Workplace-anchored migration in US counties

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Abstract

Residential amenities and access to employment are major factors in migration decisions. Yet traditional migration models are unable to reveal the causes (and effects) of migration because current data capture only movers who change their place of residence; depending on how far they move, these migrants may or may not also change their jobs. Migration flows thus could be categorized into two groups depending on whether the migrants also change their workplace. In this paper, we identify the number of movers who do and do not change their workplace by using overlapping county-to-county migration and commuting data. We refer to this as workplace-*anchored* and *unanchored* migration. Then we compare the local factors that affect both types of migration. Our analysis reveals that the most important local factors that separate workplace-anchored and unanchored migration are the poverty rate, commuting time, and age demographics of the origin and destination counties.

Keyword: migration, commuting, residential amenities

1. Introduction

Recent theoretical explanations of migration draw on two competing hypotheses: the regional restructuring hypothesis and the deconcentration hypothesis (Renkow and Hoover, 2000; Partridge *et al*., 2012; Rupasingha *et al*., 2015). One commonly accepted economic development perspective is that regional industrial structures are shifting over time toward more value-added or higher-technology industries as a reflection of changing national comparative advantage. Followers of this hypothesis argue that the uneven spatial distribution of employment opportunities arises from the location and relocation of industries, which, in turn, affect the decisions of prospective migrants. On the other hand, proponents of the deconcentration hypothesis assert that, ultimately, migration is driven by upgraded residential preferences and increases in commuting from the center of the city to suburban or rural regions (see also Partridge and Olfert, 2011). Both theories agree that changes of workplace and of preferred residential amenities are two major causes of migration.

Migration, defined and measured as the shift of population between places of residence, involves both advantages and costs. Migrants expect benefits in the form of economic gain and amenity-driven advantages (Clark and Hunter, 1992; Rupasingha and Goetz, 2004; Chen and Rosenthal, 2008), while they incur not only the financial costs of relocation, but also the social and psychological costs of leaving their family or friends, among many others (Speare *et al*., 1982; Huffman and Feridhanusetyawan, 2007). A different spatial process, commuting is an effort to secure some of the advantages typically associated with migration while avoiding or minimizing the traditional costs of actually changing the place of residence. Through commuting, a household can enjoy new economic gains while staying in the community, or it can enjoy better residential amenities while keeping the same job if the amenities in the original place of residence exceed those available or expected in residential communities closer to the workplace.

In the case of migration motivated by residential amenities, such as a better neighborhood, lower crime rate, shorter commute, better housing, cheaper rent (Ihrke, 2014) or a better educational environment, movers need not necessarily change their workplace (Shuai, 2012). Migrants who do not change their workplace instead (continue to) commute to their original workplace after migrating. We refer to moves motivated by residential amenities that are not associated with a change of employment as (workplace-) *anchored* migration, because the workplace remains fixed while the individual or household changes residence. On the other hand, some movers change both place of residence and of work; we call this *unanchored* migration.

Traditional migration studies are unable to distinguish between these two types of migration because publicly available data reveal only residential shifting, without revealing anything about jobs changes. An important caveat here is that if a move occurs over a significant distance then the likelihood is high that the mover also changes the place of employment, but this cannot be inferred from existing data. An estimated 72% of all moves occur within the same counties in 2006-2010 suggesting that a large number of moves are motivated by residential amenity-seeking rather a change in jobs. In this paper we create two different types of migration data series according to whether migrants change their workplace or not (*anchored* vs. *unanchored* migration), and then examine how these groups differ; we also are able to model whether one form of migration is affected by factors that differ from those motivating the other.

2. Method

We calculate the anchored migration data from overlapping migration and commuting data. Migration is the shift of a population between places of residence while commuting is the movement of employees between their place of residence and employment. Because both types of data reflect the movements of individuals between geographical places and both have at least one "place" in common – the place of residence – we can overlap the two datasets (Han *et al*., 2013). By considering commuting patterns of workers at the migration origin and destination, we can estimate the number of people who change their place of residence while leaving their place of work unchanged.

