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Implications of Boundary Choice for the Measurement of Residential Mobility

Michael J. White
Population Studies Center, Urban Institute, 2100 M Street, N.W., Washington, D.C. 20037
Peter R. Mueser
Department of Economics, University of Missouri, Columbia, Missouri 65211

Analyses of residential mobility are usually conditioned on a system of geography in which territory is divided into discrete units. Types of movement are defined in terms of these units, the most important distinction being that between local mobility and migration. Here we examine explicitly the implications of the choice of the migration-defining boundary in the U.S. over the 1940–1980 period. We demonstrate how boundary choice influences the extent and character of selectivity of the mobile population by using demographic and social characteristics. It appears that over time the state line may be replacing the county line in distinguishing kinds of migrants. Further, our results point to a growing fraction of footloose migrants, not tied to local territory, identified by their migration history rather than demographic characteristics.

Residential mobility is a demographic event that is defined in terms of geography. Although it is possible in theory, and occasionally in practice, to treat spatial mobility in terms of distance traversed, it is more common to identify moves in terms of discrete geographic units.

Perhaps the most important distinction in the classification of residential mobility rests on the choice of the "migration-defining boundary," which distinguishes local mobility from migration. Conventionally, the choice of this boundary identifies a distinct set of regions, with the movement between them defined as migration. This distinction speaks to the central issue in the residential mobility literature: that of separating movement within communities or local markets (especially local labor markets) from movement between them. The two types of mobility are likely to have both different causes and different consequences. Indeed, two areas with limited overlap have arisen in the literature to discuss and analyze the two components of population mobility. For examples of recent reviews, see Ritchey (1976), Quigley and Weinberg (1977), and Clark (1982).

What difference does the choice of this boundary make? Not only does the imposition of a boundary distinguish between types of social processes, but presumably the imposition of more stringent or "higher order" crossing criteria is more selective of population characteristics. In this article, we treat the issue of the choice of migration-defining boundary and selectivity directly. First, we analyze the difference in accounting introduced by different choices of boundaries. Second, we determine how well the groups defined by the boundaries they cross are distinguished by social and demographic characteristics. Third, we inquire into how the influence of the migration-defining boundary changed from 1940 to 1980, during which time the social and demographic importance of distance presumably declined.

Conventional demographic definitions of migration in the U.S. rely on the county as the migration-defining unit.[1] The county has the advantage that its boundaries are relatively stable over time and are easily recognized by most survey respondents. It has become the custom at the U.S. Bureau of the Census to treat the county boundary as migration defining, although it is not an "official" definition (Long, in press:15). Since the 1940 census, when the first place-of-previous-residence questions were asked, Census Bureau tabulations regarding residential mobility have become increasingly detailed, allowing the researcher to define the geographic system as he or she sees fit. The published 1940 census tabulations used counties and cities with population of more than 100,000 as the basic units, and some 1960 and 1970 census tabulations were based on state economic areas (aggregations of counties).

Actual practice in the research literature has exhibited considerable variation, depending on the researchers' sources of data and predilections. Lansing and Mueller (1967) employed metropolitan area boundaries and counties outside of metropolitan territory. Shryock (1964) devoted an entire chapter to concepts and definitions of migration, reviewing the Census Bureau's decisions regarding the 1940 census and the reasons for the emphasis on the county boundary.[2] His own analysis of mobility (1964:chap. 5) used the county as the migration-defining boundary but treated movements across other geographic territory as well. Schwartz (1973), in an explicit analysis of the effects of distance on migration, used data on interdivisional flows in the U.S. DaVanzo (1983), using panel survey data, aggregated counties into metropolitan areas and state economic areas and used these as the definitive boundaries for migration. Greenwood (1981) presented data from Current Population Surveys on intracounty, intercounty, and interstate mobility, labeling the last two as the usual migration tabulations. Mincer (1978), in focusing on family migration decisions, used the county to define migration.

Empirical analyses that rely on the calculation of migration for places rather than on individual-level tabulations have emphasized metropolitan areas, states, and census regions. Bowles (1970), in an examination of the human capital model, used an interregional definition of migration: movement out of the South. Long (1978) also used regions in specifying migration among the poor. Cebula (1979) focused on either states or metropolitan areas.

Multiregional demographic analyses tend to employ larger regions for the analysis of population distribution. In the Migration and Settlement Project of the International Institute for Applied Systems Analysis, most national studies involved no more than 12 regions per country, defining migration as movement between these regions (Rees and Willikens, 1985:40). For example, in their contribution for the U.S., Long and Frey (1982) made use of the nine census divisions. The Penn Study, *Population Redistribution and Economic Growth, United States 1870–1950*, used states to define migration, using primarily residual estimates of net migration (Kuznets, Miller, and Easterlin, 1960).

DaVanzo's *Why Families Move* (1976) is one of the few studies that analyzed the same model under different geographic schemes. Using a moderate-sized sample of family heads from the Panel Study of Income Dynamics and employing a linear probability model, DaVanzo showed, for six geographic schemes, that some individual determinants of migration change appreciably according to the definition used (pp. 30–31). Long and Boertlein (1976) discussed the difficulty of finding a standard administrative geography for the measurement of mobility and migration. In their own tabulations, they used multiple geographic schemes to facilitate international comparisons. In the developing-country context, Radloff (1983:23–25) showed how the number of reported migrants declines with a more stringent "territorial threshold," that is, larger geographical units. Long, Tucker, and Urton (in press), using survey data with self-reporting of distance moved, determined that the

median distance for intracounty movers is 3.9 miles, for intercounty movers within a state, 39.8 miles, and for interstate movers, 800 miles.

If mobility is progressively selective of the population for more major moves, then choice of boundary will influence both the number of events counted and the estimates of the determinants of migration. We propose to determine to what extent such differences are important and how they have changed over time.

