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Flow of cognitive capital across rural and urban United States

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ABSTRACT

Socioeconomic status and other socio-demographic factors have been associated with selective residential mobility across rural and urban areas, but the role of psychological characteristics in selective migration has been studied less. The current study used 16-year longitudinal data from the U.S. National Longitudinal Survey of Youth 1979 (NLSY79) to examine whether cognitive ability assessed at age 15–23 predicted subsequent urban/rural migration between ages 15 and 39 ($n = 11{,}481$). Higher cognitive ability was associated with selective rural-to-urban migration (12 percentile points higher ability among those moving from rural areas to central cities compared to those staying in rural areas) but also with higher probability of moving away from central cities to suburban and rural areas (4 percentile points higher ability among those moving from central cities to suburban areas compared to those staying in central cities). The mobility patterns associated with cognitive ability were largely but not completely mediated by adult educational attainment and income. The findings suggest that selective migration contributes to differential flow of cognitive ability levels across urban and rural areas in the United States.

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1. Introduction

People tend to move selectively across residential areas depending on their individual characteristics, such as age and income. The geographical distribution of people and their characteristics has important implications for regional demographics and economic development. One of the most studied topics in human geography has been the selective clustering of "human capital" across geographical boundaries, such as urban versus rural regions (Bacolod, Blum, & Strange, 2010; Glaeser & Maré, 2001). The concept of human capital refers to people's skills and traits that contribute to economic production, and it is often assessed on the basis of socio-demographic proxy measures, such as educational qualifications (Bacolod, Blum, & Strange, 2009). Compared to rural regions, urban regions tend to attract individuals with higher education. This may be related to an urban wage premium enjoyed by highly educated individuals (Glaeser & Maré, 2001; Rodgers & Rodgers, 1997), urban lifestyle preferred by individuals with higher education (Clark, 2003), and other benefits or costs associated with educational attainment in different residential areas (Florida, 2003).

While cross-sectional studies based on aggregated population data are informative in demonstrating current geographical patterns of human capital, they cannot fully address the temporal dynamics that generate these patterns, or examine how these demographic processes are connected to underlying psychological characteristics (Rentfrow, 2013; Rentfrow, Gosling, & Potter, 2008). Longitudinal studies following the same individuals over time can examine such patterns of selective migration (Jokela, Kivimäki, et al., 2009). Studies of personality and residential mobility have demonstrated that psychological characteristics may contribute to selective migration, including rural-to-urban migration (Camperio Ciani, Edelman, & Ebstein, 2013; Duncan et al., 2012; Jokela, 2013). For example, neuroticism and openness

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to experience have been associated with higher migration probability (Camperio-Ciani & Capiluppi, 2011; Jokela, 2013; Silventoinen et al., 2008), extraversion has been associated with rural-to-urban migration (Camperio-Ciani & Capiluppi, 2011; Jokela, Elovainio, Kivimäki, & Keltikangas-Järvinen, 2008), and conscientiousness and agreeableness have been associated with lower likelihood of leaving current residence (Jokela, 2009, 2013). Furthermore, aggregate data indicate that regional psychological profiles are correlated with various regional social indicators, such as crime rate and population health (Kura, 2013; Oishi, 2010; Pesta, Bertsch, McDaniel, Mahoney, & Poznanski, 2012; Rentfrow et al., 2008, 2013). Thus, the geographic clustering of psychological characteristics may be related to important social outcomes.

General cognitive ability is one of the important psychological traits associated with educational attainment, ability to learn new skills, and production potential in work environments (Gottfredson, 2002, 2003; Schmidt & Hunter, 2004). Cognitive ability can therefore be considered as a central psychological characteristic that underlies the accumulation of human capital (Rindermann & Thompson, 2013). In the United States, geographical variation in cognitive measures has been reported at the state level (McDaniel, 2006). However, despite the correlation between general cognitive ability and socioeconomic status (Strenze, 2007), it is unknown whether cognitive ability is also associated with selective residential mobility, or whether socioeconomic status contributes to selective urban migration independently of its psychological underpinnings. The latter scenario would indicate a purely socially or culturally driven selective residential mobility in contrast to a process that originates, at least partly, from individual differences in psychological characteristics.