Let x and y denote residential counties and w the workplace. Mobility functions M and C are defined to represent migration and commuting. The number of migrants from county x to y in year t-1 to t is defined as M^t_{xy}, and the number of commuters from x to w in t year as C^t_{xw}. The probability that an individual who lives in x commutes to w in t WC^t_{xw} is calculated by normalizing C^t_{xw} by the total number of out-commuters ($WC^t_{xw} = C^t_{xw} / \sum_z C^t_{xz}$), where z is defined as the set of all US counties.

Among migrants who moved from x to y between t-1 and t, the number of people who have not changed their workplace w $AM^t_{xy,w}$ is estimated as Eq (1):

$$AM^t_{xy,w} = M_{xy} WC^{t-1}_{xw} WC^t_{yw} \qquad (1)$$

Considering the number of all possible fixed workplaces *w*, the number of *anchored* migrants among migrants from *x* to *y* between *t*-1 and *t* AM_{xy}^{t} is calculated as in Eq. (2):

$$AM_{xy}^{t} = \sum_{w} AM_{xy,w}^{t} \tag{2}$$

The anchored migration equation consists of one migration term and two commuting terms, and the anchored migration occurs within a maximum commuting distance between counties. Unanchored migration from *x* to *y* UM_{xy} is computed by subtracting AM_{xy} from the total.

$$UM_{xy}^{t} = M_{xy}^{t} - AM_{xy}^{t} \tag{3}$$

Because migrants are one sample among existing residents of a county (the statistical population), we assume that migrants to or from a county have the same commuting pattern as the county residents (Han *et al*., 2013). To verify this assumption, we compare the commuting patterns of migrants and non-migrants using the US census American Community Survey, Public Use Microdata Sample (PUMS)[1]. The PUMS provides individuals' state-level place of residence and work, and mobility status (whether they moved or not). In 2006-2010, a total of 6.8 million individuals were surveyed: 5.9 million persons (86.8%) lived in the same houses (non-movers) while 0.9 million (13.2%) moved. The comparison result (Fig. 1) shows that commuting rates of movers are very similar to those of non-movers (R^2 is 0.9998). Thus, our assumption is not rejected that migrants have the same commuting patterns as the existing residents.

3. Data

We take the county as the spatial unit of migration and commuting. Within a larger unit (e.g., a city or MSA), too much heterogeneity exists to represent a single, cohesive residential community. We use 2006-2010 county-to-county migration and commuting data from the US Census.[2] In this period, a total

[1] Available at http://www.census.gov/acs/www/data_documentation/pums_data/
[2] Available at http://www.census.gov/hhes/migration/ (migration) and http://www.census.gov/hhes/commuting/ (commuting)

of 17.3 million people moved across counties (in 3,143 US counties); and 45.5 million individuals moved within the same counties.

The local factors affecting anchored or unanchored migration are selected based on Han *et al*. (2013), who categorized migration determinants into amenities and economic factors. In this paper, we modify their model to capture explicitly the suggested migration types as shown in eq. (4):

$$log(y_i) = \alpha_0 + \sum_j \beta_j AME_{ij} + \sum_k \gamma_k COM_{ik} + \sum_l \lambda_l AGE_{il} + \varepsilon_i \quad (4)$$

Here, y_i is the number of migrants in terms of in- (or out-) movers to (or from) county *i*. *AME* is the matrix of amenity variables including mean temperature for January, mean hours of sunlight in January, mean temperature for July, mean relative humidity for July, and land topography[3]. Amenity data are from USDA ERS[4]. COM_{ik} is the vector of community variables of county *i* including population density, poverty rate, average travel time to work for workers who did not work at home, and population percent with bachelor's degree or higher. AGE_{il} is a vector of population shares of each age group in county *i* and ε_i is an error term. Community and age data are from US Census 2000, Population Estimates[5], and SAIPE[6]. Table 1 provides a definition and summary statistics for each of the independent variables.

