety of detailed variables for a huge population that could be used to mitigate the omitted variable bias. Second, we are the first to investigate the commuting time of young workers, a useful indicator of the quality of matching between work and place of residence. As far as we know, no prior literature has focused on the relationship between housing price and commuting time for young workers. Our study is a new attempt to combine the first and second strands of literature, as we determine the heterogeneous effects of changes in housing price to the migration rate. Lastly, our study focuses on an empirical setting, in which housing price increased more in urban centers than in suburb regions. This context is suitable to investigating the geographical mismatch of workers because urban centers are where the majority of workplaces are located.

The remainder of this paper is organized as follows. Section II provides a background explaining the Korean housing market and socioeconomic circumstances that South Korea's young people face. Section III introduces our main data set. Section IV explains the framework for the migration analysis and its results. Section V follows with the framework and results for the commuting time analysis. Lastly, Section VI provides a brief conclusion.

II. Backgrounds

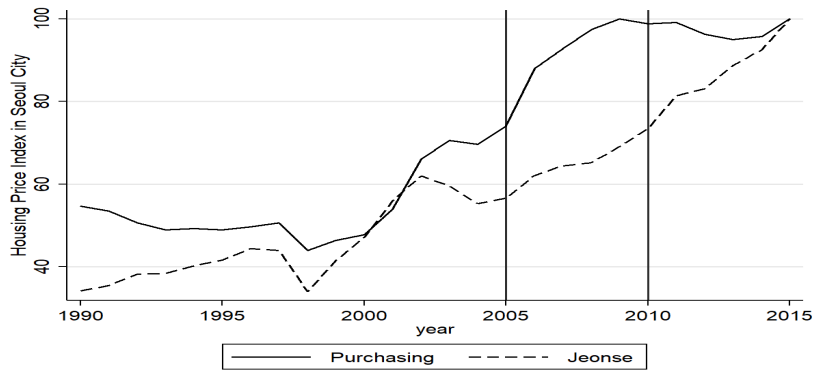
This study uses "Jeonse" price as primary index of housing cost. Jeonse is the most widely used form of tenancy contract in South Korea. In most other countries, tenants often pay rent on a monthly basis, with a certain amount of security deposit given to owners at the beginning of the contract. Although this type of monthly payment

is likewise used in South Korea, Jeonse is a considerably prevalent method of paying rents. In this method, renters deposit a lump-sum "Jeonse" fee to owners to acquire the right to live in the house for a contract period (*i.e.*, often two years). After two years, renters who wish to continue living in the house should renew their Jeonse contract by adjusting the Jeonse fee according to the new market price. Otherwise, owners should return the entire Jeonse deposit to the renters at the end of the contract period. Jeonse prices are often approximately half the purchasing price, although it tends to vary by time. The majority of renters in South Korea prefer to contract using Jeonse, except for those who pay monthly rent for small living spaces, such as studios. By considering these features of the housing market in South Korea, we select Jeonse price as our primary index of housing cost.

Our research specifically focuses on the housing market of the Seoul Metropolitan Area, which includes two large cities (*i.e.*, Seoul and Incheon) and one province (*i.e.*, Gyeonggi). Seoul, which is the capital city and home to 10 million residents, is the most important economic, social, and cultural center of South Korea. Headquarters of major domestic and foreign corporations, as well as prominent universities, hospitals, mass media, and cultural facilities, are heavily concentrated in the city. To mitigate over-concentration in Seoul, the majority of government agencies recently moved to the newly established administrative city of Sejong. However, with the Blue House (presidential residence) and National Assembly still in place, Seoul's status as the political capital remains intact.

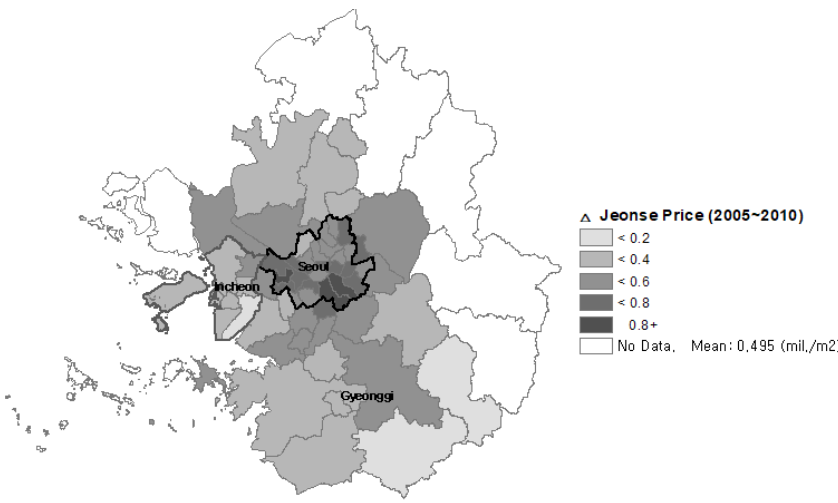
Over the last several decades, Seoul has absorbed population from the countryside and other small cities. In the course of continued mass migration to Seoul, its outskirts located in Gyeonggi province became rapidly urbanized. Out of concern with population explosion in Seoul, the government planned and constructed several "new cities" near the capital from the 1990s. A few former Seoul residents have moved to new cities in Gyeonggi, attracted by relatively low housing prices and less congested environment. Seoul Metropolitan Area, the land area of which is smaller than that of Connecticut, currently accounts for over half of South Korea's entire population.

In recent years, Gyeonggi has emerged as the most rapidly growing province in South Korea, while Seoul has stagnated or even declined in terms of population size. At present, approximately a quarter of South Koreans consider the province their home. One of the serious



Note: The 2015 value is the reference (= 100).

FIGURE 1
LONG-TERM TREND OF HOUSING PRICES IN SEOUL CITY (1990–2015)



Note: Unit of price is a million Korean won per square meters. A million Korean won is approximately 9,000 US dollars.

FIGURE 2
CHANGES IN JEONSE PRICE ACROSS LOCALITIES IN THE SEOUL METROPOLITAN AREA (2005~2010)

challenges arising from mass population inflow in the area, which is relevant for our study, is overload on the public transportation system. In particular, inter-province public transportation networks (particularly between Seoul and neighboring cities) are notoriously inadequate and inefficient owing in part to lack of coordination between regional governments. This situation is a major problem for numerous residents of Seoul's bed towns. These residents have to take fully packed metro trains or endure heavy traffic on the road daily to commute to their workplaces in Seoul.

Figure 1 presents how housing price indices in Seoul city changed from 1990 to 2015, with the 2015 value as the reference (= 100). The solid and dotted lines refer to the purchasing and Jeonse price indexes, respectively. For the last 25 years, the overall purchasing price has nearly doubled, and the Jeonse price has increased over 150%. Price particularly skyrocketed during between 2005 and 2010, showing a 50% increase. Owing to various merits associated with the capital city, housing prices in Seoul experienced a generally higher increase in property value compared with those in other regions.