Using data from the 1979 National Longitudinal Survey of Youth (NLSY79), the present study examined the flow of cognitive ability across rural, suburban, and urban areas in the United States. The purpose was to assess whether selective residential mobility across rural and urban regions in adulthood in association with cognitive ability measured in adolescence or young adulthood, and whether these associations are (a) moderated by age, and (b) mediated by educational attainment and household income in adulthood. Marital status and number of children were included as additional mediators, as these are important socio-demographic factors determining migration patterns in adulthood (Kley, 2011). Demographic data show a marked peak in the frequency of residential mobility between ages 18 and 40 (Ihrke & Faber, 2012; Kley, 2011), so the present analysis was focused on this age period.

2. Methods and materials

The ongoing U.S. National Longitudinal Survey of Youth is a nationally representative sample of individuals born between 1957 and 1964 who have been interviewed annually since 1979 and biannually after 1994 (Center for Human Resource Research, 2013). The original sample ($n = 12{,}686$) consists of three subsamples aged 14 to 22 years at baseline in 1979: a representative sample of non-institutionalized civilian youths ($n = 6111$); a supplemental sample designed to oversample civilian Hispanic, Black, and economically disadvantaged nonblack/non-Hispanic youths ($n = 5295$); and a military sample ($n = 1280$). Details of the sampling process have been reported elsewhere (http://www.bls.gov/nls/nlsy79.htm). Due to funding constraints, the number of interviewed military sample and supplemental sample members were limited after the years 1984 and 1990, respectively. The survey is sponsored and directed by the U.S. Bureau of Labor Statistics and conducted by the Center for Human Resource Research at The Ohio State University. Interviews are conducted by the National Opinion Research Center at the University of Chicago. The study was approved by institutional review boards of the institutions conducting the surveys and informed consent was obtained complying with Federal law and the policies of the U.S. Office of Management and Budget.

The sample of the present study included all participants for whom data on cognitive ability were available (assessed in 1980) and who had participated in at least one follow-up study after that between 1980 and 1996 ($n = 11{,}481$ unique individuals with up to 129,424 person-year observations over the follow-up period). The NLSY79 is an ongoing study so the participants have been followed also after 1996. However, the definitions of urban/rural and SMSA locations were changed in 1998, so the variables before and after 1996 could not be combined in a single longitudinal analysis. Given that the follow-up period between 1980 and 1996 already covered the most important residential mobility period of early adulthood, the present analysis was restricted to this 16-year period.

2.1. Measures

In 1980, the participants were administered the Armed Services Vocational Aptitude Battery, which consists of 10 subtests: general science, arithmetic reasoning, word knowledge, paragraph comprehension, numerical operations, coding speed, auto and shop information, mathematics knowledge, mechanical comprehension, and electronics information (Center for Human Resource Research, 2013). Four of the subtests comprise the Armed Forces Qualification Test (AFQT), which includes only the more general, less vocationally specific tests assessing general cognitive ability and is calculated from the scores of arithmetic reasoning, word knowledge, paragraph comprehension, and mathematics knowledge. The present analysis was based on the scores re-normed in 2006 (AFQT-3). Test scores were expressed as percentile rank scores, that is, the proportion of individuals who are below the level of the individual's cognitive ability. In addition, the main results were further illustrated in terms of normally distributed IQ scores calculated as the sum of the four subscales scored using item response theory. The IQ score was standardized to a mean of 100 and a standard deviation of 15 in the sample included in the present analysis.