Data and Methods

Several schemes, partially overlapping, are available for classifying mobility based on U.S. census data. The first is the traditional Census Bureau classification, based on county, state, and regional boundaries, which are hierarchical. A second scheme recognizes the economic and residential integration of metropolitan areas and differs from the traditional classification by defining intrametropolitan moves between counties as local. A third scheme, also used in some Census Bureau tabulations, distinguishes interstate movements according to whether they are between contiguous or noncontiguous states. These schemes are represented in Table 1. We explored additional classifications, including those that employed the central city boundary, and metropolitan–nonmetropolitan movement but dropped them in favor of the present scheme.[3]

Our data are taken from the Public Use Microdata Samples (PUMS) for 1940, 1960, and 1980 (U.S. Bureau of the Census, 1975, 1983a,b). Mobility is coded on the basis of

Table 1. Comparative Mobility Classification Schemes, 1935–1940 and 1975–1980, Percentage of U.S. Residents Aged 18 and Over

		SMSA classification, between counties		State contiguity classification, between states	
Conventional classification	Total	Within metropolitan area	Other moves	Contiguous states	Noncontiguous states
		1975–1980 (N = 23,837)			
Same house	54.8				
Intracounty	25.1				
Intercounty	9.9	2.5	7.4		
Interstate	4.7	0.3	4.5	2.7	2.0
Interregion	5.5	0.0	5.5	0.5	5.1
Total		2.8	17.4	3.2	7.1
		1935–1940 (N = 24,596)			
Same house	41.6				
Intracounty	46.8				
Intercounty	5.9	0.8	5.0		
Interstate	3.0	0.2	2.8	2.2	0.8
Interregion	2.7	0.0	2.7	0.3	2.4
Total		1.0	10.5	2.5	3.2

Note: Conventional classifications are defined as follows: same house, no move; intracounty, moves within a county; intercounty, moves within a state; interstate, moves within a region; interregion, moves between regions (Northeast, North Central, South, and West, as defined by the U.S. Bureau of the Census). Metropolitan areas for 1975–1980 are those so classified in 1980. Metropolitan areas had not been designated for 1940; however, the 1940 Public Use Microdata Sample files classified territory and mobility on the basis of geography for 1950 standard metropolitan areas. SMSA = standard metropolitan statistical area.

reported residence five years prior to the Census, so multiple and return moves within the period are impossible to record. Previous analyses of residential mobility for 1940 have relied solely on published tabulations, employing the scheme in use at that time, in which movement between counties or across the boundary of a city of 100,000 persons is coded as migration. The 1960 PUMS provides less detail on mobility than is available in the other samples. The conventional county-based tabulation is available, but geographic information necessary to construct other migration classification schemes is lacking.[4]

Our sample for analysis was all persons aged 18 and over who resided in the U.S. in the census year and five years before. Subject to the age restriction, this sample is representative of the adult population who were exposed to the risk of internal migration in the five-year period, remained in the U.S., and survived to the census date. In 1940 about 3 percent of the resident U.S. population had resided abroad five years before; in 1980 the proportion had declined to 1.9 percent. For 1940 we selected a random sample from the PUMS of 24,596; our 1980 analysis is based on 23,837 cases for which the Census Bureau has coded migration information. The 1960 comparison sample included 10,625 cases.

How Many Movers?

From an accounting standpoint, where one draws lines on the earth's surface will affect the number of persons classified in different mobility categories. Table 1 demonstrates the implications of boundary choice in 1940 and 1980. Column 1 presents the five-category conventional tabulation. In 1980 the majority of adults were residing in the same house as in 1975, up appreciably from the 1935–1940 period. One-fifth of the population, about 44 percent of the mobile population, crossed a county boundary and could be classified as migrants. In 1940 only 11.6 percent of the population (20 percent of the mobile population) could be so classified.

One major change in the distribution of the population in the U.S. over this 40-year period is the increasing concentration of the population in metropolitan areas, whose number and territorial extent have grown. In 1940 52.6 percent of the population resided in 168 standard metropolitan areas (defined as of 1950), containing about 250 counties. By 1980 74.8 percent of the population resided in 318 standard metropolitan statistical areas (SMSAs), containing more than 800 counties.

Since metropolitan areas are designated to approximate local labor markets,[5] one may choose to classify all individuals who move within metropolitan areas as "local movers," even when they cross a county boundary. Columns 2 and 3 apply this correction, with metropolitan areas defined as of the date of the respective census. The magnitude of this correction is greater for 1980 than for 1940. In the recent census, 14 percent of all movers who crossed a county boundary remained within the limits of a metropolitan area. (Some of these were even interstate migrants.) In 1940 9 percent of all intercounty movers remained within metropolitan areas. The increasing importance of intercounty–intrametropolitan mobility is recognized by recent Census Bureau tabulations in the Current Population Survey, which offer this cross-tabulation. Even after this correction, however, the 1980 population contains many more migrants than the 1940 population.

Another oft-used scheme breaks up the interstate migrants not by regional designation but, rather, by state contiguity. The presumption is that since moves to noncontiguous states must be of some minimum distance, they will be more selective of characteristics associated with migration. Of interstate movers in 1940, 39 percent moved within regions and to contiguous states; by 1980 this figure had declined to 26 percent. By contrast, half of all interstate movers (5 percent of all persons) moved to a noncontiguous state outside of the region of origin during 1975–1980 versus 42 percent (2.4 percent of persons) for the prior period.

In sum, despite the decline in overall mobility for the latter period, the tabulations testify to the weakening of local boundaries in restraining the population. It remains to be seen just how different are the kinds of people who undertake these moves.

Mobility and Population Selectivity

It is well known that the mobile and migratory populations are selective of a number of characteristics. Thomas (1938), in one of the oldest extensive analyses of selectivity with respect to internal migration, analyzed differentials by age, sex, family status, health, intelligence, occupation, and motivation. The migratory population tends to be especially selective with respect to measures associated with human capital, such as age and education. Selectivity of the population of local movers is linked predominantly to characteristics of the life cycle. Thus compared with persons who remain in their present residences, local movers tend to be younger, childless (or with preschool children), and renters. Changes in family size (recent or anticipated) are especially linked to movement within the community (Graves and Linneman, 1979).

Table 2 compares characteristics of the U.S. adult population classified by type of mobility in the previous five years for 1940 and 1980. In both periods, compared with nonmovers, movers were younger, better educated, and less likely to be homeowners or to have school-aged children. Moves between counties are further selective by individual characteristics. Such longer moves are more likely to be made by those who are younger, and more educated, and by those who have been in college or in the armed forces five years before.