4. Results

By overlapping migration and commuting data using the suggested method, we calculate the number of anchored and unanchored migrants between counties. We estimate that among 62.7 million total movers, 29.5 million nearly half (47.1%) did not change their workplace while 33.2 million (52.9%) changed both their residence and workplace. Importantly, the share of anchored moves (47.1%) is remarkably similar to the percentage of housing-related reason for moving (48.0% in 2012-2013) of Americans (Ihrke, 2013).

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[3] Land topography consists of 21 codes: Plains (1-4), Tablelands (5-8), Plains with Hills or Mountains (9-12), Open Hills and Mountains (13-17), and Hills and Mountains (18-21).
[4] Available at http://www.ers.usda.gov/data-products/natural-amenities-scale.aspx
[5] Available at http://www.census.gov/popest/index.html
[6] Available at http://www.census.gov/did/www/saipe/index.html

Our analysis shows that large and coastal counties and counties in Central and Mountain regions record large anchored migration flows (Fig. 2a and b). Counties in the Central and Mountain regions have large land areas and most employees work within their counties of residence; not surprisingly, the rate of intra-county movers within these large counties is higher than in places elsewhere in the US. As a result, a large part of intra-county movers in the Central and Mountain regions also work within their residential counties and therefore are categorized as anchored migrants. To compensate for the land area effect, we exclude intra-county migrants from the anchored migration model (Fig. 2c and d). The anchored migration with only inter-county movers provides a cleaner migration pattern of migrants who remained "anchored" to their workplace. The total number of inter-county movers is 17.3 million, and the number of anchored migrants is 1.2 million (6.9%).

Anchored migration is limited by the distance over which it is practical to commute. We expect anchored migrants to move shorter distances than unanchored migrants (van Ommeren *et al*., 2000). To verify this hypothesis, we plot the percent of migrants according to their distance moved (Fig. 3). The distance moved is calculated from centroids of the origin and current counties, considering the curvature of the Earth. Intra-county movers are excluded because their distance moved (from one county to another) is zero. The percent of migrants of both types follows a power-law distribution: a large share of migrants moving a short distance, and a few moving a long distance. Among those moving a short distance (less than 50 miles) the percentage of anchored migrants is higher than that of unanchored movers. The extreme distance (longer than 2,000 miles) unanchored migration represents movers to or from Alaska and Hawaii. Beyond a distance moved of 30 miles, the percentage of anchored migration decreases rapidly. This suggests that the 30-mile mark acts as a threshold for anchored migration, reflecting an upper bound on practical commuting distances (Renkow and Hoover, 2000).

To analyze counties' pull and push factors motivating anchored and unanchored migrants, we develop and estimate a county-level cross-section regression model. To mitigate endogeneity concerns we use 10 year lags or beginning period values of the regressors that are likely to be problematic. We use only inter-county migration data.

The anchored and unanchored migration data show distinctive results (Table 2), as might be expected. Natural amenity and residential community factors influence both anchored and unanchored migrants. However, natural amenities have a further effect on unanchored migrants that they do not have on anchored migrants, while the opposite is true of community factors. This is important evidence confirming that the residential quality of communities is a major factor motivating anchored migrants: they are concerned about quality of life factors in the migration destination.

The major common factors that determine place of residence in both anchored and unanchored migration groups are population density and humidity: greater population density and lower humidity are two major pull factors. However, comparing the two groups reveals differences in the sizes of the standardized (beta) coefficients of variables. For anchored migrants, the poverty rate (0.139), commuting time (0.103), and percent of population who are 35–49 years old (0.099) are major pull factors; while January temperature (0.208), percent of residents in the 20–34 age range (0.179), and July temperature (0.153) are major pull factors for unanchored migrants.

