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Mobility and Destination in Migration Decisions: The Roles of Earnings, Quality of Life, and Housing Prices*

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Migration is traditionally explained by better earnings opportunities. A recent alternative explanation emphasizes improved living conditions in a new location. This paper builds on limited work that combines earnings and consumption approaches and recent research on quality of life. We consider the individual's decision to move and choice of destination. Augmented microdata from the 1980 Census are used to estimate impacts of wages, housing costs, quality of life, and moving costs on the probabilities of changing counties between 1975 and 1980 and on movers choosing specific counties. Wages and moving costs are most important in choosing whether or not to move. Quality of life, wages, and housing prices matter in choosing destination. © 1992 Academic Press, Inc.

I. INTRODUCTION

Economists have traditionally analyzed migration within models that are driven by disequilibrium wage gains which can be obtained by moving from one location to another (see Greenwood, 1975, 1985; Greenwood and Hunt, 1984). More recently economists have constructed models in which migration is driven by life-cycle changes or secular increases in income. Individuals relocate to areas that contain the bundle of location-specific characteristics or amenities that suit their circumstances. Areas differ in the bundle of location-specific characteristics they offer, and implicit compensation in the housing and labor markets equalizes the attractiveness of areas at the margin. Graves (1979), Graves and Linneman (1979, 1983), and Knapp and Graves (1989) consider this to be equilibrium migration. This work was preceded by Liu (1975), who finds that

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net migration rates are higher for areas for which his quality of life index is higher.

More recently, studies have begun to incorporate both approaches. In Linneman and Graves (1983), earnings opportunities and living conditions factors are combined with moving cost factors in a multinomial logit analysis of data from the Michigan Panel Study of Income Dynamics. They find both earnings and amenities matter. Greenwood and Hunt (1989) use aggregate data for 171 U.S. locations to argue that jobs and wages are more important than location-specific amenities in explaining the net migration of employed persons. However, Greenwood *et al.* (1991), using state aggregate data, find that both economic opportunities and amenities are important in explaining migration. Mueser and Graves (1990) characterize migration as a dynamic disequilibrium and derive reduced-form migration equations depending on employment-related variables, amenities, and other factors. They find that amenities explain a larger portion of the observed migration than do employment variables.

While the combination of equilibrium and disequilibrium approaches is a welcome innovation, these studies typically use aggregated data. In fact, most studies of migration have used aggregated data, explaining flows of migration out of or into a particular location, or flows among a set of locations. The underlying models of migration, however, are invariably couched in terms of terms of individual maximizing behavior. Previous studies of migration using microdata have typically focused on either wage differences (Polachek and Horvath, 1977; Bartel, 1979; Falaris, 1982, 1988; Robinson and Tomes, 1982) or amenity differences (Graves, 1979; Graves and Linneman, 1979; Herzog and Schlottmann, 1986), but not both.

More generally, the decision to migrate depends on not only wage and quality-of-life differences across locations, but also differences in housing costs and the costs of moving from one location to another. Moving costs include the attachment to an area that an individual has because of family and friends and "sense of place." Some studies have examined moving costs (Bartik *et al.*, 1990) and distance of move (Clark and Cosgrove, 1991), but a unified treatment of all of these factors within an individual decision-making model is lacking.

The previous literature based on individual decision-making has been devoted primarily to explaining the decision whether or not to move (e.g., Linneman and Graves, 1983). Although a number of studies do explain migration from region to region (e.g., Falaris, 1982, 1988; Robinson and Tomes, 1982; Gabriel *et al.*, in press), migration decisions usually involve smaller geographic areas than regions. Within broadly defined geographic regions, there is usually a whole variety of possible locations, where each location has associated with it a different set of amentities, wage gains, and housing and moving costs. Predicting choice of specific location has remained largely an unmet challenge.

Quality-of-life indexes based on individual decision-making have been developed for rankings of metropolitan areas and counties (Roback, 1982; Blomquist *et al.*, 1988). Quality-of-life factors that can be measured and incorporated into an overall quality-of-life index include climate, urban conditions, and environmental quality. We use these recent preference-based estimates of quality of life in counties in our analysis of individual decisions to move and individual choices of destinations.