The conventional classification of migrants as those moving between counties is supported by these statistics. In both periods, among the mobile population, the differences in characteristics are most marked between those making intracounty moves and those making moves involving at least a change of county. For example, in 1980 the average level of education for those moving between counties is about one year greater than that for intracounty movers, but the differences among the three categories of movers who change counties is less than one-half year. Such a pattern holds for 8 of the 12 variables presented in Table 2.

The primary exception is the measure of the proportion living outside their state of birth at the beginning of the migration period. Of those who moved within a state between 1975 and 1980, fewer than 40 percent had been living outside their state of birth in 1975. In contrast, the figure is more than 80 percent for those who moved between states. This represents partly a return to a home state, but the relationship is much too strong for this to be the primary cause. Clearly, residence outside the state of birth[6] identifies individuals with relatively weak ties to their states, for whom moving to yet another state is highly likely. Residence outside the state of birth has a similar relationship to migration in the 1940 data, but it is much weaker. It appears, then, that the class of footloose migrants may have grown in the last 40 years.

Although these comparisons are suggestive, since each individual characteristic must be considered separately, it is not possible to infer the joint impact of the measures on mobility status. To judge the overall selectivity of various kinds of mobility, and thus to identify the importance of alternative boundary choices, it is necessary to use a multivariate technique. We have chosen discriminant analysis.[7] We consider the population we observe in 1980 to be members of distinct subpopulations according to their mobility statuses. We wish to determine how well these groups can be separated in multivariate space and what characteristics best predict that separation.

The procedure we use produces a sequence of discriminant functions that span the space occupied by the classification measure. The functions are specified to be hierarchical:

Table 2. Selected Characteristics of the Population by Mobility Status, U.S. Residents Aged 18 Years and Older

Mobility	1940	1980	1940	1980	1940	1980	1940	1980
	Mean age		% black		% outside state of birth 5 years before		Mean years of education	
Same house	44.3	49.2	6.9	11.0	34.6	36.0	8.5	11.4
Intracounty	38.6	36.5	11.6	12.2	38.5	37.0	8.6	12.0
Intercounty	36.5	35.0	5.6	6.6	30.2	35.5	9.6	12.7
Interstate	34.9	34.8	7.8	7.7	49.3	81.9	10.1	13.1
Interregion	36.5	35.1	8.4	7.4	49.7	81.8	10.4	13.1
Total sample	40.6	43.1	9.1	10.5	37.0	40.9	8.7	11.8
	% in armed forces, 1975		% in college, 1975		Per capita household income*		% managerial workers	
Same house	NA	0.3	NA	2.8	311	8,064	2.6	13.7
Intracounty	NA	1.0	NA	8.4	333	7,794	3.1	16.2
Intercounty	NA	1.3	NA	14.1	288	7,476	5.7	21.1
Interstate	NA	4.0	NA	12.9	344	7,343	5.9	22.8
Interregion	NA	5.2	NA	14.1	377	7,890	4.7	23.3
Total sample	NA	1.0	NA	6.5	323	7,895	3.2	16.0
	% with preschool children		% with school-aged children		% female-headed households		% homeowners	
Same house	NA	2.8	NA	21.6	10.5	9.4	67.6	82.4
Intracounty	NA	16.1	NA	16.9	8.2	11.2	31.2	53.8
Intercounty	NA	14.0	NA	14.5	4.3	6.1	26.6	51.6
Interstate	NA	13.6	NA	15.0	7.0	6.1	25.9	45.5
Interregion	NA	14.1	NA	13.3	7.8	6.3	21.0	47.9
Total sample	NA	8.3	NA	18.9	8.9	9.2	45.4	68.5

Note: See Table 1 for explanation of classifications. NA = not applicable.
* In 1940 only wage and salary income sources were obtained.

The first one explains the maximum amount of variance in the space attributable to a single dimension, the next factor, the maximum that can be explained of the remaining variance, and so forth. For each function, we can calculate a mean score for each group—a group centroid—in standardized space. The plot of centroids is a measure of how well the particular functions discriminate between members of the various groups.

We will examine how the groups are aligned relative to one another so that we may see which categories of the classification may be collapsed with a minimum loss of information. Further, we will explore how alternative classification schemes (i.e., those based on SMSAs or state contiguity) alter results. To measure how the classification system performs over time, we compare the results for 1940 and 1960.

Results of Discriminant Analysis

Using the 1980 PUMS, we performed discriminant analysis for the five-category conventional typology, then for the SMSA-based and contiguity classifications. For the conventional typology we repeated the analysis for a more limited set of variables that were comparable to the characteristics available in the 1940 PUMS. We also carried out discriminant analysis on the 1940 and 1960 PUMS. Measures indicating explained variance for several of these models are presented in Table 3.

Predetermined characteristics available in the decennial census explain much of the variance in mobility. Panel A shows that sex, age (through a fifth-order polynomial, orthogonalized through regression), ethnicity (dummy variables for black, other nonwhite, and Hispanic), employment and schooling status at the beginning of the period, years of education, and the state of birth at the beginning of the period reduce Wilks's lambda to 0.70788 in the total sample.[8] Adding 12 more variables to the analysis further reduces lambda by 2.6 percent to 0.68963. Most of this decline is due to five measures of family composition. Measures of occupation, income, and labor force participation contribute less to explained variance.

The final variable included in these equations is home ownership. Even when entered last, home ownership adds appreciably to the discriminating power of the functions. Since this characteristic is measured at the time of the census, the causal influence of the estimated effect of home ownership is problematic. In analyses using panel data, owning a home is consistently found to be a substantial deterrent to local mobility and somewhat of a deterrent to migration (DaVanzo, 1976). Home ownership may reflect individual expectations about future mobility, but the causal connection is more complex. An individual may move expressly to change housing tenure, as most owner-occupants move when they purchase their dwelling; so home ownership may, in some sense, cause mobility. Whatever the causal relations, the observed association is of interest here. The importance of home ownership in predicting mobility status underscores the tie between mobility and other life choices, whether these are determinants or consequences of relocation.

When we repeat this analysis for the SMSA-based and contiguity classifications, we obtain similar results. This is as expected, since most migrants are categorized similarly in the three schemes. In each of these analyses, we predict slightly more than 60 percent of the observations correctly.