Figure 2 graphically shows how the magnitude of the Jeonse price increase between 2005 and 2010 differed across localities (*i.e.*, districts, cities, and counties) within the Seoul Metropolitan Area. Substantial differences across places stand out from the result. During the five years, the increase in Jeonse price was significantly higher in districts in Seoul city than in Incheon or Gyeonggi province. Even within Seoul, we can observe substantial differences across districts. For example, the district of Gangnam, known for its prestigious residential areas and clusters of private academies for tutoring, boasted the highest increase in Jeonse prices (nearly 1 million won per m2). By contrast, the majority of districts in Incheon and Gyeonggi province only had relatively mild Jeonse price increase (*i.e.*, below 0.5 million won per m2). These differential changes in Jeonse prices would induce migrations within the Seoul Metropolitan Area (may be regarded as a commuting zone) for avoiding excessively high housing costs.

An increase in house prices would affect migration decisions of individuals differently according to their homeownership status. Renters would be considerably responsive to Jeonse price increase because they would have to pay an increased Jeonse deposit to renew the contract. Renters who cannot afford to pay an increased Jeonse deposit would migrate out of the expensive neighborhood looking for affordable

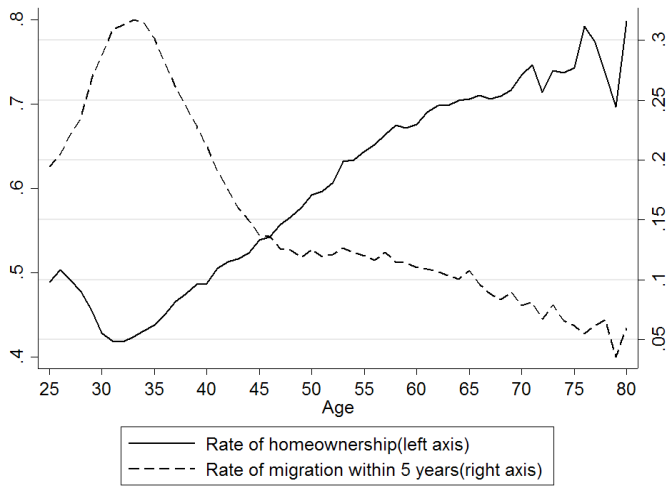


FIGURE 3
RATE OF HOMEOWNERSHIP AND MIGRATION BY AGE (IN OUR BASELINE SAMPLE)

housing. Renters saving for home would have to move further away from Seoul to find a property they can afford to buy.

In the following analyses, we hypothesize that migration decisions of the young would be more strongly affected by a housing boom than older persons for the following reasons. In general, homeownership rate is low among young people. Figure 3 shows that South Korea is no exception. The probability of homeownership (obtained from the 10% sample of the 2010 census) is positively associated with age for householders aged 30 and older. Homeownership rate among 30-year-old persons is lower than that of 65-year-old individuals by 30% points. Relationship between homeownership and age is reversed for those in their late 20s, presumably because numerous young adults tend to live with their parents in their early 20s. Even among renters (or homeowners), financial circumstance is likely worse for the young than the old. In South Korea (as in other countries), youth unemployment in recent years has been alarmingly high, and the quality of jobs (indicated by wage, and the proportion of irregular or temporary workers) held by young employees has been deteriorating over time. These circumstances lead us to predict that the young generation would be likely victims of the huge increase in housing prices.

Recent patterns of internal migration in South Korea are at least

consistent with this conjecture. Figure 3 shows that the age profile of migration rate is the mirror image of the age profile of homeownership rate in 2010. Although the results do not indicate anything about the causal relationship, the young were least likely to own home and most likely to migrate during the housing boom between 2005 and 2010. Moreover, results obtained from the Migration Statistics Data (drawn from administrative registration records) suggest that housing was the most crucial reason for migration in 2015, accounting for 32% of all transfers. Unfortunately, the data do not allow us to examine how the reason for migration differs by age. Nevertheless, the result indicates that a significant fraction of migrations was driven by factors associated with housing.

III. Data

We use large samples of micro-level South Korean population and housing censuses as our primary data source. The South Korean census data, enumerated every five years, are known as among the most reliable censuses at least since the 1980s. Although public-use 2% micro samples of the censuses are available for personal use, they do not provide some key variables required for our study, including information on residential history. Therefore, we use large micro samples containing additional variables that can be accessed only in the Korean Statistical office upon acquiring its permission. In particular, we use a 20% sample of the 2015 census and 10% samples of the 2010 and 2005 censuses. The 10% sample of the 2010 census, our primary source of evidence, consist of 5,457,530 individuals. The key advantage of using these data is that they provide reasonably detailed information on personal and family characteristics for many people. This method enables us to include a rich set of control variables in our analysis and examine heterogeneity across different population groups.[1]

[1] Micro-level census data provide the following information: personal characteristics, such as age, gender, nationality, education, marital status, working status, occupation, place of birth, place of residence, place of work, place of residence one and 5 year(s) ago, mode of commuting, commuting time; family characteristics, such as family structure, relationship with head of household, number and age of children; and house characteristics such as size of house, homeownership, and the number of years the householders lived in

Census data provide information on the current place (city/county/district) of residence and places where the respondent lived in the previous year and five years ago. By utilizing variables on residential history, we can infer geographic migrations of individuals in a given census during the five years prior to census enumeration. We construct a dummy variable that has a value of 1 if the county (city or district) of current residence is different from the county of residence five years ago (in the previous year). By definition, this variable captures inter-county geographic mobility for a five-year (one-year) period. A clear drawback of the data is that we do not know the full residential history for the period under study. For example, a person who migrated out of a county and returned to the place within five years between two census years would be counted as a stayer in our analysis. Similarly, we cannot distinguish multiple movers from single movers whose migration decisions could be differently affected by the characteristics of the initial place of residence. Moreover, the precise timing of migration cannot be determined with the data. To address this problem (at least partially), we analyze the probability of migration for one year that is minimally subject to problems associated with return and multiple migrations. In addition, we use subsamples of migrants who have lived in the current residence for over two or three years for partially controlling the timing of geographic transfers.

The other main data used in our study are the housing price database constructed by the Korea Appraisal Board. The board provides monthly housing price data for each county or district, except for highly rural counties.[2] The data consist of two price measures: price index and an average price per unit (million won/m^2). Our measure of interest is an average price per unit since renters are more concerned about the amount of additional deposit rather than the percentage of change. Given that this measure is available only for apartments starting from 2012, we extrapolated the average price per unit for the period before 2012, using the county-specific trends of the price index and average price per unit after 2012.[3] In addition to the housing price data, we

the current house.

[2] In the Seoul Metropolitan Area, data for 59 out of 66 counties are available. All unreported counties are in rural regions.

[3] There are two concerns about using the estimated price measure in our analysis. One concern is the accuracy of the estimation. However, the fact that

constructed county-level data from the Korean Statistical Information Service (KOSIS) pertaining to the characteristics of each locality, including levels of amenities and provisions of public goods.[4] They are included as control variables in our analysis.

In the analysis, we restricted our samples of individuals aged 25 or older, who were currently working, who had lived in the Seoul Metropolitan Area for the last five years, and who had workplaces in the Seoul Metropolitan Area in 2010. We made such sample selections to focus on the migration decisions and commuting time of workers in the highly populated Seoul Metropolitan Area. Samples living in communal facilities and those from counties for which housing price data are unavailable (mostly located in rural areas within the metropolitan area) were also excluded. Of the entire sample of 5,457,530 persons in the 2010 census, a subsample of 753,470 individuals is included in the working sample.