This paper addresses several voids in the migration literature. We use microdata from the 1980 Census and other sources to examine the migration of individuals as a function of wage gains, quality-of-life, housing cost differences, and moving costs within a unified individual maximizing framework. We are thus able to address the issue of whether earnings or amentities are more important for decisions whether or not to move. Perhaps more importantly, we are able to address the difficult problem of choice of destination. In our framework, individuals choose from over 250 possible counties. For each individual, a ranking of counties is obtained that combines wage, housing cost, quality-of-life, and moving cost differences. We can thus measure the influence of these differences on choice of destination; that is, we can determine whether or not individuals do in fact move to counties that have high rankings for them.

II. FRAMEWORK

A. *Net Benefits of Moving*

Individuals consider the net overall gains available to them when deciding whether or not to change counties. In particular, they look at whether they obtain higher wages, higher quality of life, and lower housing costs, and whether these gains outweigh the costs of relocation. If the net gains are positive, then we would expect the individual to relocate, and we would predict a move to the county for which the net gains are greatest. More formally,

$$\text{NETGAIN}_i = \sum_{t=0}^{n} (1 + r_t)^{-t}(\text{WDIFF}_{it} + \text{QOLDIFF}_{it} - \text{HDIFF}_{it} - \text{MOVECOST}_{it} + u_{it}), \tag{1}$$

where NETGAIN_i is the present value of the net gains for an individual moving from their current county to county *i*. NETGAIN depends on: (a)

WDIFF_{it}, the annual wage difference in year t between the current county and county i after controlling for individual characteristics and quality of life differences across counties; (b) QOLDIFF_{it}, the annual value of the quality of life difference between the two counties in year t; (c) HDIFF_{it}, the annual housing price difference between the two counties, holding constant housing characteristics and quality of life; (d) MOVECOST_{it}, the moving costs of county i in year t; and (e) u_{it}, other factors affecting the net gains of locating in county i over the current county in year t. These net gains (or losses) are discounted over the n periods in which the individual will reside in the new county. The individual chooses to locate in the county with the highest value of NETGAIN. We observe an individual moving to a new county between two points in time only if at least one $\text{NETGAIN}_i > 0$.[1]

The framework given by Eq. (1) incorporates both equilibrium and disequilibrium influences on migration, in addition to considering moving costs. Equilibrium migration is a response to income effects or life-cycle changes. It is movement for the purpose of obtaining a preferable bundle of location-specific amenities. Individuals pay for differences in the values of these bundles implicitly through the housing and labor markets. QOLDIFF captures these differences in Eq. (1). Disequilibrium influences in the labor market are captured by WDIFF. Disequilibrium influences in the housing market—typically not considered in migration models—are captured here through HDIFF. Finally, moving cost differences are captured by MOVECOST.

B. Differences in Quality of Life, Wages, and Housing Prices

The values of QOLDIFF, WDIFF, and HDIFF are determined by first estimating wage and housing expenditure equations. These equations can be expressed as

$$W = g(Z, A, \text{DISEQ}) \tag{2}$$

[1] Equation (1) is a modern formulation of Sjaastad's (1962) human capital investment model of migration. In our formulation in which we assume constant differences in wages, quality of life, and housing costs, the individual will move if any NETGAIN > 0. If we knew about the changes in differences over time and hence the time path of NETGAIN, then a positive NETGAIN would not be sufficient to predict a move. If NETGAIN > 0 and growing before an anticipated decline, the optimal time for a move would be in the future. We assume also the individual stays at the move destination. If the individual were to anticipate another move, then optimization over both moves could lead the individual to stay in the first location even though NETGAIN > 0 and make just one move later.

and

$$H = h(Y, A, \text{DISEQ}), \tag{3}$$

where W is the wage, Z is a vector of personal characteristics, A represents county-specific amenities which enter into the formulation of a measure of overall quality of life, DISEQ are disequilibrium variables such as unemployment or population growth measured at the county level, H is housing expenditures (rents or imputed expenditures for owners), and Y is a vector of structural characteristics of the housing unit.

The parameter estimates obtained are then used to generate values for QOLDIFF, WDIFF, and HDIFF for each individual across all counties in the sample. The parameter estimates on the amenity (A) variables are linearized and then combined to yield annual implicit prices for each amenity. These prices estimate the amounts individuals implicitly pay at the margin for changes in amenity levels through changes in wages and housing expenditures. These implicit prices can then be multiplied by amenity levels in each county and summed across all amenities to yield a quality-of-life index

$$\text{QOLI}_i = \sum_j p_j A_j, \tag{4}$$

where QOLI_i is the quality-of-life index for the ith county and p_j is the implicit price of the jth amenity. Berger *et al.* (1987) and Blomquist *et al.* (1988) present models that derive the implicit amenity prices; they also describe the quality-of-life index in more detail for both metropolitan areas and heterogeneous multicounty urban areas.