The over 300 metropolitan areas of the United States can be divided into central city and suburban areas. Central city refers to a major urban center within the metropolitan area (e.g., Baltimore, Memphis, Seattle). Residential locations outside metropolitan areas can be considered as rural. In the present study, a 4-point scale of urban/rural areas was used based on the Metropolitan Statistical Area (SMSA/MSA) categorization that was pre-coded in the NLSY database (see Appendix 6 in (Center for Human Resource Research, 2013) for details). The participants' SMSA/MSA and Place Description (PD) were assigned based on the county, state, and zip code of current residence, and based on these data the participants were assigned to one of four categories: (1) participants not residing in an SMSA/MSA were defined as "not in SMSA"; (2) participants residing in an SMSA/MSA, but not in a central city of an SMSA/MSA according to the PD, were defined as "SMSA, not central city"; (3) participants for whom the PD lead to an ambiguous central city residence status (most often because of zip codes that cover more than one geographically defined area) were defined as "SMSA, central city not known"; and (4) participants residing in both an SMSA/MSA and the central city of an SMSA/MSA according to the PD were defined as "SMSA in central city." A cross-tabulation of the SMSA/MSA categorization and a dichotomous urban/rural category (measured on the basis of urban population proportion of the county of residence) indicated that the percentage of "urban" locations increased from 31.5% to 85.1%, 99.1%, and 99.6% in increasing order of SMSA/MSA categories, indicating that the vast majority of SMSA locations for which central city was not known were urban areas. For the purposes of the present study, the four categories were labeled as "rural" (not in SMSA), "suburban" (SMSA, not central city), "urban" (SMSA, central city not known), and "central city" (SMSA in central city).

Following an earlier study in the same sample (Jokela, Elovainio, Singh-Manoux, & Kivimäki, 2009), socioeconomic status was measured with two separate variables of the highest completed education and household income assessed at each follow-up phase. The participants reported their highest completed grade on a 20-point scale (range from 1 = no education to 20 = 8th year of college or more) and household income as the total net household income from all income sources of the participant and her/his spouse in the past calendar year. In order not to exclude individuals with missing income data, the income scale was first categorized into quintiles and then a sixth category of "missing data" was added for those with no income data available, and this 6-category variable was used as a categorical variable in the analyses. Marital status (0 = not married, 1 = married) and number of children were reported by the participants in each study wave.

3. Statistical analysis

The first analysis examined the average cognitive ability level by the interaction effect between categorically coded 1980 baseline location and subsequent location after 1980, adjusted for sex, race/ethnicity, birth year, subsample, and time-varying age. A second analysis was then performed to examine average cognitive ability level by the interaction effect of residential category in current and in the next follow-up phases across all the consecutive study phases, adjusted for the covariates listed above and baseline residential category. These two analyses were thus conducted with cognitive ability as the outcome variable, and with the residential categories and their interaction effects as the independent variables, adjusted for covariates. The model-predicted ability level percentiles by residential location combinations were calculated from these interaction effects. These analyses were additionally performed with IQ score as the outcome to illustrate the results with another scoring method of cognitive ability (but based on the same cognitive test). Third, a multinomial logistic regression predicting residential location at different ages by cognitive ability was fitted to examine whether and how the associations between cognitive ability and selective migration changed over age.

Given that people's residential locations cannot be considered as fixed at any point in time, especially in early adulthood, each participant was allowed to contribute multiple person-year observations to the dataset. In the first analysis of moving away from baseline location, only 1 person-year observation for each new residential location after 1980 was included in the individual's repeated measurements to avoid including repeated measurements for individuals who stayed in the same location over several years ($n = 19{,}936$ person-year observations of 10,454 individuals, excluding baseline observations). In the second analysis of consecutive follow-up phases, all available person-year observations were included ($n = 129{,}242$ person-year observations of 11,481 individuals). Standard errors were calculated using robust estimator with individuals as the clustering variable to take into account the non-independence of repeated measurements.

Appropriate sampling weights of 1980 were used in all analyses designed to produce nationally representative estimates based on the sample that completed the cognitive ability tests, which take into account sex, race/ethnicity, year of birth, sample type, and location in order to adjust for differential probabilities of selection into the sample.