These results show the different reasons that motivate moving of each migrant group. As noted, anchored migrants are interested in the quality of new neighbors. Here the poverty rate is important, as assumptions about poverty factor into aspiring migrants' inferences about prospective new neighbors. For unanchored migrants, the standardized coefficient of poverty rate also has a negative effect (0.069), but the standardized coefficient is smaller than that for anchored migrants (0.139).

The standardized coefficient of commuting time is positive for anchored migrants (0.103) but negative for unanchored migrants (-0.044). Places that provide good residential amenities tend to be in suburban areas farther away from cities (workplaces) and have longer commuting times. However, unanchored migrants likely search for places to live in that are close to their workplaces in order to save commuting time and cost. As a result, unanchored migrants have a negative coefficient for commuting time.

The share of 35–49 year olds affects anchored migrants. Children of this age group are expected to enter or be in school. Parents (35–49 years old) generally want to provide a good educational environment as well as good residential amenities to their children; parents may be willing to move to a better school district. Consequently, counties with good educational environment have greater 35-49 year old population shares, and attract more anchored (0.099) than unanchored (0.038) migrants.

5. Conclusion

Employment and residential advantages are well-known factors that motivate migrants. Ideally, migration flows should be categorized into two groups depending on which factor dominates. In this study, we derive anchored and unanchored county-to-county migration data for the US in 2006–2010, depending on whether county-to-county migrants changed their workplace, and we analyze the characteristics of the origin and target moving counties. Based on this analysis, the most important local factors that differentiate between anchored and unanchored migration are poverty rate, commuting time, and age demographics of the county. Distinguishing between these two types of migrant groups allows competing theories of migration to be examined. Our model presents a novel way of doing this, which offers an advantage over existing analyses.

In our anchored migration model, a county has one of three potential roles: as a migrant's origin (residential) county, target (residential) county, or the fixed workplace. The role of the fixed workplace is also important in understanding migration; if a large number of migrants retain the same workplace, this implies that the benefits to keeping one's workplace (e.g., earnings and job satisfaction) are sufficient to offset the cost of moving. Thus, an economic analysis involving industrial structure, earnings, and topological position among other counties would be an interesting extension of this work.

Existing migration studies have focused on the number of in- and out-migrants. Here, different types of movers (e.g., anchored migrants) are collapsed into total migrants, and we only know the shares of a given type of migrant, such as housing-related moves: 48.0% of all moves, family-related moves: 30.3%, job-related moves: 19.4%, and others 2.3%, as shown in Ihrke (2013). However, it is more useful for policy makers and planners to know where different types of people move from and to, e.g., urban to rural, urban to urban, and rural to urban, etc. In this study, we focus on the type of movers between counties, so that we can uncover the structure of migration flows using a network analysis as well as the number of in- and out-migrants. Using the migration and commuting networks by age groups or income, we could also extract the anchored migration network by age group or income-level. The result would provide another perspective on estimating spillover effects of large cities and socioeconomic changes in the US.

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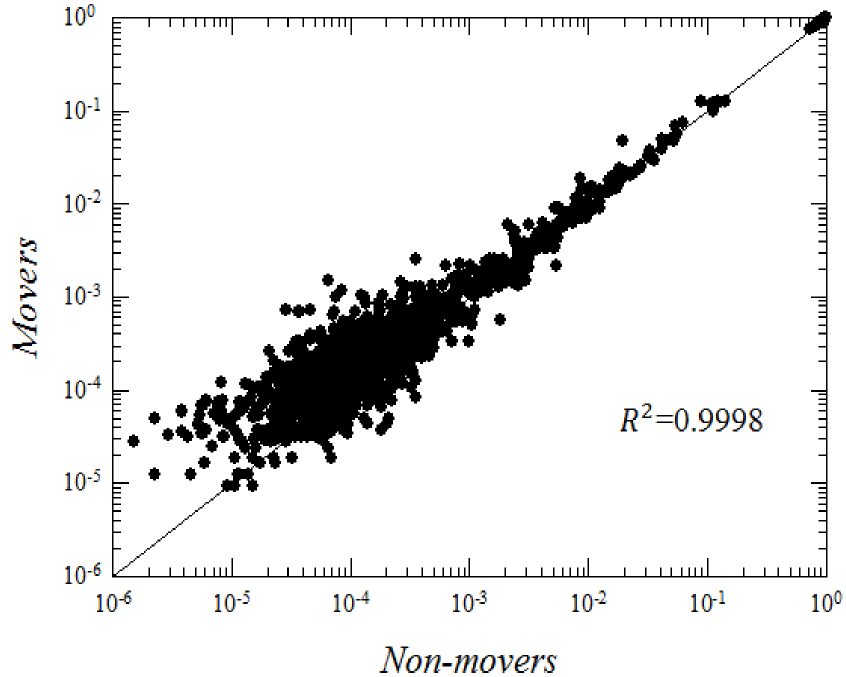