QOLDIFF is measured by the difference in the QOLIs between the beginning-period county of residence and that in an alternative county. The WDIFF variable for Eq. (1) is the difference in predicted annual wages for each individual between the beginning county and an alternative county, holding constant the level of amenities between the two counties. Amenity level differences enter the QOLDIFF variable described above. The differences by county in WDIFF come from the disequilibrium variables (DISEQ). The HDIFF variable for Eq. (1) is the difference in predicted housing expenditures between the beginning county of residence and another county, holding constant housing characteristics and amenities. These differences in housing expenditures across counties are generated empirically from the difference in the DISEQ variable. Differences in housing costs between counties will be one element in the mobility decision. Housing prices are also an important element of cost of living differences across areas. Thus, cost of living differences are partly reflected in the HDIFF variable.

C. *Moving Costs*

The cost of moving is not directly observable and cannot be easily constructed from existing data or parameter estimates. One approach would be to substitute variables that influence the cost of moving (e.g., distance to the individual's best county from the origin county) into Eq. (2). However, the initial ranking of the counties to determine the best overall county for an individual would by necessity, exclude moving costs. The inadequate ranking would include only wage, housing cost, and quality-of-life differences. Since moving costs are likely to be an important part of the migration decision, this approach seems inappropriate.

A more ambitious approach is to estimate a MOVECOST equation based on a sample of movers. For movers, we know that $\text{NETGAIN}_C > 0$, where C refers to the destination county actually chosen. From Eq. (1) this means

$$\sum_{t=0}^{n} (\text{MOVECOST}_{Ct} - u_{Ct})(1 + r_t)^{-t} < \sum_{t=0}^{n} (\text{WDIFF}_{Ct} + \text{QOLDIFF}_{Ct} - \text{HDIFF}_{Ct})(1 + r_t)^{-t}. \quad (5)$$

That is, the discounted sum of WDIFF, QOLDIFF, and -HDIFF over the years the individual is expected to reside in county C is an upper bound estimate of moving costs minus any unmeasured effects on the net gain of moving to county C.[2] Using individual-specific estimates of WDIFF_C, QOLDIFF_C, and HDIFF_C, an upper-bound estimate of the left-hand side of (5) can be obtained for all movers. This estimate of moving costs and other unmeasured factors ($\text{MOVECOST}'_C$) can be expressed as a function of variables influencing moving costs:

$$\text{MOVECOST}'_C = k(\text{DIST}_C, M), \quad (6)$$

where DIST_C is the distance from the origin county to the new county and M represents other variables influencing moving costs. Distance is in-

[2] While (WDIFF + QOLDIFF − HDIFF) represents an upper bound on the moving costs of movers, it is a lower bound on the moving costs of nonmovers; otherwise we would observe the nonmovers changing locations. In predicting the moving costs of nonmovers, we correct for selection bias, which should in part address this problem.

cluded to reflect the direct cost and part of the psychic cost of moving. Psychic cost includes losing some sense of place. A proxy for family ties, for example, could be a variable indicating place of birth. Whether or not the destination county is within the same metropolitan area is included to allow for differences between mobility over short distances and migration over long distances. This moving cost equation can be estimated for the sample of movers and the parameters used to predict moving costs to each county for all individuals. These predicted values will be on average an overestimate of the left-hand (cost) side of (5), but as long as the overestimate is constant across counties, the county ranking by NETGAIN for each individual will be unaffected. This will be the case as long as unobservable factors influencing the true NETGAIN_C are uncorrelated with variables in the moving cost Eq. (6). Lack of correlation is likely for a variable such as distance, unless the best locations for most individuals are located relatively close together.

Selection bias may be of some concern in the estimation of Eq. (6). Unobserved factors affecting moving costs may be correlated with unobserved factors affecting the probability of moving. If they are correlated, then we have a nonrandom sample of movers and biased predictions of moving costs for nonmovers. In order to account for this problem, standard correction procedures (Heckman, 1979) are employed. In particular, a reduced form probability of moving equation is estimated as

$$Pr(\text{MOVE}) = f'(A_O, \text{DISEQ}_O, M), \tag{7}$$

where A_O and DISEQ_O are measures of amenities and disequilibrium for the origin county. This equation is used to generate an inverse Mills ratio for inclusion in the moving cost Eq. (6) as a correction for selection bias.