Table 1 shows the summary descriptive statistics for the variables used in our analysis. The probability of inter-county migration within five years (0.189) indicates that nearly 1 out of 5 workers experienced geographic relocations during the period. Average change in Jeonse price for 59 counties included in the sample is 0.495 (nearly 500 US dollars per square meters) with standard deviation of 0.181. Considering the average initial Jeonse price of 1.712, the period between 2005 and 2010 showed a sharp increase in housing prices (28.9%). The proportion of the young, another key variable of interest in our study, is 0.407 if it is defined to include those aged between 25 and 39 years.[5]

the R-squared value of the regression models was about 0.98 on average should alleviate the concern for accuracy. Another concern is whether the apartment price is a suitable measure that represents the housing cost encountered by the whole population. In the Seoul Metropolitan Area, approximately half of the population reside in apartments. However, we still need an assumption that the trends of apartment prices are similar to those of the overall housing prices. This assumption appears to be valid because the correlation coefficient between two variables is 0.87.

[4] Variables for local amenities include the number of childcare facilities, number of elderly welfare facilities, and number of social welfare facilities. Variables for local public goods include financial dependency ratio and local tax in the region.

[5] This is a higher figure than the actual proportion of the young in the entire Korean population because we restricted our samples to those currently

TABLE 1
SUMMARY STATISTICS (N = 753,470)

Variable Types	Variable Names	Mean	SD	Min	Max
Housing price	△ Jeonse (million won/m^2)	0.495	0.181	0.113	1.001
	2005 Jeonse Price (million won/m^2)	1.712	0.636	0.528	3.468
Personal characteristics	Inter-county migration within 5 years	0.189	0.392	0	1
	Young	0.407	0.491	0	1
	Male	0.616	0.486	0	1
	Education				
	>= college	0.501	0.500	0	1
	>= high school	0.367	0.482	0	1
	< high school	0.123	0.328	0	1
	2005 married	0.670	0.470	0	1
	2005 number of children				
	ages 0–~4	0.151	0.425	0	4
	ages 5–9	0.204	0.497	0	4
	ages 10–14	0.207	0.499	0	5
	ages 15–19	0.130	0.392	0	4
Job characteristics	Self-employed	0.280	0.450	0	1
	Occupation				
	professional	0.265	0.441	0	1
	clerical	0.191	0.393	0	1
	service and sales	0.226	0.418	0	1
	operative and manual	0.297	0.457	0	1
	agricultural	0.017	0.131	0	1
	other	0.003	0.050	0	1
Family characteristics and homeownership	Relationship with householder				
	same generation	0.813	0.389	0	1
	higher generation	0.146	0.352	0	1
	lower generation	0.008	0.089	0	1
	Other	0.033	0.179	0	1
	Homeownership	0.534	0.499	0	1
Region characteristics	Number of childcare facility (per 1,000 infants)	11.544	2.071	7.99	17.94
	Number of elderly care facility (per 1,000 seniors)	4.289	2.567	1.67	15.88
	Number of welfare facility (per 100,000 people)	1.869	1.524	0.23	13.31
	Suicide rate (per 100,000 people)	21.77	4.764	9.30	44.50
	Public park area (m2 per capita)	14.54	22.91	1.57	344.4
	Local tax (1,000 won per capita)	203.35	148.49	40	896
	Population density (person per km^2)	12031	7811	289.2	28890
	Number of local firms (per 100,000 people)	64.31	42.91	39.80	520.5
	Financial dependency ratio	52.78	16.13	21.6	92.6
Commuting characteristics	Commuting Time (min.)	36.4	25.61	1	180
	Distance to work (km.)	7.73	10.65	0	107.93

working, and the young are more likely to work than the old.

IV. Housing Cost and Geographic Mobility

A. Framework

This section investigates how migration decisions of individuals were related to the change in housing expenses in their places of residence. During our period of interest (*i.e.*, years between 2005 and 2010), house prices soared in South Korea, particularly in the central districts of Seoul city. The likelihood is that the increase in house prices differentially affect migration decisions of renters and owners. Renters would be severely affected by housing cost increase because they would have to pay an increased Jeonse deposit to renew the contract. Renters who cannot afford to pay an increased Jeonse deposit would migrate out of the expensive neighborhood looking for affordable housing. Renters saving for home would have to move further away from Seoul city to find a property they can afford to buy.

A crucial drawback arising from the cross-sectional feature of our data is that we are not allowed to determine whether a person was renting or owning a house at the beginning of the period (2005). We can only observe home ownership status for the endpoint (2010). Note that age is positively related to the probability of owning a house. Even among renters, younger individuals are on average likely to be less prepared for paying increased rents than older persons. We use these reasons as bases to hypothesize that the effect of increased housing

Table 2
Number of Migrants by Migration Type and Age Group

		Young (25–39)	Not Young (40+)
All		306,922 (100%)	446,548 (100%)
Non-migrants		224,676 (73.2%)	386,252 (86.5%)
Migrants		82,246 (26.8%)	60,296 (13.5%)
	Downward	47,869 (15.6%)	34,407 (7.7%)
	Upward	34,377 (11.2%)	25,889 (5.8%)
Downward/Upward		1.39	1.33

**Note*: We define two types of migration according to the relative change in rents between origin and destination. "Downward migration" refers to transfers to counties, where rents increased less than those of the original places of residence. "Upward migration" refers to transfers to counties, where increases in housing costs were higher than those in the counties of original residence.

price on the probability of out-migration would be stronger for the young than for older persons.

Table 2 summarizes migration patterns by age group between 2005 and 2010. The proportion of migrants among the young (26.8%) is considerably larger than among the older (13.5%), as suggested by the lower rate of homeownership for the young in the previous section. To examine the relationship between migration pattern and housing prices by age group, we divided migrations into two types according to the relative change in rents between origin and destination. The first type is "downward" migration, which refers to transfers to a county where rents increased less than the original place of residence. The other type is "upward" migration, which refers to transfers to a county where the increase of housing cost was larger than in the county of original residence.

The proportions of upward migrants are 11.2% and 5.8% for the young and the older, respectively, while the proportions of downward migrants are 15.6% and 7.7%, respectively. The number of downward migrants relative to upward migrants is substantially higher for the young than the old (1.39 vs. 1.33). This result suggests that young migrants are more likely to choose the destinations where the housing price rose less compared with older migrants. Moreover, this result provides suggestive evidence for our hypothesis that the probability of out-migration from the housing price would be strong for the young.

To investigate our hypothesis rigorously, we estimate the following model regarding the factors of the out-migration probability from the county of residence in 2005 within the following five years:

$$M_{i,c} = \beta_1 Y_i + \beta_2 H_c + \beta_3 H_c \times Y_i + \gamma X_i + \delta Z_c + \varepsilon_{i,c}, \quad (1)$$

where $M_{i,c}$ denotes the binary variable indicating whether or not individual i migrated out of county c within five years, H_c denotes Jeonse price change in county c within five years, Y_i denotes the binary variable for the young generation (aged 25 to 39), X_i denotes personal characteristics for individual i, and Z_c denotes characteristics of county c at the initial period. Our main coefficient of interest is β_3, which is the interaction term between Jeonse price change and the young generation. If the young generation is more likely to migrate out from counties with a higher increase in housing prices, then we expect the sign of β_3 to be positive. Moreover, if the housing cost induces the

average workers to migrate out, then we expect the sign of β_2 to be also positive.