4. Results

4.1. Descriptive statistics

The sample consisted of 11,481 individuals (50.2% women; 15.9% Hispanic, 25.5% Black, 58.7% White/Other) aged 15–23 at baseline in 1980 (mean age = 18.6, SD = 2.3). The proportion of individuals living in rural and central cities declined with age, while suburban residence became more common (Fig. 1). Adjusted for covariates, the mean percentile scores of cognitive ability at baseline were 46.6 (95% confidence interval = 45.4, 47.8) in rural, 50.5 (CI = 49.4, 51.7) in suburban, 51.9 (CI = 50.5, 53.3) in urban, and 52.6 (CI = 51.1, 54.1) in central-city areas.

4.2. Cognitive ability and migration

Individuals moving to central cities from less urban areas had higher cognitive ability than their counterparts remaining at their baseline residential category (Fig. 2A). The average difference in cognitive ability between individuals moving and not moving to a central city from their baseline residence was 12 percentile points for those from rural areas (linear trend in cognitive ability levels over the four residential areas for those from rural areas, i.e., when a linear effect was fitted over the four points of the left-most line in Fig. 2A, was B = 3.79 cognitive percentile points per 1-unit difference in rural/urban residence, CI = 3.03, 4.55), 7 points

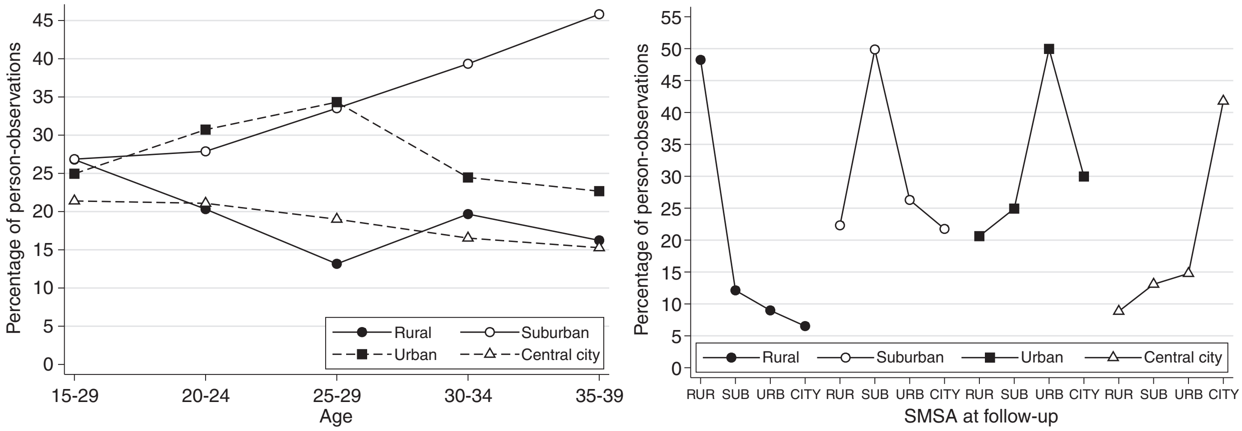

Fig. 1. Percentage of participants living in different residential areas by age (left panel), and the percentage of participants moving away or staying at the baseline residential category after baseline (right panel).

for suburban area (B = 2.69, CI = 1.84, 3.53), and 5 points for urban area (B = 0.41; CI = −0.54, 1.36). A reverse association was observed for central-city residents, among whom individuals moving to urban or suburban areas had 2–4 percentile points higher cognitive ability than those who stayed in central cities (B = −1.74; CI = −2.63, −0.85, for linear trend excluding individuals moving to rural areas). These gradients were attenuated considerably when adjusted for socioeconomic status (Fig. 2B); the linear trends were attenuated to B = 1.09 (CI = 0.44, 1.74) for rural areas, B = 0.52 (CI = −0.15, 1.20) for suburban areas, B = −0.08 (CI = −0.88, 0.73) for urban areas, and B = −0.60 (CI = −1.27, 0.05) for central cities. After socioeconomic status had been taken into account, adjusting for marital status and number of children had negligible effect on the associations (data not shown).