Four orthogonal functions emerge from the discriminant analysis. The first function discriminates primarily between nonmovers and movers; it picks up 80 percent of the explained variance. The second function explains about 17 percent of the variation and differentiates between types of movers, to which we will turn shortly. The remaining two functions add very little discriminating power, and we ignore these in the discussion.

We can achieve a better sense of the distinctiveness of these groups by plotting their average scores on the discriminant functions. Since the first two functions account for nearly all of the variance, a simple plot of the group's mean value on function 1 against the value on function 2 (the centroids), will summarize most of the information. The distance between centroid points is a measure of their distinctiveness, based on the characteristics we have measured.

Figure 1 plots the 1980 group centroids for the conventional classification. The first function (x axis) clearly separates nonmovers from movers. We can label the second function (y axis) as that which separates the local movers from migrants. It is most telling that the centroid for intercounty movers in 1980 is relatively close to the centroid for intracounty movers. Interstate and interregional movers are nearly indistinguishable on the basis of these characteristics. These tabulations alone suggest that the state boundary, *not the county*

Table 3. Discriminant Models of Mobility: Wilks's Lambda and Function Contributions to Explained Variance

Variables entered	A: Full variable set				B: Comparable variable set			C: Comparable variable set omitting residence outside state of birth			
		1980 classification				Conventional classification			Conventional classification		
	K	Conventional	SMSA-based[c]	Contiguity[d]	*K*	1980	1940	*K*	1980	1960	1940
Predetermined measures	14[a]	0.70788	0.70823	0.70713	10[e]	0.72461	0.91659	9[g]	0.80065	0.85050	0.93107
Family and employment	26[b]	0.68938	0.68874	0.68834	20[f]	0.71259	0.89780	19[f]	0.78611	0.83476	0.91009
Home ownership	27	0.63690	0.63611	0.63597	21	0.65627	0.79766	20	0.71830	0.77509	0.80612
% of variance explained											
Function 1: "Move vs. stay"		79.8	79.6	79.6		81.7	88.3		92.2	88.0	89.8
Function 2: "Migrate vs. local"		16.8	16.6	16.8		15.3	8.5		6.9	9.7	8.5

Note: *K* = number of variables.

[a] Includes sex, age (fifth-order polynomial), race (black, white, other), Spanish origin, employment and schooling status 5 years earlier (military, employed, college, other), a dummy indicating whether lived in state of birth 5 years earlier, and years of education completed.

[b] Includes measures applying at the time of the census: variables indicating age of children in household [preschool child (age 0–5), school-aged child (6–17), both preschool and school-aged children, no children under 18] for household heads and spouses, marital status, sex of household head, occupational category (professional and managerial; technical, sales, and administrative support; precision production, craft, and repair; operative and laborer; farming, forestry, and fishing; service), household income per capita, and labor force participation.

[c] Moves within an SMSA are classified with intracounty moves.

[d] The fourth category is of movements to contiguous states, and the fifth category is of movements to noncontiguous states.

[e] Includes sex, age (fifth-order polynomial), race (black, white, other), a dummy indicating whether lived in state of birth 5 years earlier, and years of education completed.

[f] Includes measures applying at the time of the census: children in household (child aged 0–17, no child), marital status, sex of household head, occupational category (professional and managerial; technical, sales, and administrative support; precision production, craft, and repair; farming, forestry, and fishing; service), household income per capita, and a dummy for labor force participation.

[g] As in c, but omitting dummy for state of birth 5 years earlier.

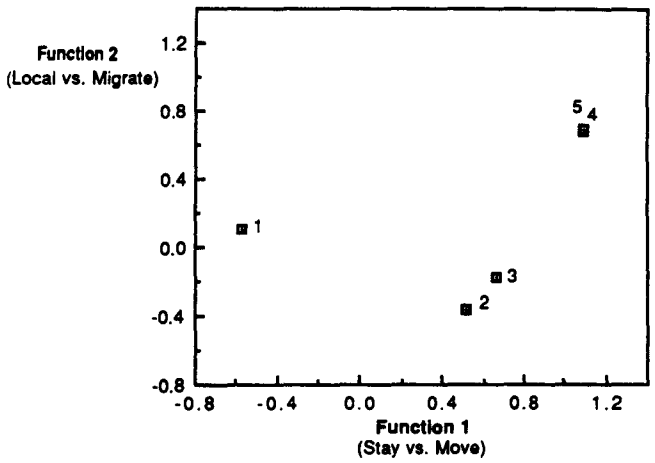

Figure 1.—Centroids for Mobility Groups: Conventional Classification, 1980 (1, same house; 2, intracounty; 3, intercounty–intrastate; 4, interstate–intraregion; 5, interregion)

boundary, is the critical migration-defining boundary for the set of determinants and consequences of population movement in the 1980 census.

We explore further the implication of the alternative classifications in Figure 2. Consider intercounty movers who remain within the boundaries of the SMSA. As we might expect, their centroid is intermediate between those moving within a county and those moving between counties. On the other hand, crossing a state boundary, even if one remains within the SMSA, does appear to have an important selectivity aspect. Such individuals (only 7 percent of interstate movers within region) are not like other intrametropolitan movers but are, rather, about halfway between intercounty and interstate groups in this two-dimensional space. Although the characteristics of intrametropolitan movers who change counties or states are somewhat different from other movers within the metropolis, because their numbers are small, the overall pattern of centroids for the categories based on SMSAs is very close to that of the conventional classification.