An ideal situation is to include as control variables all the individual and family characteristics as of 2005 that could be related to migration decisions. However, socioeconomic and demographic characteristics in 2005 can only be inferred from those included in the 2010 census. Moreover, a few time-varying characteristics are subject to endogeneity problems because they could be influenced by migration decisions. For this reason, we classified the variables pertaining to personal socioeconomic status and family characteristics into four categories according to the likelihood of having a potential endogeneity problem and added them to our analysis one by one.

B. Baseline Results

Table 3 shows the regression results based on four specifications including different sets of controls. In the first model (column 1), we included as controls only the variables pertaining to gender and education. Given that individuals in the sample were aged 25 or older and that the highest educational category was defined as entering college, the education variable likely remained unchanged between 2005 and 2010, except for a relatively few late entrants to colleges. Therefore, this model is least subject to potential endogeneity problems.

The second model (column 2) additionally includes marital status and the number of children inferred from the timing of marriage and ages of children reported in the 2010 census. Marital status was estimated from the variable on the age at first marriage. If the gap between current age and age at first-marriage is larger than five years, then we assumed that the individual was married in 2005. To estimate the number of children in 2005, we first determined the children of the person in our sample based on each family member's relationship to the householder. Thereafter, we estimated the number of children in 2005 using the ages of children in 2010. These variables may have measurement errors. For example, children who left home during the five years could not be counted in our estimation. Our method of determining marital status in 2005 is also subject to errors. For example, if a person who divorced prior to 2005 and remarried between 2005 and 2010, then his or her marital status in 2005 will be determined as married although the person was actually a divorcee in 2005.

In addition to the preceding variables, Model 3 (column 3) includes the type of employment (*e.g.* wage workers or self-employed) and occupation in 2010. Occupation is classified into six categories: professional, clerical, service and sales, operative and manual, agricultural, and others (mostly military personnel). Job changes may be closely associated with geographic relocations. However, adults aged 25 and older would unlikely change their job as a consequence of migration. Given that broadly classified occupations were used, most of the job changes should have likely occurred within each occupational category.

Lastly, variables on family type and homeownership were included in Model 4 (column 4). Family type is classified according to the relationship to the householder, namely, the same generation, high generation, low generation, and others. Homeownership indicates whether or not an individual is a homeowner or renter in the current residence. Living arrangement and homeownership can be changed as a consequence of migration. Thus, these variables are subject to potentially serious endogeneity problems.

In all four models, we included county-specific variables pertaining to local amenities, public goods or economic conditions that can influence migrations decisions. Only a few of such variables are available for each county or district. Included in our analysis are the following variables: number of childcare facilities, number of elderly welfare facilities, number of social welfare facilities, local suicide ratio, area of public parks, population density, number of local firms, local financial dependency ratio, and local taxes per capita. Dummy variables indicating province and city are also included.

The results presented in Table 3 show that increased housing prices in a locality tend to increase the probability of out-migration among its residents and that the effect was stronger for the young. The estimated coefficients for the increase in Jeonse price, dummy variable for the young, and interaction between the two are all positive and statistically significant for all four specifications. Magnitudes of the estimated coefficients are similar for all models. According to the result from Model 3, an increase in Jeonse price by one standard deviation was associated with an increase in the probability of inter-county migration for the young by approximately 1.7% points (9.4% of the sample mean). The increase in the probability of migration driven by one-standard-deviation change in Jeonse price was 0.5% points (2.8% of the sample

TABLE 3
MIGRATION ANALYSIS: BASELINE RESULTS

	(1)	(2)	(3)	(4)
Variables	*Dependent Variable Mean: 0.189*			
△ Jeonse * Young	0.028** (0.014)	0.025**(0.014)	0.030**(0.013)	0.029**(0.011)
△ Jeonse	0.071***(0.025)	0.074***(0.025)	0.068***(0.025)	0.061***(0.026)
Young	0.096***(0.008)	0.061***(0.008)	0.056***(0.008)	0.072***(0.008)
2005 Jeonse price	0.004(0.011)	0.003(0.011)	0.003(0.011)	−0.001(0.011)
Male	0.020***(0.002)	0.016***(0.002)	0.020***(0.001)	0.017***(0.001)
Education				
>= college	0.078***(0.005)	0.093***(0.005)	0.071***(0.003)	0.085***(0.004)
>= high school	0.026***(0.002)	0.043***(0.002)	0.036***(0.002)	0.038***(0.002)
< high school	NI	NI	NI	NI
2005 married		−0.016***(0.004)	−0.015***(0.004)	−0.066***(0.003)
2005 number of children				
age 0–4		0.004**(0.002)	0.003* (0.002)	−0.004**(0.002)
age 5–9		−0.025***(0.002)	−0.026***(0.002)	−0.027***(0.002)
age 10–14		−0.041***(0.002)	−0.042***(0.002)	−0.042***(0.002)
age 15–19		−0.032***(0.002)	−0.033***(0.002)	−0.029***(0.001)
Self-employed			−0.006***(0.001)	−0.005***(0.001)
Occupation				
professional			NI	NI
Clerical			−0.016***(0.002)	−0.011***(0.002)
service and sales			−0.022***(0.003)	−0.022***(0.002)
operative and manual			−0.038***(0.004)	−0.039***(0.004)
agricultural			−0.075***(0.013)	−0.053***(0.011)
Other			0.100***(0.023)	0.041*(0.024)
Family types (by relationship with householder)				
same generation				NI
high generation				-0.207***(0.005)
lower generation				0.044***(0.007)
Other				-0.037***(0.005)
Homeownership				-0.081***(0.007)
Regional Controls	Yes	Yes	Yes	Yes
R-Squared	0.039	0.044	0.045	0.089
F-value	207.9	210.8	220.3	284.5
N	753,470	753,470	753,470	753,470

**Note:* Regional controls indicate the level of amenities, public goods provision, and local economic conditions, which include the number of childcare facilities, number of elderly welfare facilities, number of social welfare facilities, suicide rate, financial dependency ratio, local tax per capita, public park area, number of local firms, population density, and province/city dummies. Standard errors are clustered within the counties of original residence (Significance levels: * 0.1, **0.05, and ***0.01).

mean) higher for the young compared with the effect observed for the old generation.

In contrast to the strong effect of the change in housing price, the initial level of local housing price in 2005 did not have a significant effect on the migration decisions. The possible reason is that individuals had been sorted into places with particular rents and local amenities that matched well with their incomes and needs until they were hit by the real estate boom. For the other variables, younger age, being male, and more schooling were positively related to the probability of inter-county migration. Married people and parents of school-age children were less likely to move to a different county than singles and those having no child aged 5 to 19 (Models 2 to 4). The self-employed were less likely to migrate than wage and salary workers. People employed in professional and other occupations (mostly military personnel) were particularly mobile compared with the rest (Models 3 and 4).

C. Additional Results and Robustness

We hypothesize that the preceding results were generally driven by an increase in housing price in a locality pushing out the residents who cannot afford to pay increased Jeonse deposits. If this is the case, then migrants likely moved to a county or district where the price increase was lower than in the original place of residence. To examine the hypothesis, we again divide the migrations into two types (i.e., downward and upward migrations) according to the relative change in rents between origin and destination.