After values for WDIFF, QOLDIFF, HDIFF, and MOVECOST are constructed for all counties across all individuals, they can be combined to obtain values of NETGAIN and obtain a ranking of counties for each individual.

Using the framework of net benefits given by Eq. (1), hypotheses about the impact of the quality of life can be tested with an equation describing the probability of whether or not an individual changes county of residence. This equation can be specified as

$$Pr(\text{MOVE}) = f(\text{QOLDIFF}_B, \text{WDIFF}_B, \text{HDIFF}_B, \text{MOVECOST}_B, X), \tag{8}$$

where for estimation purposes MOVE = 1 if the individual changes counties (NETGAIN > 0) and zero otherwise. QOLDIFF_B is the dollar difference in measured quality of life between the actual residence in the beginning period and the most highly valued (best) county, i.e., county with the highest value of NETGAIN. $WDIFF_B$ measures the wage difference between the actual county and the best county given the individual's characteristics, and holding constant quality of life. $HDIFF_B$ is the difference in housing expenditures (an important component of cost of living) between the actual county and best county, holding constant housing characteristics and quality of life. $MOVECOST_B$ is the cost of moving to the most highly valued county. X represents variables such as age that are correlated with the potential number of future periods in the new location and thus influence the size of NETGAIN in Eq. (1).

The parameter estimates obtained from Eq. (8) can be used to investigate hypotheses about factors affecting the migration decision. For example, the parameter estimate on $QOLDIFF_B$ provides a test of whether migration decisions are related to the gains in quality of life that can be realized by moving to the most highly valued county. Our framework suggests that increases in $QOLDIFF_B$ represent increases in the relative attractiveness of highly valued alternative counties. Thus, other things being equal, we expect that increases in $QOLDIFF_B$ will be associated with higher probabilities of changing counties. Similarly increases in $WDIFF_B$ should lead to higher probabilities of moving, while higher values of $HDIFF_B$ and $MOVECOST_B$ should be associated with lower move probabilities.

The more difficult task is predicting the county to which a person moves. We expect that individuals will locate in counties with the best combinations of wages, housing costs, quality of life, and moving costs. In order to test this hypothesis, we need the parameter estimates of the wage, housing cost, and moving cost equations, personal characteristics, and location decisions made over time. In the course of testing hypotheses about whether a person moves, the $QOLDIFF_B$, $WDIFF_B$, $HDIFF_B$, and $MOVECOST_B$ variables and $NETGAIN_B$ are calculated for each person in the sample. At the end of the sample period we observe the counties actually chosen by individuals. We are then able to estimate models explaining whether movers actually choose one of their most highly rated counties:

$$Pr(\text{HIGHRANK}) = f(\text{QOLDIFF}_B, \text{WDIFF}_B, \text{HDIFF}_B, \text{MOVECOST}_B, X), \quad (9)$$

where HIGHRANK = 1 if a mover chooses his or her most highly ranked county, and HIGHRANK = 0 otherwise. Just as in the move equation, we would expect that the probability of a mover choosing the highest-rated county would be positively related to $WDIFF_B$ and $QOLDIFF_B$, and negatively related to $HDIFF_B$ and $MOVECOST_B$. However, the estimates of this equation will provide us with evidence not on the determinants of the decision to move but instead on the determinants of choice of destination.

Our procedure can be summarized in six steps.

Step 1: Estimate the wage and housing expenditure hedonic equations, (2) and (3), with disequilibrium variables included.

Step 2: Use parameter estimates on disequilibrium variables from the wage and housing hedonic regressions to compute $WDIFF_C$ and $HDIFF_C$ for all individual movers for their chosen destination counties. Use parameter estimates on location amentities from the wage and housing regressions to calculate weights (p_i), and compute the $QOLDIFF_C$ for individual movers for their destination counties. Add $WDIFF_C$ to $QOLDIFF_C$ and subtract $HDIFF_C$ to get an upper-bound estimate of $MOVECOST_C$, following Eq. (5).

Step 3: Use $MOVECOST'_C$ as the dependent variable in Eq. (6) and estimate moving costs as a function of distance and other factors. Use parameter estimates from the MOVECOST′ regression estimated with the Mills ratio to compute moving costs for all individuals for all possible destination counties.

Step 4: With estimates of MOVECOST for all individuals, use Eq. (1) to compute NETGAIN for all individuals for all destination counties, rank the destination counties by NETGAIN, and identify the best possible move, $NETGAIN_B$.