In 1980, the participants were aged between 15 and 23 years, so many of them had already moved away from their parents and possibly from their childhood/adolescent residential area. The results shown in Fig. 2 did not change substantially when individuals older than 18 years at baseline were excluded from the analysis (data now shown). This suggests that baseline residential category in the total sample functioned as a sufficiently good proxy for adolescent residential location despite the fact that some of the participants were already young adults at baseline.

Fig. 3 illustrates the associations between adolescent cognitive ability and selective migration when considering all the consecutive study years across the total follow-up time instead of keeping the baseline residence constant. The patterns were very similar to the analysis of baseline-to-later residence analysis presented in Fig. 2, with rural-to-urban migration being associated with higher cognitive ability, except for out-migration from central cities, which was also associated with higher cognitive ability. These patterns were attenuated when adjusted for socioeconomic status; linear trends for the adjusted associations for cognitive-ability percentile associated with 1-unit difference in rural/urban

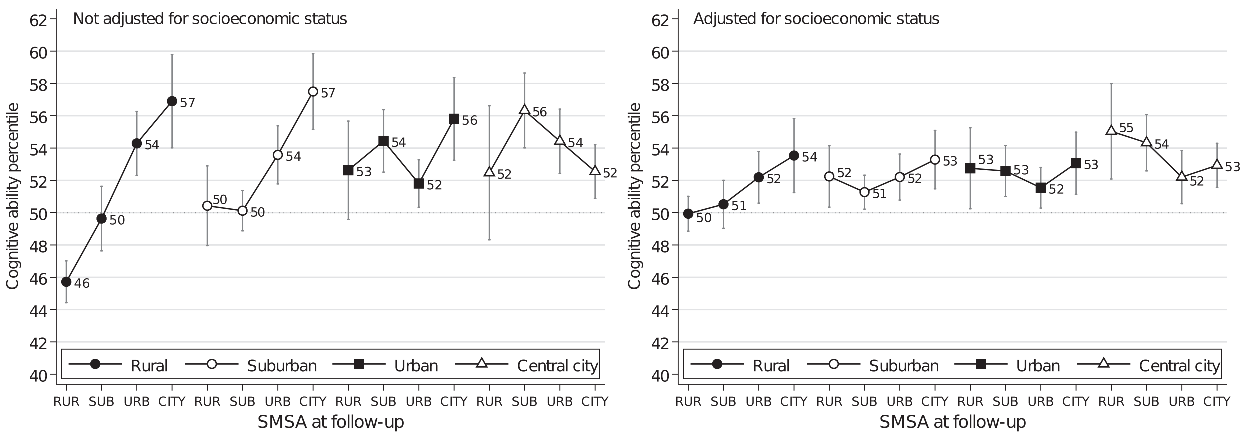

Fig. 2. Residential mobility from baseline residence (separate lines) to later residential location (x-axis) associated with adolescent cognitive ability (y-axis). For example, individuals from rural areas who stayed in a rural area were in the 46th percentile of cognitive ability while individuals who were from rural areas and later moved to central cities were in the 57th percentile. Left-hand panel shows results of model not adjusted for socioeconomic status, right-hand panel shows the results of model adjusted for socioeconomic status. Both models were additionally adjusted for sex, age, subsample, and race/ethnicity. Error bars are 95% confidence intervals. N = 16,929 person-observations from 10,181 participants.