Figure 1. Comparison the commuting patterns of non-movers and movers in 2006-2010.

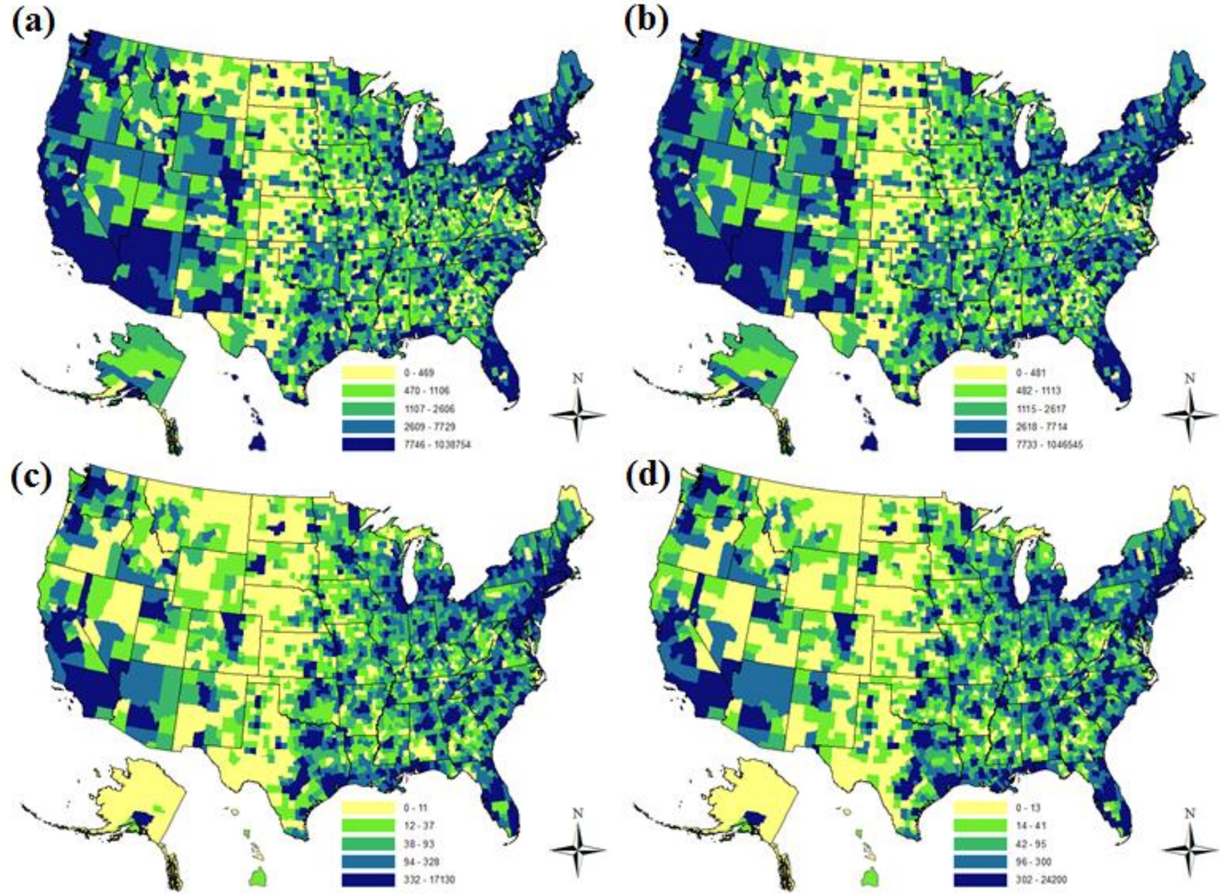

Figure 2. Map of workplace-anchored migration: (a) and (b) is the number of in- and out- anchored migrants using all movers; (c) and (d) is the number of in- and out- anchored migrants based only on inter-county movers (exclude movers in the same county).

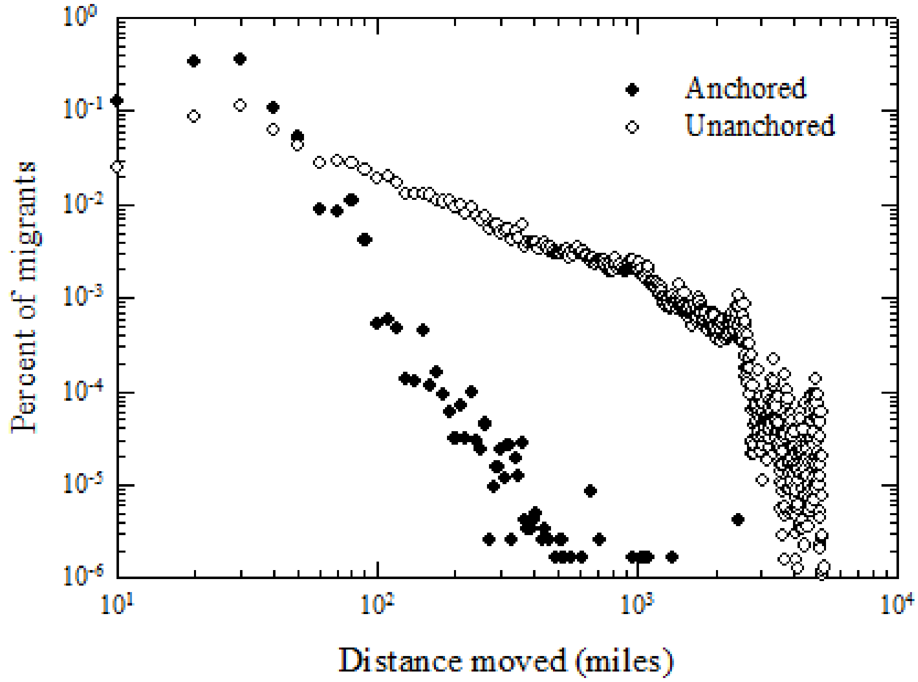

Figure 3. Percent of anchored and unanchored migrants according to distance moved.

Table 1. Description of variables and summary statistics

Variable	description	Obs.	Mean	Std. Dev.	Min	Max
dependent variable						
total_in, log	Total number of in-migrants across counties, 2006-2010	3141	3.23	0.66	0.30	5.33
total_out, log	Total number of out-migrants across counties, 2006-2010	3141	3.24	0.63	0.70	5.56
anchor_in, log	Number of in-migrants who fix their workplace, 2006-2010	3034	1.82	0.83	0.00	4.23
anchor_out, log	Number of out-migrants who fix their workplace, 2006-2010	3038	1.84	0.80	0.00	4.38
unanchor_in, log	Number of in-migrants who change both workplace and residence, 2006-2010	3141	3.21	0.65	0.30	5.31