Step 5: Estimate the move choice equation (8) for all individuals.

Step 6: Estimate the destination choice equation (9) for movers.

III. DATA

The models described above are estimated using data from the 1-in-1000 A Public Use Sample of the 1980 Census and already-compiled quality-of-life measures merged to the Census at the county level. This Census public use sample contains data for approximately 225,000 individuals and 80,000 housing units. The standard set of labor force, human capital, and demographic variables is contained in the individual records, while the corresponding housing records contain county of residence, location within an SMSA (central city, suburbs), and characteristics of the housing unit. For one-half of the households, migration questions were also asked, including county of residence in 1975. This enables construction of a mobility variable for the period 1975 to 1980.

A set of 16 quality of life variables has been compiled for 253 U.S. urban counties representing most of the largest counties in most of the largest SMSAs. These quality of life variables can be grouped into those measuring (1) climate, taken from *Comparative Climatic Data* prepared by the National Climatic Data Center; (2) urban conditions (e.g., crime and public services), collected from sources such as the *U.S. FBI Uniform Crime Reports for the United States* and the *Census of Governments*; and (3) environmental quality, obtained primarily from published and unpubished USEPA data.

Wage and housing expenditure equations are used to generate the weights for the quality of life index and county-specific wage and housing premiums. They are the same equations estimated by Blomquist *et al.* (1988) except for two disequilibrium variables. The data set used to estimate the wage and housing expenditure equations, which is described in more detail in our earlier paper, consists of 46,004 workers in 34,414 housing units in 253 counties. The housing sample includes all housing units on 10 or fewer acres for which value of the unit or contract rent is reported. The wage sample consists of all individuals aged 16 and over who reported their earnings, hours, and weeks; had nonzero wage and salary earnings; and had positive total earnings.

A transformation of monthly housing expenditure is the dependent variable in the housing equation. For renters, monthly housing expenditure is defined as gross rent including utilities. For owners, gross imputed rent is obtained by converting reported house value to monthly imputed rent and adding monthly expenditures for utilities. The dependent variable in the wage equation is a transformation of average hourly earnings. Average hourly earnings is obtained by dividing annual earnings by the product of weeks worked during the year and usual hours worked per week. The transformations used come from a Box–Cox search of alternative functional forms. The best functional form for the housing equation consists of linear independent variables and the following transformation of the dependent variable: $(Y^{0.2} - 1)/0.2$, where Y is monthly housing expenditure. The best functional form for the wage equation consists of linear independent variables and a dependent variable of $(Y^{0.1} - 1)/0.1$, where Y is average hourly earnings. The parameter estimates are then linearized to obtain estimates of WDIFF, HDIFF, QOLDIFF, and ultimately MOVECOST.

The wage and housing expenditure equations include the 16 quality-of-life variables, two disequilibrium variables, and a number of structural characteristics in the housing expenditure equation and personal, industry, and occupation characteristics in the wage equation. The disequilibrium variables are the county unemployment rate and the county population growth rate between 1970 and 1980. Structural characteristics in the housing equation are units at the address, age of the structure, stories, rooms, bedrooms, bathrooms, condominium status, central air, presence of a sewer, whether the lot size exceeds 1 acre, renter status, and renter interactions with each of the structural characteristics. Control variables in the wage equation are potential experience (age − schooling − 6), experience squared, gender, gender interactions with experience and experience squared, race, gender interaction with race, marital status, gender interaction with marital status, gender interaction with children under 18, years of schooling, whether disabled, whether enrolled in school, dummies for five of six broad occupation groups, and percentage of the worker's industry covered by unions.

A somewhat different sample is used to investigate county-to-county mobility between 1975 and 1980. First of all, only one-half of the households are asked about location of residence in 1975, a question which is necessary to construct a mobility variable. Two other important restrictions are made. In order to focus on individuals for whom all four components of NETGAIN are important, only those who worked in both 1975 and 1979 are included in the sample. This excludes retirees, children, and others not in the labor market and thus not able to take advantage of disequilibrium wage gains. The other restriction is that the individual must live in 1 of the 253 counties for which we have complete sets of amenity data in both 1975 and 1980. This is necessary in order to assess the effects of quality of life on migration. The full sample for this study of migration consists of 17,778 individuals, 2120 (or 11.9%) of whom changed their county of residence between 1975 and 1980, and 15,658 of whom are observed to be in the same county in both 1975 and 1980.