We regard the two types of migrations as distinct choices presumably influenced by different motives. We conducted regressions similar to the baseline analysis to estimate the equations for the probabilities of upward and downward migrations separately. In the regression for downward migration, the dependent variable has a value of 1 if a person made a downward migration, and 0 otherwise (stayed or made an upward migration).

The results in Table 4 (columns 1 and 2) suggest that the baseline results were generally driven by the increased probability of downward out-migration in places with high rates of housing cost rise. Estimated coefficients of the increase in Jeonse price and interaction between the young and Jeonse price change are positive for downward migration. By contrast, coefficients are negative for upward migration. One standard

TABLE 4
MIGRATION ANALYSIS: BY MIGRATION TYPE AND HOMEOWNERSHIP STATUS

	(1) Downward	(2) Upward	(3) Downward +Owner	(4) Downward +Renter	(5) Upward +Owner	(6) Upward +Renter
	Mean: 0.109	Mean: 0.082	Mean: 0.043	Mean: 0.066	Mean: 0.026	Mean: 0.054
△ Jeonse * Young	0.198*** (0.014)	−0.171*** (0.017)	0.047*** (0.006)	0.152*** (0.010)	−0.034*** (0.006)	−0.135*** (0.012)
△ Jeonse	0.223*** (0.037)	−0.159*** (0.033)	0.091*** (0.016)	0.131*** (0.023)	−0.067*** (0.014)	−0.087*** (0.022)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-Squared	0.053	0.041	0.016	0.040	0.011	0.032
F-value	152.4	104.4	69.33	135.7	23.18	95.05
N	753,470	753,470	753,470	753,470	753,470	753,470

**Note*: We define two types of migration according to the relative change in rents between origin and destination. "Downward migration" refers to transfers to counties, where rents increased less than those in the original places of residence. "Upward migration" refers to transfers to counties, where increases in housing costs were higher than those in counties of original residence. Interaction terms between △ Jeonse and Young are presented in the table. Other controls include control variables from Table 3. Standard errors are clustered within the counties of original residence (Significance level: * 0.1, **0.05, and ***0.01).

deviation change in Jeonse price was associated with an increase of 3.6% points (33% of the sample mean) in the probability of downward migration for the young. By contrast, it was associated with 3% points (38% of the sample mean) decrease in the probability of upward migration for the young.

We also jointly considered the choice of owning or renting a home after making a geographic transfer as well as the directions of migration. In particular, we examined how the change in housing cost affected each of the following four choices: (1) downward migration and owning a home, (2) downward migration and renting a home, (3) upward migration and owning a home, and (4) upward migration and renting a home. In the regression for downward migration and owning a home, the dependent variable has a value of 1 if the person made a downward migration between 2005 and 2010 and owned a home in 2010, and 0 otherwise.

The results of the regressions in columns (3) to (6) confirm that an increase in housing prices significantly increased the probability of migration to places with affordable housing, particularly for young persons. The magnitudes of the effects of Jeonse price change and its interaction with the young are larger for "downward migration and

Table 5
Migration Analysis: Robustness Checks

Panel A. Alternative definition of younger and older individuals	
Young: 25–39, Not Young: 40+ (Baseline)	0.030**(0.013)
Young: 30–39, Not Young: 40+	0.046***(0.016)
Young: 30–39, Not Young: 45+	0.037*(0.019)
Young: 25–39, Not Young: 45+	0.023(0.016)
Panel B. Sample selection according to timing of migration	
Lived in the 2010 county for 3 years or longer	0.039***(0.012)
Lived in the 2010 county for 2 years or longer	0.035***(0.013)
Panel C. Alternative measures of change in housing costs	
△Purchasing price (2005–2010)	0.007*(0.004)
△Jeonse (2005–2007)	0.072***(0.018)
△Jeonse (2005–2008)	0.062***(0.020)
Panel D. Alternative samples of urban areas	
Five Major Cities (excluding Seoul Metro)	−0.034**(0.015)
Five Major Cities + Seoul Metro	0.127***(0.015)
Panel E. Alternative time periods	
2009–2010	0.085***(0.015)
2010–2015	0.016*(0.008)
2014–2015	0.027**(0.012)

**Note:* Interaction terms between △ Jeonse and the young are presented in the table. The five major cities used in the analysis are Busan, Daegu, Gwangju, Daejeon, and Ulsan. For the last two rows in panel E, we report the results using the 20% samples from the 2015 census. Standard errors are clustered within the counties of original residence (Significance levels: * 0.1 **0.05, and ***0.01).

renting" compared with "downward migration and owning." This result suggests that moving to a locality with a lower increase in property price and renting a home there is the option that was most strongly (and positively) affected by increased housing expenses. Given that the majority of renters in 2010 were likely renting a house in 2005, the result suggests that renters (young renters in particular) were particularly vulnerable to increased property prices.

Table 5 presents the estimated coefficient of the interaction term of Jeonse price increase and the young obtained from additional regressions conducted for testing the robustness of the baseline results. In Panel A, young and older persons were defined in several different ways. The coefficient of the interaction term becomes larger if individuals aged under 30 are excluded from the sample and those aged 30 to 39 are classified as the young and compared with older persons. A possible explanation is that many of the persons aged 25 to 29 still

live with their parents, as the age profile of homeownership (Figure 3) shows. Those who live in a house owned by their parents would be less affected by changes in housing prices.

In panel B, we used two alternative samples that were selected according to the estimated timing of migration. As explained in Section 2, census data do not allow to determine how many times a migrant actually moved during the period under study. Moreover, we do not know the exact timing of migration. For these reasons, the change in house price for five years in the 2005 county may not be the appropriate index of increased housing expenses for some individuals who lived there in 2005. To consider this problem at least partially, we used subsamples of individuals who had lived in the current residence (the 2010 county) for a given number of years (two or three years or longer) to determine how the effects of local house price change differs by the timing of migration. This sample includes stayers and only the migrants who left the 2005 county early. The results are generally similar to those of baseline regressions.

In panel C, we used alternative indices of change in housing costs. Even though county-level purchasing prices and Jeonse prices are highly correlated, their trends are not perfectly matched. Homeowners and renters planning to purchase a house could be more responsive to changes in purchasing price than to Jeonse price. For this reason, we used the change in purchasing price as a measure of housing cost. We also included Jeonse price increase for the first two or three years under study (2005 to 2007 and 2005 to 2008) as an independent variable. The reason is to consider possible time lags between price changes and migration decisions that arise from the remaining contract period. The regression results based on using these alternative indices are similar to those of baseline regressions.

In Panel D, we used alternative samples based on different definitions of urban areas, five major cities located outside the Seoul Metropolitan Area, namely, Busan, Daejeon, Daegu, Gwangju, and Ulsan. The results show that the significant positive effect of increased housing cost on the probability of migration of the young is observed only in the Seoul Metropolitan Area. The possible reason is that other cities, as well as rural areas, lost population and experienced stagnation in housing markets during the period under study. If all metro cities (including Seoul) are included in the analysis, then a strong positive effect of increased housing cost on young people's migration emerges.