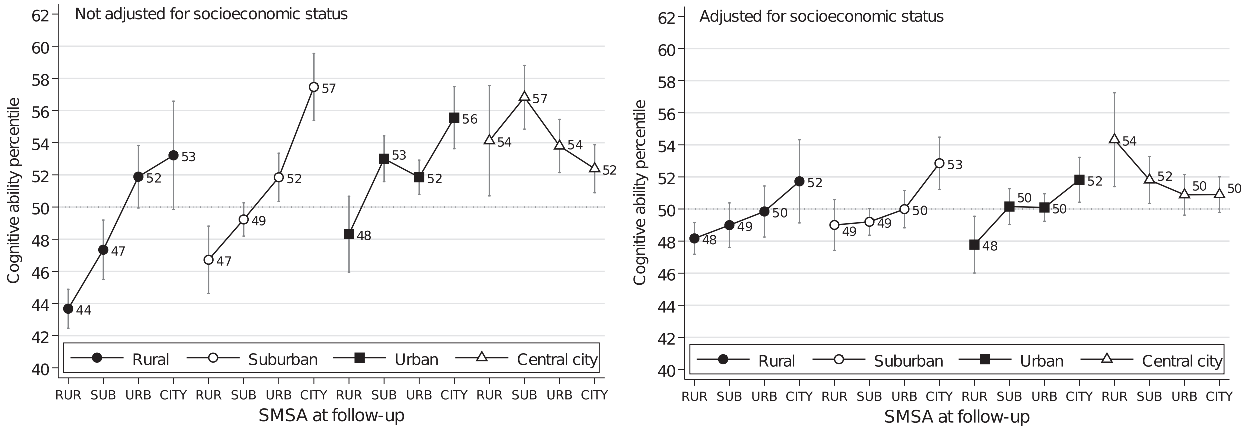

Fig. 3. Residential mobility from current residence (separate lines) to residence at the next study wave (x-axis) associated with adolescent cognitive ability (y-axis). For example, individuals who lived in a rural area across two consecutive study waves were in the 44th percentile of cognitive ability while those who moved from rural area to central city between two consecutive study waves were in the 53rd percentile. Left-hand panel shows results of model not adjusted for socioeconomic status, right-hand panel shows the results of model adjusted for socioeconomic status. Both models were additionally adjusted for sex, age, subsample, and race/ethnicity. Error bars are 95% confidence intervals. N = 129,242 person-observations from 11,482 participants.

mobility were B = 0.98 (CI = 0.34, 1.62) for rural, B = 1.27 (CI = 0.63, 1.91) for suburban, B = 0.85 (CI = 0.22, 1.48) for urban, and B = −0.61 (CI = −1.23, 0.00) for central city. After socioeconomic status had been taken into account, adjusting for marital status and number of children had negligible effect on the associations (data not shown). The above analyses were then repeated with IQ score instead of ability percentile as the outcome. Table 1 reports the results presented in Figs. 2A and 3A as IQ scores with mean of 100 and standard deviation of 15.

Results from multinomial logistic regressions (Table 2) showed that the association between cognitive ability and selective urban migration changed with age; it was the strongest at ages 25–29 after which it became weaker.

4.3. Attrition analysis

Some of the longitudinal patterns reported above might have been biased if cognitive ability was differently associated with selective attrition in rural vs. urban areas, for example, if individuals with high cognitive ability were more likely to drop out from the study in rural compared to urban areas, so that high-ability individuals in rural areas would become underrepresented over time. To examine attrition related to cognitive ability and current residential area, a multilevel logistic regression was fitted in which the interaction effects between cognitive ability and categorically coded current residential area (and their main effects) were used to predict the probability of dropout in the next study wave (0 = participated, 1 = did not participate). When examining only main effects, higher odds of dropout were associated with time (OR = 1.06 per 5 years, CI = 1.02, 1.09, $p < 0.001$) and marginally with higher cognitive ability (OR = 1.01 per 10 percentile points, CI = 1.00, 1.02, p = 0.052), and compared to rural areas the probability of dropout was higher in central cities (OR = 1.23, CI = 1.11, 1.36, $p < 0.001$) but not in urban (OR = 1.04, CI = 0.95, 1.14, p = 0.39) or suburban areas (OR = 1.04, 0.95, CI = 0.95, 1.14, p = 0.38). However, there were no interaction effects between cognitive ability and residential location (all

Table 1
Levels of IQ assessed at age 15–23 by subsequent residential mobility patterns in adulthood.