unanchor_out, log	Number of out-migrants who change both workplace and residence, 2006-2010	3141	3.22	0.62	0.70	5.53
Natural amenity variables						
jantem	Mean temperature for January, 1841-70	3107	32.90	12.02	1.1	66.8
jansun	Mean hours of sunlight January, 1941-70	3107	151.57	33.14	48.0	266.0
julytem	Mean temperature for July, 1941-70	3107	75.86	5.35	55.5	93.7
humidity	Mean relative humidity July, 1941-70	3107	56.12	14.61	14.0	80.0
land topography	Land surface form topography	3107	8.89	6.59	1.0	21.0
Community variables						
pop density, log	population density (person per square mile), 2006	3140	1.63	0.76	-1.40	4.84
poverty	poverty rate, 2006	3137	15.42	6.23	2.5	48.5
commuting time	Average travel time to work for those who did not work at home, 2000	3140	23.43	5.67	6.3	48.7
education	Educational attainment, percent bachelor's degree or higher, 2000	3143	16.53	7.79	4.9	63.7
Aging variables						
age2034	Percent of resident population 20 to 34, 2006	3143	17.61	4.03	8.52	42.71
age3549	Percent of resident population 35 to 49, 2006	3143	21.13	2.07	9.40	34.36
age5064	Percent of resident population 50 to 64, 2006	3143	19.24	2.68	6.48	35.78