Four additional centroids appear in Figure 2, describing the interstate–interregion ×

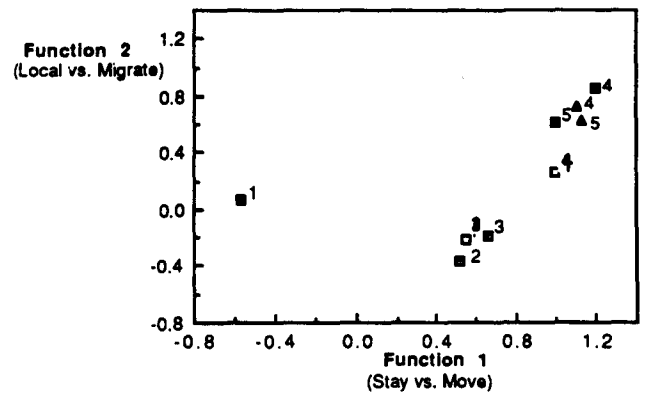

Figure 2.—Centroids for Mobility Groups: Selected Conventional and Alternative Classifications, 1980 (▣, conventional; □, moves within metropolitan areas; ■, contiguous state; ▲, noncontiguous state; 1, same house; 2, intracounty; 3, intercounty–intrastate; 4, interstate–intraregion; 5, interregion; for metropolitan classification, 4 includes all interstate moves)

contiguity combination. Moves to contiguous states are less selective of population characteristics than those to noncontiguous states, but the differences are remarkably small. With these categories it makes little difference whether moves are within or between regions. Our finding may be linked to the regional restructuring of job opportunities in the U.S. during the period, with lower-skilled employment moving to the South and West and therefore attracting individuals who are, in terms of age and education, more similar to those making moves that cross boundaries lower in the geographic hierarchy.

We also examined inter- and intrastate movers between metropolitan areas and plotted them similarly. These results (not shown) indicate once again that the state boundary distinguishes individuals. The centroid for intrastate movers who change metropolitan areas is relatively proximate to the centroid for other intrastate movers.

Comparison of Results for 1980 and 1940

We repeated discriminant analyses for 1940 and 1980, employing only variables available in both samples. Panel B of Table 3 includes a summary of these results. Figure 3 presents the centroids for mobility categories based on this analysis. Characteristics unavailable in the 1940 census included activity five years prior to the census (work, college, military service) and Spanish origin. In addition, whereas the 1980 census provided detail on children of preschool and school ages, the 1940 census only identifies the presence of any children less than 18 years old. The variables measuring status five years before contribute on both dimensions but are not nearly as strong as the age, education, and home ownership effects. The effects of the presence of children of different ages (which operated in opposite directions) will now be blurred.

In standardized space, the five conventional mobility groups are not as separable in 1940 as in 1980. Movers during the 1935–1940 period are very distinct from nonmovers, but the vertical axis has less differentiation, although the rank ordering of the four mobile groups remains the same. The graph clearly points up the changing significance of crossing a county boundary. In 1940 intercounty movers are midway between intracounty movers and the other migrants. In 1980 intercounty movers are much more similar to movers within counties. From what we have seen earlier, this is only partly due to the expansion of metropolitan areas over the decades. Clearly, then, the county boundary has become less selective of migratory characteristics.

In the 1940 sample, we also examined the relative positions of the intrametropolitan

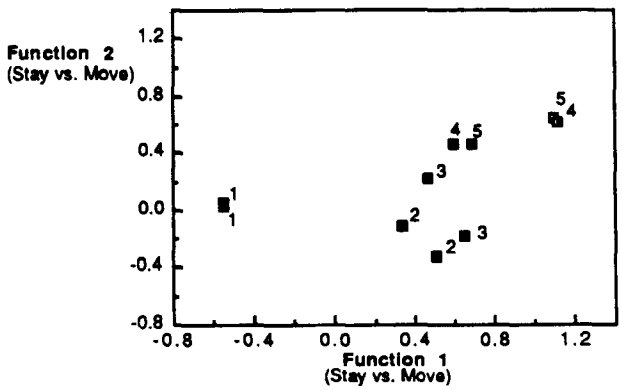

Figure 3.—Centroids for Mobility Groups: Conventional Classification, 1980 (□) and 1940 (■) (1, same house; 2, intracounty; 3, intercounty–intrastate; 4, interstate–intraregion; 5, interregion)

and contiguity subgroups (not shown). Intercounty–intrametropolitan movers are about the same distance from the intracounty centroid in 1940 as in 1980, but they are closer to the nonmover origin. Compared with our results for 1980, movers to a noncontiguous state (within or outside the region) are more selective of population characteristics vis-à-vis movers to contiguous states. Seen from another point of view, the 1975–1980 data suggest that crossing the state boundary is critical, but that subgroups of interstate movers are less differentiated than in the 1935–1940 period.

State of Birth and Selectivity

For the 1980 data, departure from the state of birth by 1975 contributes substantially to our ability to distinguish local movers from migrants. This state-of-birth effect is much stronger in 1980 than in the earlier period. The discussion of means for Table 1 already hinted at this, but it is confirmed in these multivariate analyses by a comparison of the magnitude of the standardized coefficients for the two discriminant analyses.[9] It is worthwhile, then, to determine how much of the difference is solely due to the change in the influence of this characteristic over the period.

We reran our discriminant analyses for 1940 and 1980, omitting residence in state of birth at the beginning of the migration interval from among the predictors of mobility category. By comparing panels C and B of Table 3, one can see the sharp decline in the explanatory power of the model for 1980; the omission of the state of birth is of less consequence in 1940. When it is eliminated in the 1980 equation, some of its influence is picked up by other variables. Most notably the effects of race, education, and occupational status increase. These characteristics only account for part of the difference, however. The new version also produces a dramatic realignment in the relative position of the 1980 centroids, as can be seen in Figure 4. The centroid patterns for 1940, 1960, and 1980 are similar. (No information is available on lifetime migration by 1955 to perform the comparable test for the 1960 data.) When the state-of-birth dummy was included, we found that the groups were more differentiated along the vertical (migrate vs. local move) dimension than they are here. Whereas more than one standard unit separated local movers from interregional migrants in the first analysis (with state of birth), only about one-half unit separates them when the state-of-birth effect has been removed. Moreover, intercounty movers occupy a position in this two-dimensional space that is much closer to the other two

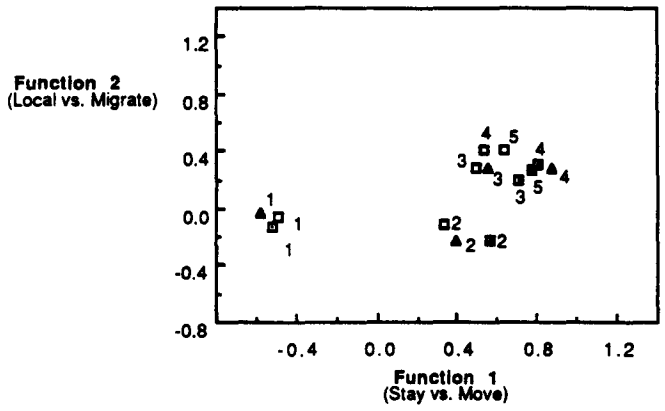

Figure 4.—Centroids for Mobility Groups: Conventional Classification (omitting state of birth dummy), 1940 (□), 1960 (▲), and 1980 (⊡) (1, same house; 2, intracounty; 3, intercounty–intrastate; 4, interstate–intraregion; 5, interregion)