Destination					
Origin	Rural	Suburban	Urban	Central city	p For trend
Model 1. From baseline residence to later residence					
Rural	97 (96, 97)	99 (98, 100)	101 (100, 102)	102 (101, 104)	<0.001
Suburban	99 (98, 100)	99 (99, 100)	101 (100, 102)	103 (102, 104)	<0.001
Urban	100 (99, 102)	101 (100, 102)	100 (99, 101)	102 (101, 103)	0.57
Central city	100 (98, 102)	102 (101, 103)	101 (100, 102)	100 (99, 101)	<0.001
Model 2. From current residence to residence the following year					
Rural	97 (96, 98)	99 (98, 100)	101 (100, 102)	102 (100, 103)	<0.001
Suburban	99 (97, 100)	100 (99, 100)	101 (100, 102)	104 (103, 106)	<0.001
Urban	99 (98, 101)	102 (101, 103)	101 (101, 102)	103 (102, 104)	0.01
Central city	102 (100, 104)	104 (103, 105)	102 (101, 103)	101 (101, 102)	<0.001

Note: Values are estimated means (and 95% confidence intervals) of IQ scores (Mean = 100, SD = 15), adjusted for sex, race/ethnicity, subsample, and age. Model 1 replicates the results of Fig. 2 (N = 16,929 person-observations from 10,181 participants), Model 2 replicates the results of Fig. 3 (N = 129,242 person-observations from 11,482 participants) with IQ score instead of cognitive ability percentile as the outcome. p-Values for trends are linear trends from linear regression models. See text and Figs. 2 and 3 for details.

Table 2
Association of adolescent cognitive ability with later residential location by age.

Age	Rural (ref.)	Suburban	Urban	Central city
15–19	1.00	1.07 (1.04, 1.10)	1.08 (1.05, 1.11)	1.09 (1.05, 1.13)
20–24	1.00	1.07 (1.05, 1.10)	1.11 (1.09, 1.14)	1.13 (1.10, 1.16)
25–29	1.00	1.10 (1.07, 1.13)	1.16 (1.12, 1.19)	1.19 (1.15, 1.23)
30–34	1.00	1.08 (1.05, 1.11)	1.11 (1.07, 1.15)	1.15 (1.11, 1.20)
35–39	1.00	1.06 (1.01, 1.10)	1.07 (1.02, 1.12)	1.08 (1.02, 1.15)
p-value*	–	0.09	<0.001	<0.001

Note: Values are odds ratios (and 95% confidence intervals) per 10 percentile points of cognitive ability from a multinomial logistic regression predicting location of residence at different ages, with rural residence as the reference category. * p-value indicates the overall of age-by-cognitive ability interaction effect. The model is adjusted for sex, race/ethnicity, baseline residential area, and subsample membership, with baseline sampling weights and robust estimation of standard errors taking into account repeated person-observations (n = 124,775) from n = 10,685 unique participants.

p-values > 0.16), indicating that the dropout risk associated with cognitive ability was not different in different residential areas.

5. Discussion

Higher cognitive ability was associated with selective rural-to-urban residential mobility. This selection effect peaked when the participants were in their late 20s after which it became weaker. However, cognitive ability also predicted higher probability of moving away from central cities to suburban and rural areas, suggesting that the selection effect was not only unidirectional from rural to urban regions. The selective mobility patterns associated with cognitive ability were largely mediated by income and educational attainment achieved later in adulthood. Thus, the residential-mobility patterns associated with socioeconomic status appear to be linked to underlying cognitive ability differences measured in adolescence and young adulthood.

It is important to emphasize that cognitive ability was measured in adolescence or young adulthood (between ages 15 and 23), so all the analyses were concerned with how early cognitive ability gets differently distributed across rural–urban continuum over time in adulthood. This is a strong methodological setting for the analysis of selective migration, as the observed patterns cannot be confounded by reverse causality, that is, by effects of adult residential mobility on cognitive ability. People's residential locations were determined based on address and census data instead of participants' self-reported data of urban/rural residence, so the results were not affected by reporting bias either. The main limitations of the study were the lack of other measures of residential location besides urban/rural continuum and the focus on early adulthood only. The present analysis covered only one time period between 1980 and 1996. The patterns of residential mobility associated with cognitive ability may have changed with the changing social demography of cities, suburbs and rural areas (Barcus, 2004; Kasarda, Appold, Sweeney, & Sieff, 1997; Li, Campbell, & Fernandez, 2013). The associations may also vary across regions or states of the United States, which needs to be examined in more detail with more specific geographical data. Finally, the present analysis did not yet address the potential long-term population implications of selective migration patterns associated with cognitive ability; demographic models and simulations that take into account the population structure and proportions of individuals moving across urban and rural areas are needed for this purpose.