Table 2. Regression results for migration and estimated anchored and unanchored migration

	In-migrants			Out-migrants		
	All	Anchored	Unanchored	All	Anchored	Unanchored
jantem	0.204***	0.083***	0.208***	0.193***	0.072***	0.197***
	(12.7)	(4.74)	(12.9)	(12.3)	(4.07)	(12.4)
jansun	0.040***	-0.033**	0.043***	0.041***	-0.033**	0.045***
	(3.12)	(-2.32)	(3.36)	(3.16)	(-2.31)	(3.38)
julytem	-0.145***	0.000	-0.153***	-0.168***	0.003	-0.177***
	(-7.67)	(0.02)	(-8.00)	(-9.24)	(0.13)	(-9.62)
humidity	-0.226***	-0.172***	-0.225***	-0.235***	-0.170***	-0.234***
	(-18.6)	(-12.9)	(-18.1)	(-18.5)	(-12.4)	(-18.0)
land topology	-0.002	-0.022*	-0.001	-0.014	-0.014	-0.013
	(-0.17)	(-1.96)	(-0.08)	(-1.31)	(-1.26)	(-1.26)
pop density, log	0.781***	0.704***	0.781***	0.832***	0.716***	0.833***
	(42.7)	(41.0)	(41.5)	(41.1)	(39.6)	(40.2)
poverty	-0.075***	-0.139***	-0.069***	-0.022*	-0.083***	-0.017
	(-6.06)	(-9.06)	(-5.52)	(-1.78)	(-5.52)	(-1.34)
commuting time	-0.036***	0.103***	-0.044***	-0.040***	0.099***	-0.047***
	(-2.94)	(7.54)	(-3.51)	(-3.07)	(6.78)	(-3.61)
education	0.054***	0.056***	0.054***	0.075***	0.066***	0.075***
	(3.40)	(3.52)	(3.36)	(4.57)	(4.02)	(4.53)
% age20-34	0.177***	0.078***	0.179***	0.078***	0.037*	0.077***
	(8.97)	(3.93)	(8.92)	(4.17)	(1.86)	(4.03)
% age35-49	0.043***	0.099***	0.038**	0.049***	0.106***	0.044***
	(2.76)	(6.97)	(2.36)	(3.12)	(7.5)	(2.72)
% age50-64	-0.036*	-0.081***	-0.034*	-0.064***	-0.092***	-0.064***
	(-1.85)	(-4.20)	(-1.69)	(-3.64)	(-4.66)	(-3.50)
cons.	. ***	.	.***	. ***	.	.***
	(12.0)	(0.41)	(12.2)	(15.9)	(0.65)	(16.1)
N	3105	3013	3105	3106	3016	3106
Adj. R^2	0.8042	0.7473	0.7981	0.7958	0.7230	0.7892

Significance levels: different from zero at *10%, **5%, and ***1% or lower.
Table shows robust standardized coefficients and t-statistics in parentheses.