Table 4. Unstandardized Discriminant Coefficients for Personal Determinants of 1980 Mobility Status

Variable	Function 1: Move vs. stay	Function 2: Migrate vs. local move	*F*
Predetermined			
Female	−0.037	−0.187	5.79
Age[a]	−0.038	0.007	487.39
Age**2(/1,000)[a]	0.377	−0.393	20.69
Age**3(/10,000)[a]	0.310	−0.165	53.16
Age**4(/100,000)[a]	−0.155	0.108	58.44
Age**5(/10,000,000)[a]	0.499	−0.461	21.79
Black	−0.452	−0.376	44.75
Other race	−0.143	−0.298	4.78
Spanish origin	−0.219	−1.027	23.50
In state of birth 1975	−0.805	−1.622	568.92
In armed forces 1975	1.217	2.521	56.14
At work 1975	0.143	−0.326	12.13
In college 1975	0.284	0.175	18.05
Education in years	0.020	0.056	16.20
Family status, 1980			
Child aged 0–5	0.542	−0.797	48.63
Child aged 6–17	−0.220	−0.247	10.61
Children aged 0–5 and 6–17	−0.035	−0.419	4.34
Married	0.126	−0.084	4.18
Female-headed household	−0.143	−0.289	12.01
Occupation and economic status, 1980			
Professional and managerial	0.157	0.076	7.72
Technical and sales	0.091	0.069	6.70
Operative, laborer	−0.084	−0.359	6.07
Craft	−0.014	0.279	2.19
Farm	−0.249	0.081	3.27
Per capita household income	0.001	−0.035	25.20
In labor force	−0.109	−0.086	10.36
Home ownership			
Own home	−1.222	0.408	490.43
Constant	−48.286	33.980	—

[a] Power terms for age have been constructed to be uncorrelated with all lower order age terms. This means that the coefficient for linear age is not appreciably influenced by the presence of higher order age variables in the equation.

groups of migrants. Thus prior lifetime interstate mobility is tapping an element of population selectivity that is both very strong and distinct from other measured characteristics. More important, this selectivity operates in the 1975–1980 interval in a decidedly more important way than it did in 1935–1940. What is the explanation for this? Although the overall proportions of the persons residing outside their state of birth five years prior to the census were similar in the two periods (37 percent in 1935, 40 percent in 1975), far fewer remained in the state over the next five years during the more recent period (93 percent in 1935–1940, 79 percent in 1975–1980). In each time period about one-quarter of those making the second interstate move returned to their state of birth. We can speculate on the meaning of these tabulations and the multivariate results. For the adult population represented in the 1980 census, once the bonds of attachment to the state of birth had been

broken, it became much more likely that the individual would continue to migrate across state boundaries. The effect is much stronger in 1980 compared with 1940, suggesting that the U.S. has witnessed a growing class of footloose migrants who participate in national labor markets. This is a group whose migratory behavior is not otherwise indicated by any demographic or socioeconomic characteristics available in the census.

Personal Characteristics and Mobility

Now we turn to the analysis of the individuals' characteristics associated with their mobility status. Our most detailed model for the discriminant analysis included 26 characteristics available in the census, both predetermined and contemporaneous. Summary statistics are provided in Table 3, panel A, for the conventional classification. Table 4 presents the values of the unstandardized coefficients of these variables for the first two discriminating functions as well as the associated F statistics. Given our sample size, almost all coefficients are statistically significant discriminators at low probability levels.[10] The coefficients for the analyses of the earlier years were generally similar in substance to those reported in Table 4.[11]

The predetermined characteristics are important predictors of mobility for both of the first two discriminant functions. The characteristics most associated with the stay–move function are age, home ownership, education, and the presence of preschool children. The basic age pattern of mobility is illustrated in Figure 5A, which graphs the increment to the likelihood (standardized discriminant score) of being a stayer according to age (from 18 to 80 years), net of other variables included in the model. Despite the fact that we measure age at the census for movement at some point during the preceding five-year interval, the basic age profile of mobility (see Rogers and Castro, 1984) is preserved. Figure 5B presents the age profile for discriminant function 2. It represents the increased probability of being an interstate or interregional migrant, *given* that an individual is a mover. Individuals in the youngest ages (18–20) are very likely to migrate, given mover status. Movers in the early adult years (near age 30) are unlikely to be migrants; they are most likely to be moving for local housing consumption. The migrate-given-mover age profile rises until a peak at about age 50, an interval over which the likelihood of moving at all declines sharply.

Membership in any of the three ethnic minority groups predicts an increased probability of immobility. Prior mobility strongly predicts mobility over the census interval. As discussed previously, individuals who had left their state of birth by 1975 were more likely to move and were particularly more likely to migrate across a state boundary again. Individuals who were in the armed forces in 1975 were more likely to move and much more likely to migrate. The same is true for those in college in 1975, although the effect is not as strong. Education is associated with both mobility and increased migration, with the latter effect appreciably stronger. Nonetheless, both effects are modest in comparison with the impacts of many other characteristics, particularly age.

The presence of preschool children promotes local mobility, but the presence of school-aged children deters all kinds of movement. Female-headed families are less mobile and less migratory; the married are more mobile and less migratory. Compared with other characteristics, the predictive ability of occupation is weak, but we do find that higher status nonfarm occupations are associated with migration. Those in craft occupations are particularly likely to make a migratory move, given that they are mobile. (The omitted category is other service workers.) Although strongly associated with immobility, home ownership is positively associated with migration (given mobility), probably because it is a good proxy for wealth and socioeconomic status.