Lastly, in panel E, we used three alternative periods: 2009–2010, 2010–2015, and 2014–2015. We utilized the information on the place of residence in the previous year for studying geographic mobility between 2009 and 2010. In addition, we used a 20% micro sample of the 2015 census to analyze migrations between 2010 and 2015 and between 2014 and 2015. During the period between 2010 and 2015, Jeonse prices substantially increased, whereas purchasing prices of properties stagnated. The results of regressions obtained from the three study periods are similar to those of baseline regressions.

V. Effects on Commuting Time

A. Framework

This section examines how geographic relocation driven by increased house price changed the commuting time and distance of the migrants. Business and commercial activities are concentrated in the core areas in Seoul, where property prices mostly sharply increased during the real estate boom. This situation is demonstrated by the distribution of average commuting time across the districts in the Seoul Metropolitan Area (presented in Figure 4). In the central districts in Seoul city, where

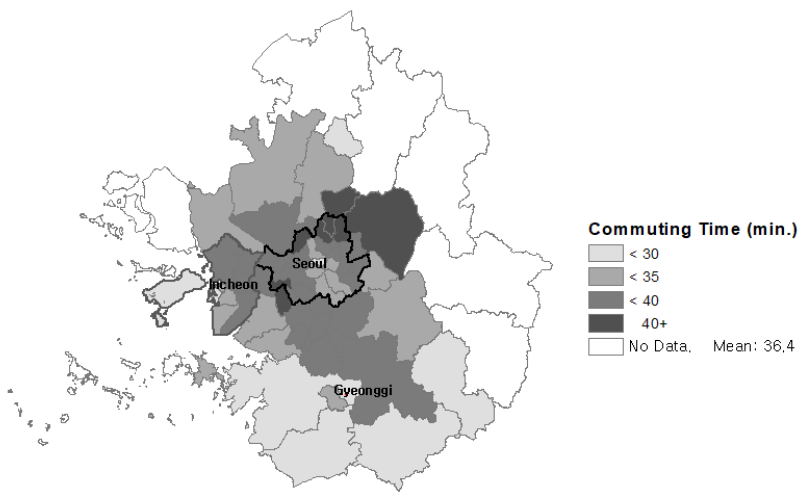


FIGURE 4
COMMUTING TIME ACROSS LOCALITIES IN THE SEOUL METROPOLITAN AREA (IN OUR BASELINE SAMPLE)

property prices most sharply increased (see Figure 2), the average commuting time is lower than their surrounding peripheries and neighboring cities in Gyeonggi province. If workers were to migrate in search of affordable housing, then they would be more likely to move away from their workplaces. Thus, we expect that relocations driven by increased housing cost should be associated with the increased commuting time of the migrants. We also hypothesize that such effects would be more strongly observed among the young who are less likely to own a house.

Table 6 shows the average commuting time and distance to work by migration type and age group. We observe that the commuting time increases substantially when people move to different counties, from 39.6 minutes to 41.17 minutes for the young and from 33.25 minutes to 38.05 minutes for the older. Focusing on the differential effect by the types of migration, the downward migrants, who migrated to the counties with less increase in housing prices, are the ones who experience the longer commuting time for both age groups. Average commuting time of downward migrants is 8% longer than that of upward migrants for the young, while the average commuting time of downward migrants is 6% longer than that of upward migrants for the older. The results are similar for the average distance to work as well. The difference in the relative commuting cost between migration types across the age group suggests that the effect of migration induced by

Table 6
Average Commuting Cost by Migration Type and Age Group

		Commuting Time (min)		*Distance to Work (km)*	
		Young (25–39)	Not Young (40+)	Young (25–39)	Not Young (40+)
All		40.02	33.90	8.76	7.02
Non-migrant		39.60	33.25	8.17	6.59
Migrant		41.17	38.05	10.36	9.78
	Downward	42.47	38.97	11.40	10.59
	Upward	39.37	36.82	8.92	8.72
Downward / Upward		1.08	1.06	1.28	1.21

**Note*: We define two types of migration according to the relative change in rents between origin and destination. "Downward migration" refers to transfers to counties, where rents increased less than those in the original places of residence. "Upward migration" refers to transfers to counties, where increases in housing costs were higher than those in the counties of original residence.

the rise in housing price on the longer commuting time could be larger for the young than the older.

To investigate the hypothesis more precisely, we estimate the following triple-difference equation:

$$T_{i,c} = \beta_1 M_{i,c} + \beta_2 H_c + \beta_3 Y_i + \beta_4 M_i \times H_C + \beta_5 H_c \times Y_i + \beta_6 M_i \times Y_i + \boldsymbol{\beta_7 M_i \times H_C \times Y_i} + \gamma X_i + \delta Z_c + \varepsilon_{i,c}, \quad (2)$$

where $T_{i,c}$ denotes the commuting time or distance to work for an individual i who lived in county c in 2005. In addition to the controls included in (1), we also control for variables regarding the mode of transportation.[6] We utilized the self-reported commuting time reported in the census. Distance to work was estimated based on the information regarding the counties of current residence and workplace. Given that we do not know the exact home and work addresses, we estimated and used the linear distance between the locations of the municipal government offices. If the migration induced by the change in housing cost worsens the locational mismatch between the young workers and their workplace, then we expect the sign of β_7 to be positive.

B. Baseline Results

Table 7 presents the results of regressions regarding the effect of housing cost on commuting time (columns 1 to 3) and on the distance to work (columns 4 and 5). Similar to the migration regressions, we begin with a model less subject to endogeneity problems (Model 1 in Table 7) and added additional controls to it. Mode of transportation is newly included in Models 2 and 3, while family characteristics and homeownership are controlled for in Model 3 (column 3). Given that distance to work is independent of transportation, we did not include transportation variables in the analysis pertaining to distance.

The regression results show that the coefficients for the triple difference term are positive and statistically significant for all specifications. This result indicates that geographic relocations driven

[6] The mode of transportation includes walking, car, bus, commuting bus, express bus, subway, train, taxi, bike, and others. We also control for the usage of multiple modes.