Cross-sectional analysis of urban/rural differences indicated higher cognitive ability level in central cities compared to rural areas. This is in agreement with studies reporting higher levels of social capital and economic productivity in urban areas (Bacolod et al., 2010; Glaeser & Maré, 2001). Some studies have also reported higher creativity among children living in urban compared to rural areas (Shi, Lu, Dai, & Lin, 2013). However, the longitudinal analysis showed that the highest average level of cognitive ability was among individuals who lived in rural areas as adolescents and moved to central cities as adults. Thus, longer distances of rural-to-urban mobility select for higher cognitive ability of individuals.

With respect to the other direction of mobility, individuals who were living in central cities but later moved to suburbs or rural areas had higher cognitive ability than those who stayed in central cities. Migration patterns in the United States have long been characterized by suburbanization where the more affluent households, especially families with children, tend to move outward from the urban cores to the suburbs (Kasarda et al., 1997; Sanchez & Dawkins, 2001). Given that cognitive ability is related to higher socioeconomic status (Strenze, 2007), the suburban migration associated with cognitive ability may reflect the suburbanization of higher-income families. In line with this, adjusting for socioeconomic status accounted for most of the city-to-suburban migration, as shown by the right-most line in Fig. 3B when compared to the corresponding line in Fig. 3A. However, Fig. 3 also shows that socioeconomic status did not explain the higher cognitive ability associated with city-to-rural migration, indicating that the suburbanization of affluence may not account for all the higher ability levels related to city-to-rural migration. Although suburban migration is often associated with having children (Sanchez & Dawkins, 2001), marital status and number of children did not account for the associations between cognitive ability and migration across rural, suburban, and urban areas.

Adjusting for socioeconomic status in adulthood substantially attenuated the associations between cognitive ability and selective migration. This suggests that underlying cognitive-ability differences get differently distributed across rural and urban areas largely because educational attainment and household income are related to selective urban/rural residential mobility (i.e., mediation effect). The age effect (i.e., weakening association between cognitive ability and rural-to-urban migration after age 30) probably reflects people's overall life-course migration patterns that change depending on life stages and social roles, such as leaving parental home, going to college, getting married, having children, and establishing a stable career (Kley, 2011). Individuals pursuing education and work opportunities in high-skilled occupations, which are associated with higher cognitive ability (Strenze, 2007), are more likely to move in central cities in their 20s, but then move to suburban areas in their late 30s when the suburbs provide less housing stress (Wolpert, 1966) and higher place utility for families (Kley & Mulder, 2009) compared to the urban areas, including safer neighborhoods and larger homes (Jargowsky & Park, 2009; Sanchez & Dawkins, 2001). These life-course changes may help to explain the bidirectional associations of higher cognitive ability in residential mobility across rural, suburban, and urban areas.

In conclusion, the current results suggest that the average levels of cognitive ability get differently distributed across urban and rural areas of the United States as a result of selective migration. Higher cognitive ability measured in adolescence or young adulthood predicts both rural-to-urban migration and higher migration from central cities to suburban and rural areas. These associations were largely, but not completely, mediated by socioeconomic status, suggesting that the migration patterns associated with educational attainment and income are connected to underlying differences in cognitive ability. The relative importance of cognitive ability in predicting migration across rural and urban areas appears to depend on age, so that the association with rural-to-urban migration is amplified when people are in their late 20s. More detailed demographic analysis is needed to determine the population-level implications of residential mobility associated with individual psychological characteristics.

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