In sum, we find that personal characteristics effectively distinguish different kinds of moves in the population. The effects of these characteristics are consistent with human

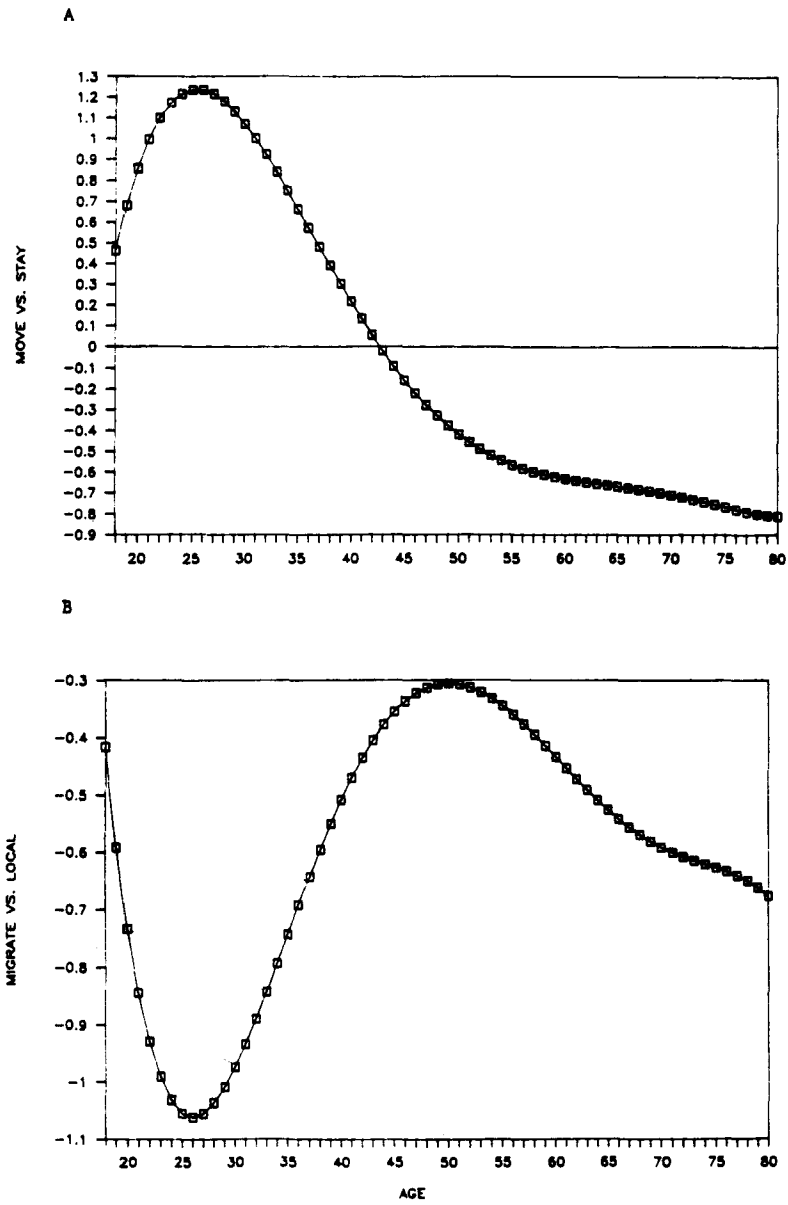

Figure 5.—Age Profiles of Residential Mobility From Discriminant Analysis: (A) Function 1, Move vs. Stay; (B) Function 2, Migrate vs. Local Move (given any move)

capital theories of migration and life cycle theories of local residential mobility, giving further evidence of the value of separating local residential mobility from migration. Despite our efforts to make detailed allowances for age, education, prior mobility, and activity in 1975, appreciable differences by race and family headship exist. In contrast, remaining differences by sex and occupational classification, although statistically significant, are substantively small.

Conclusions

Most migration analysis adopts a migration-defining boundary by convenience or convention. Typically researchers use the county boundary to separate migration from local mobility. We have demonstrated here that the choice of migration-defining boundary cannot be made cavalierly. Boundary choice has real consequences, both from an accounting point of view and, more important, for any attempt to identify the causes or consequences of mobility. Alternative boundaries are selective of different subgroups in the population. Therefore the estimated effects of the characteristics used to explain migration will differ according to the geographic scheme used.

Our analysis sheds light on the usefulness of alternative criteria for distinguishing migrants from other movers. In the censuses of 1940 and 1960, individuals who crossed a county boundary differed from other movers, although interstate movers were still more select. As of the 1980 census, however, the distinction between those who cross a county boundary and others who move within a state has become less clear. No doubt expansion of the SMSA system to include 318 areas in 1980 (vs. 178 in 1960) and population movement into nonmetropolitan counties at the periphery of metropolitan areas have contributed to this change. Because migration is linked in the theoretical literature to movement between labor markets (usually approximated by metropolitan areas), the strength of the link between selectivity and the state boundary presents a challenge to the delineation of geographic areas that will accurately define labor markets as well as separate migrants from local movers.

We have also identified an aspect of selectivity that has developed over the period studied. In the 1975–1980 period, interstate migrants are particularly distinguished by prior (pre-1975) interstate migration, a phenomenon without a parallel in 1935–1940. This characteristic identifies a subgroup in the population who, net of other characteristics, migrate for opportunities in national labor markets.

Our results suggest that the choice of a particular geographic scheme can introduce considerable variation into the values of coefficients, thereby hampering comparisons across studies. Further, the state line may be supplanting the county line as the migration-defining boundary in the U.S., particularly when we take into account the growing fraction of footloose migrants. As the country has grown smaller by virtue of the changes in the technology of transportation and communication, the geographic units that distinguish migratory behavior have become larger.

Notes

[1] See, for example, Bogue (1985).

[2] Shryock (1964:8–10) also discussed the difficulty of using distance directly and the problems arising from differences in the structure of county boundaries in various parts of the country.

[3] In nonmetropolitan areas one could reaggregate counties into state economic areas, as an analog to SMSAs, but this information was not available in the 1980 microdata files.

[4] The 1940 PUMS contains information on migration distance. This calculation was made on the basis of the distance between the centers of population for 1970 for the counties involved (William Frey, personal correspondence, May 1982). Since analogous information is not available in the 1960 and 1980 samples, we have not made use of this distance measure.