TABLE 7
COMMUTING TIME AND DISTANCE ANALYSIS: BASELINE RESULTS

	Commuting Time (mean: 36.39 min)			*Distance to Work (mean: 7.73km)*	
Variables	(1)	(2)	(3)	(4)	(5)
△ Jeonse*Migration*Young	3.878**(1.755)	6.569***(0.937)	6.502*** (0.998)	3.179***(0.440)	3.147***(0.433)
△ Jeonse*Young	−0.571(1.961)	−3.939***(0.881)	−3.951***(0.807)	−1.605***(0.491)	−1.620***(0.452)
△ Jeonse*Migration	5.090**(2.253)	3.552**(1.759)	3.033*(1.749)	2.786**(1.228)	2.440**(1.217)
Migration*Young	−4.532***(0.877)	−4.683***(0.562)	−3.756***(0.548)	−2.447***(0.256)	−2.037***(0.250)
△ Jeonse	0.622(2.458)	2.464(1.993)	2.657(1.930)	-0.193(1.526)	-0.064(1.522)
Young	1.006(0.980)	1.657***(0.452)	1.196***(0.410)	0.891***(0.282)	0.713***(0.265)
Migration	0.402(1.195)	0.132(0.993)	0.773(0.984)	1.127(0.768)	1.527**(0.753)
2005 Jeonse Price	−1.175(1.240)	−1.456(0.913)	−1.382(0.869)	−0.946(0.650)	−0.896(0.638)
Male	5.771***(0.258)	4.789***(0.248)	4.860***(0.251)	2.991***(0.131)	3.003***(0.133)
Education					
>= college	5.542***(0.263)	2.440***(0.265)	2.226***(0.262)	2.474***(0.183)	2.344***(0.180)
>= high school	1.008***(0.183)	−0.043(0.123)	−0.036(0.119)	0.647***(0.065)	0.650***(0.064)
< high school	NI	NI	NI	NI	NI
2005 married	−1.432***(0.171)	−0.018(0.133)	0.841***(0.130)	−0.108(0.088)	0.221**(0.091)
2005 number of children					
age 0–4	0.065(0.106)	0.234***(0.090)	0.408***(0.087)	0.051(0.047)	0.137***(0.046)
age 5–9	−0.396***(0.077)	0.035(0.065)	0.122*(0.065)	−0.186***(0.044)	−0.142***(0.043)
age 10–14	−0.268***(0.068)	0.104*(0.057)	0.175***(0.054)	−0.109**(0.043)	−0.073(0.042)
age 15–19	0.229***(0.085)	0.254***(0.076)	0.238***(0.077)	0.082(0.052)	0.057(0.053)
Self-employed	−8.377***(0.17)	−4.019***(0.119)	−4.076**(0.119)	−1.760***(0.066)	−1.785***(0.065)
Occupation					
professional	NI	NI	NI	NI	NI
Clerical	1.406***(0.197)	0.132(0.131)	0.075(0.128)	0.188**(0.086)	0.153(0.084)
service and sales	−3.454***(0.14)	−2.164***(0.126)	−2.14**(0.123)	−1.327***(0.067)	−1.284***(0.064)
operative and manual	−3.667***(0.27)	−1.863***(0.233)	−1.799***(0.228)	−1.729***(0.153)	−1.666***(0.151)
agricultural	−8.662***(1.19)	−2.848***(0.929)	−3.321***(0.932)	−3.899***(0 547)	−4.109*** (0.556)
Other	−16.87***(1.30)	−10.44***(1.09)	−9.414***(1.02)	−4.757***(0.672)	−4.156***(0.635)
Family type (by relationship with householder)					
same generation			NI		NI
higher generation			3.592***(0.147)		1.546***(0.112)
lower generation			1.617***(0.269)		0.621***(0.151)
Other			1.675***(0.162)		0.560***(0.094)
Homeownership			1.780 ***(0.105)		1.131***(0.057)
Transportation Controls	No	Yes	Yes	No	No
Regional Controls	Yes	Yes	Yes	Yes	Yes
R-Squared	0.097	0.326	0.329	0.073	0.078
F-value	486.2	4,386	8,455	485.1	489.9
N	753,470	753,470	753,470	753,470	753,470

**Note:* For transportation controls, we control for the mode of transportation, such as walking, car, bus, commuting bus, express bus, subway, train, taxi, bike, and others. Regional controls are the same as those in Table 3. Standard errors are clustered within the counties of original residence (Significance levels: * 0.1, **0.05, and ***0.01).

by the housing boom increase the commuting time and distance of young migrants. The estimated coefficients suggest that a unit increase in Jeonse price (one million Won per m2) is associated with an increase in commuting time by approximately 6.6 minutes (18.1% of the sample mean) and with an increase in the distance to work by 3.2km (41.6% of the sample mean) for young migrants.

For other personal and family characteristics, males spend more time on commuting than females. Commuting time is significantly longer for the college-educated and professionals than the low-educated and those employed in other jobs, respectively. The self-employed tends to live closer to their workplace compared to wage workers.

C. Additional Results and Robustness

Table 8

Commuting Time and Distance Analysis: By Migration Type and Homeownership Status

	Commuting Time					
	(1) Down ward	(2) Upward	(3) Down +Owner	(4) Down +Renter	(5) Up +Owner	(6) Up +Renter
△ Jeonse *Migration *Young	6.223*** (1.113)	−1.027 (1.379)	5.307** (1.399)	5.590*** (1.608)	−3.216 (2.066)	−0.201 (1.865)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-Squared	0.326	0.325	0.327	0.325	0.325	0.325
F-value	2,306	4,321	2,417	2,370	5,932	4,007
N	753,470	753,470	753,470	753,470	753,470	753,470
	Distance to Work					
	(7) Down ward	(8) Upward	(9) Down +Owner	(10) Down +Renter	(11) Up +Owner	(12) Up +Renter
△ Jeonse* Migration*Young	3.178*** (0.620)	−0.432 (0.716)	2.002** (0.902)	2.733*** (0.796)	−0.988 (1.340)	−0.154 (0.823)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-Squared	0.075	0.066	0.074	0.068	0.067	0.066
F-value	452.7	361.4	505.3	407.1	301.1	316.3
N	753,470	753,470	753,470	753,470	753,470	753,470

**Note*: We define two types of migration according to the relative changes in rents between origin and destination. "Downward migration" refers to transfers to counties, where rents increased less than those in the original places of residence. "Upward migration" refers to transfers to counties, where the increase in housing costs were higher than those in the counties of original residence. Triple interaction terms among △ Jeonse, Migration, and Young are presented in the table. Standard errors are clustered within the counties of original residence (Significance levels: * 0.1, **0.05, and ***0.01).

We conducted regressions similar to those presented in Table 4, in which the direction of migration (e.g., downward or upward migrations) and choice of owning or renting a home after making a geographic transfer are jointly considered. The results of the regressions in Table 8 suggest that only downward migrations (moving to a county with a lower property price increase) significantly increased the commuting time and the distance to work for young migrants. Unlike the corresponding results from migration regressions, no differences are observed between "downward migration and renting a home" and "downward migration and owning a home." The results are consistent with the hypothesis that a rise in housing cost in a locality would force its residents (particularly the young) migrate away from their workplaces for renting or buying an affordable home. Consequently, commuting time (and distance) among young migrants increases.

TABLE 9
COMMUTING TIME AND DISTANCE ANALYSIS: ROBUSTNESS CHECKS

	Commuting Time	Distance to Work
Panel A. Alternative definition of younger and older individuals		
Young: 25–39, Not Young: 40+ (Baseline)	6.569***(0.937)	3.179***(0.440)
Young: 30–39, Not Young: 40+	4.658***(0.856)	2.748***(0.397)
Young: 30–39, Not Young: 45+	5.535***(1.004)	3.093***(0.562)
Young: 25–39, Not Young: 45+	7.465***(1.083)	3.517***(0.588)
Panel B. Sample selection according to the timing of migration		
Lived in the 2010 county for 3 years or longer	6.358***(1.314)	3.002***(0.571)
Lived in the 2010 county for 2 years or longer	6.649***(1.104)	3.347***(0.486)
Panel C. Alternative measures of change in housing costs		
△Purchasing price (2005–2010)	2.037***(0.307)	0.943***(0.147)
△Jeonse (2005–2007)	9.228***(1.304)	4.687***(0.684)
△Jeonse (2005–2008)	8.277***(1.591)	4.797***(0.776)
Panel D. Alternative samples of urban areas		
Five Major Cities (excluding Seoul Metro)	−0.671(1.560)	−0.266(0.845)
Five Major Cities + Seoul Metro	2.346***(0.962)	0.651(0.541)
Panel E. Alternative periods		
2009–2010	14.59***(4.303)	6.379***(2.576)
2010–2015	2.985***(0.639)	0.781*(0.401)
2014–2015	2.712(3.360)	0.724(1.646)

**Note:* Triple interaction terms among △ Jeonse, young, and migration are presented in the table. Standard errors are clustered within the counties of original residence. The five major cities used in the analysis are Busan, Daegu, Gwangju, Daejeon, and Ulsan. For the last two rows in panel E, we report regressions using the 2015 census data (Significance levels: * 0.1, **0.05, and ***0.01).