[5] An SMSA is usually defined as a large city (population of at least 50,000 persons), its surrounding county, and contiguous counties "if they are socially and economically integrated with the central county" (U.S. Bureau of the Census, 1982:54).

[6] Technically, this measure refers to the state of residence at the beginning of the migration interval (1935, 1975) outside the state of birth, but we will refer to it in more abbreviated form as the "state of birth."

[7] Discriminant analysis has the advantage of providing a fit by least squares, so it is no more computationally intensive than regression analysis. It enables us to use a very large sample and thereby

obtain estimates of coefficients with low levels of error. Other methods of separating these groups are available, principally multinomial logit estimation techniques. These, however, require maximization of a nonlinear likelihood function, which is prohibitively expensive for large samples. For a subsample of the 1980 data, we performed multinomial logit estimation analyses classifying the population as nonmovers, intracounty movers, intercounty movers, and interstate movers. Results were consistent with those reported in Table 4.

[8] Wilks's lambda varies between 0 and 1, where 0 indicates that identification of membership is perfect and 1 indicates no discrimination. It is analogous to $1 - R^2$ for regression. We employ a fifth-order polynomial to capture the basic age profile of residential mobility and migration, consistent with model age schedules (see Rogers and Willikens, 1985). Empirically, the first five terms added appreciably to predictive power; additional terms added little.

[9] In 1980 the standardized coefficients for the state of birth were 0.38 and 0.84 on functions 1 and 2, respectively. The companion values for the 1940 analysis were 0.19 and 0.26.

[10] A dummy variable for unemployment at the time of the census never added significantly to explained variance and is therefore omitted from all reported analyses.

[11] Effects for farm and craft occupations were stronger for the 1940 and 1960 samples.

Acknowledgments

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References

Bogue, D. J. 1985. *The Population of the United States: Historical Trends and Future Projections.* New York: Free Press.

Bowles, S. 1970. Migration as investment: Empirical tests of the human investment approach to geographic mobility. *Review of Economics and Statistics* 52:356–362.

Cebula, R. J. 1979. *The Determinants of Human Migration.* Lexington, Mass.: Lexington Books.

Clark, W. A. V. 1982. Recent research on migration and mobility. *Progress in Planning* 18(Pt. 1):1–56.

DaVanzo, J. 1976. *Why Families Move: A Model of the Geographic Mobility of Married Couples,* Technical Report R-1976-DOL. Santa Monica, Calif.: Rand Corp.

———. 1983. Repeat migration in the U.S. *Review of Economics and Statistics* 65:552–559.

Graves, P. E., and P. D. Linneman. 1979. Household migration: Theoretical and empirical results. *Journal of Urban Economics* 6:383–404.

Greenwood, M. J. 1981. *Migration and Economic Growth in the United States.* New York: Academic Press.

Kuznets, S., A. R. Miller, and R. A. Easterlin. 1960. *Population Redistribution and Economic Growth, United States, 1870–1950: Analyses of Economic Change* (Vol. 2). Philadelphia: American Philosophical Society.

Lansing, J. B., and E. Mueller. 1967. *The Geographic Mobility of Labor.* Ann Arbor: University of Michigan, Institute for Social Research.

Long, L. H. 1978. *Interregional Migration of the Poor: Some Recent Changes,* Current Population Reports, Ser. P-23, No. 73. Washington, D.C.: U.S. Government Printing Office.

———. In press. *Migration and Residential Mobility in the U.S.* New York: Russell Sage.

Long, L. H., and C. Boertlein. 1976. *The Geographic Mobility of Americans in Comparative Perspective,* Current Population Reports, Ser. P-23, No. 64. Washington, D.C.: U.S. Government Printing Office.

Long, L. H., and W. Frey. 1982. *Migration and Settlement 14: United States* (Pub. No. RR-82-15). Laxenburg, Austria: International Institute for Applied Systems Analysis.

Long, L. H., C. J. Tucker, and W. L. Urton. In press. Measuring migration distances: Self-reporting and indirect methods. *Journal of the American Statistical Association.*

Mincer, J. 1978. Family migration decisions. *Journal of Political Economy* 86:749–773.

Quigley, J. M., and D. H. Weinberg. 1977. Intra-urban residential mobility: A review and synthesis. *International Regional Science Review* 2:41–66.

Radloff, S. R. 1983. *Detecting Migration: An Exploration of Measurement Issues Using the Malaysian Family Life Survey,* Note N-1927-AID (April). Santa Monica, Calif.: Rand Corp.

Rees, P., and F. Willikens. 1985. Data and accounts. Pp. 37–45 in A. Rogers and F. Willikens (eds.), *Migration and Settlement: A Multiregional Comparative Study.* Boston: D. Reidel.

Ritchey, P. N. 1976. Explanations of migration. Pp. 363–404 in A. Inkeles (ed.), *Annual Review of Sociology* (Vol. 2). Palo Alto, Calif.: Annual Reviews.

Rogers, A., and L. Castro. 1984. Model migration schedules. Chap. 2 in A. Rogers (ed.), *Migration, Urbanization, and Spatial Population Dynamics*. Boulder, Colo.: Westview.

Rogers, A., and F. Willikens (eds.). 1985. *Migration and Settlement: A Multiregional Comparative Study*. Boston: D. Reidel.

Schwartz, A. 1973. On interpreting the effect of distance on migration. *Journal of Political Economy* 81:1153–1169.

Shryock, H. S. 1964. *Population Mobility Within the United States*. Chicago: University of Chicago Press.

Thomas, D. S. 1938. *Research Memorandum on Migration Differentials*. New York: Social Science Research Council.

U.S. Bureau of the Census. 1975. *A Public Use Sample of Basic Records From the 1960 Census*. Washington, D.C.: U.S. Bureau of the Census. (machine-readable data file and documentation)

———. 1982. *1980 Census Users Guide* (Pt. A). Washington, D.C.: U.S. Government Printing Office.

———. 1983a. *Census of Population and Housing 1940: Public Use Microdata Sample*. Washington, D.C.: U.S. Bureau of the Census. (machine-readable data file and documentation)

———. 1983b. *Census of Population and Housing 1980: Public Use Microdata Sample*. Washington, D.C.: U.S. Bureau of the Census. (machine-readable data file and documentation)