We also conducted robustness tests similar to those shown in Table 5. We tried alternative definitions of young and old people (panel A), selected different samples according to the timing of migration (panel B), included alternative indices of change in housing cost (panel C), used alternative definitions of metropolitan cities, and choose different time periods in regression analysis. The results in Table 9 show that the results are robust to changes in variables as far as the Seoul Metropolitan Area is concerned. Similar to the case of migration regressions, no significant effect of the change in property price is observed for other large cities (panel D).

VI. Conclusion

The contemporary young, even though widely regarded as the best-educated generation in history, suffer from high unemployment rate, decline of marriage, and waning hope of upward social mobility. One of the explanations for the younger generation's economic hardships is the growing mismatch between places with affordable housing and those with labor-market opportunities. In particular, we suspect that an increase in housing cost in large cities could intensify the mismatch by making it increasingly difficult for young people to live close to urban centers where jobs and opportunities are abundant.

This study investigated whether or not the quality of matching between jobs and workers (young workers in particular) worsened because of increasing property prices in South Korean cities. For this purpose, we examined how a change in housing cost in the Seoul Metropolitan Area during a major real estate boom affected the migration decisions of young residents, and how geographic relocations driven by rising rents changed the migrants' commuting time and distance.

By using 10% samples of micro censuses, we found that an increase in housing cost in a district is positively associated with the probability of migration out of the district. The effect of increased housing cost on migration was larger for the young, with one-standard-deviation change in property price being associated with an increase in migration probability of the young by 9% of the sample mean. We also found that migrations driven by soared housing cost increased the commuting time and distance, especially for young movers. A unit change in Jeonse price (one million won per m2) was associated with an increase in

commuting time and distance of the young migrants by 18% and 42% of the sample means, respectively. The results are robust to changes in the definition of the young age group, index of change in housing cost, and the study period.

Our key results suggest that "forced migrations" driven by housing booms can intensify mismatch between workers (places with affordable housing) and jobs (workplace). Additional results suggest that an increase in housing price had a particularly strong effect on the probability of migration to districts where price increase was lower than in the district of origin. Similarly, commuting time and distance increased more if the young migrated to districts where an increase in housing cost was lower than in the district of origin. These results tend to support the hypothesis that housing booms push renters out to the places located away from their jobs, looking for affordable housing.

We may derive several policy implications from the results. First, policy makers dealing with the housing market should consider the possible negative externalities of increase in property prices. Housing booms can produce other types of mismatch (e.g., between children and childcare, between students and schools, and between patients and hospitals) in addition to the one considered in this study. Second, in providing affordable housing for the young and newly married, it is important to consider the quality of its location (e.g. proximity to jobs, childcare, schools, and other amenities). Lastly, improving the public transportation system (inter-regional networks in particular) would be beneficial for alleviating the mismatch between workers and jobs.

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REFERENCES

Albouy, D., & Lue, B. "Driving to opportunity: Local rents, wages, commuting, and sub-metropolitan quality of life." *Journal of Urban Economics 89*(2015): 74-92.

Cameron, G., & Muellbauer, J. "The housing market and regional commuting and migration choices." *Scottish Journal of Political Economy 45*(No.4 1998): 420-446.

Cameron, G., Muellbauer, J., & Murphy, A. *Housing market dynamics and regional migration in Britain.* CEPR Discussion Paper No.

5832. Available at SSRN: https://ssrn.com/abstract=944063

Chan, S. "Spatial lock-in: Do falling house prices constrain residential mobility?." *Journal of Urban Economics*, 49(No.3, 2001): 567-586.

Dettling, L. J., & Kearney, M. S. "House prices and birth rates: The impact of the real estate market on the decision to have a baby." *Journal of Public Economics 110*(2014): 82-100.

Donovan, C., & Schnure, C. *Locked in the house: Do underwater mortgages reduce labor market mobility?*, Working Paper, 2014.

Edlund, L., Machado, C., & Sviatschi, M. *Gentrification and rising returns to skill*, Working Paper, 2017.

Ferreira, F., Gyourko, J., & Tracy, J. "Housing busts and household mobility." *Journal of Urban Economics 68*(No.1 2010): 34-45.

Farnham, M., Schmidt, L., & Sevak, P. "House prices and marital stability." *American Economic Review* 101(No.3 2011): 615-19.

Guerrieri, V., Hartley, D., & Hurst, E. "Endogenous gentrification and housing price dynamics." *Journal of Public Economics 100*(2013): 45-60.

Jeanty, P. W., Partridge, M., & Irwin, E. "Estimation of a spatial simultaneous equation model of population migration and housing price dynamics." *Regional Science and Urban Economics 40*(No.5 2010): 343-352.

Kang, J. K., & Ma, K. R. "The Impact of Regional Housing Price on Timing of First Marriage." *Journal of The Korean Regional Development Association 29*(No.2 2017): 97-110.

Kim, J., & Cho. S "Can Housing Prices be Justified by Economic Fundamentals? Evidence from Regional Housing Markets in Korea." *Seoul Journal of Economics 31*(No.2 2018): 157-193

Lovenheim, M. F., & Mumford, K. J. : "Do family wealth shocks affect fertility choices? Evidence from the housing market." *Review of Economics and Statistics 95*(No.2 2013): 464-475.

Laeven, L., & Popov, A. "A lost generation? education decisions and employment outcomes during the U.S. housing boom-bust cycle of the 2000s." *American Economic Review Papers and Proceedings 106*(No.5 2016): 630-35.

Lee, C. "Did Pro-natal Policy in Korea Fail?: A Decomposition of Fertility Change from 2000 to 2016." *The Korean Journal of Economic Studies 66*(No.3 2018): 1-38.

McKinnish, T., Walsh, R., & White, T. K. "Who gentrifies low-income neighborhoods?." *Journal of Urban economics 67*(No.2 2010): 180-

193.

Molloy, R., Smith, C. L., & Wozniak, A. "Internal migration in the United States." *Journal of Economic perspectives 25*(No.3 2011): 173-96.

Ruiz, I., & Vargas-Silva, C. "The labor market impacts of forced migration." *American Economic Review Papers and Proceedings 105*(No.5 2015): 581-86.

Seo, M. "Do House Price Changes Affect Household Birth Rates?." *The Journal of Women and Economics*, *10*(No.1 2-13): 63-79.

Stein, J. C. "Prices and trading volume in the housing market: A model with down-payment effects." *The Quarterly Journal of Economics 110*(No.2 1995), 379-406.