IV. RESULTS

A. *Wages, Housing Prices, and Quality of Life*

The empirical work begins with the estimation of the wage (W) and housing expenditure (H) hedonic equations, Eqs. (2) and (3). Parameter estimates are shown for the 16 quality-of-life or amenity variables and for the two disequilibrium variables in the Appendix. Higher county unemployment rates are associated with lower wages and housing expenditures. Higher county population growth rates are associated with higher wages and housing expenditures. The results for these two variables form the basis for the WDIFF and HDIFF variables in the migration analysis.

For quality of life, in general, one might expect lower wages and higher housing expenditures to be associated with amenities and higher wages and lower housing expenditures associated with disamenities. In this way individuals pay implicitly through the labor and housing market for location-specific amenities and are compensated for disamenities. The direction of the compensation in the separate markets, however, is not important. Instead, as Roback (1982) and Hoehn *et al.* (1987) demonstrate, it is the full compensation across the two markets that matters. In fact, all 16 quality-of-life variables have implicit prices of the expected sign. The difference in quality of life (QOLDIFF) is constructed by aggregating these prices as shown in Eq. (4).

B. *Estimates of Moving Costs*

The results of the wage and housing expenditure hedonics are first used to construct WDIFF, HDIFF, and QOLDIFF for those who changed counties between 1975 and 1980. These variables are then combined and used to estimate the moving cost equation.[3] The moving cost equation is estimated with and without the inverse Mills ratio variable. This variable controls for unobservables that affect moving costs and are also correlated with the migration decision. The Mills variable is constructed from estimates of a reduced form probit of whether or not a person changes counties between 1975 and 1980.[4]

Table I contains estimates of the Moving Cost Eq. (6) for those who changed counties between 1975 and 1980, along with the mean characteristics of those people who did and did not change counties. Before turning to the moving cost equation estimates, it is useful to compare the characteristics of movers and nonmovers. The movers are less likely to be living in the state that they were born, and the average distance of their move is 625 miles. The movers have more schooling, are younger, are less likely to be homeowners, married, parents, or nonwhite, and are more likely to have been in college in 1975. There is only a minor difference in the proportion of females between the movers and nonmovers.

An interesting question about movers is whether individuals move to higher quality of life and wage areas and lower housing cost areas. In the sample of movers, the average predicted change in quality of life is a $120 increase per year. The average predicted wage change from disequilib-

[3] In constructing WDIFF, HDIFF, and QOLDIFF we assume constant time horizons and discount rates across individuals in the sample. Thus (WDIFF + QOLDIFF − HDIFF) is an estimate of annual moving cost. In order to obtain an estimate of total moving costs, the annual estimate would have to be adjusted to reflect the number of future periods and the discounted value of future periods.

[4] The reduced form probit includes the 16 amenity variables for the county of residence in 1975, the two disequilibrium variables for the county of residence in 1975, and variables measuring years of schooling, age, age squared, whether the first marriage occurred prior to 1975, whether the individual had children prior to 1975 (using the ages of the individual's children in 1980), the race of the individual, the gender of the individual, whether the individual was in college in 1975, and whether the individual was born in the state of residence in 1975.

TABLE I
Moving Cost Equation Estimates and Mean Characteristics of Movers and Nonmovers
(t Statistics in Parentheses)

Variable	Moving cost equation[a]		Mover means	Nonmover means
Born in 1975 state of residence (yes = 1)	425.1	952.3	.467	.571
	(7.54)	(11.6)		
Born in 1980 state of residence (yes = 1)	−376.5	−370.0	.377	.571
	(6.34)	(6.34)		
Distance between 1975 and 1980 counties (miles)	.2908	.3024	624.6	0.00
	(2.87)	(3.04)		
Distance between 1975 and 1980 counties squared (miles/1000)	−.0610	−.0705	984,588	0.00
	(1.55)	(1.82)		
Years of schooling, 1980	−.4047	−79.55	13.9	12.6
	(.045)	(6.27)		
Age, 1980 (years)	−29.96	−4.027	34.0	41.8
	(1.96)	(.262)		
Age^2, 1980 (years)	.4232	.6364	1275.4	1932.0
	(2.50)	(3.55)		
Married, 1980 (yes = 1)	−18.21	−15.56	.631	.684
	(.317)	(.276)		
Children at home, 1980 (yes = 1)	73.26	34.11	.412	.434
	(.963)	(.456)		
Race (nonwhite = 1)	63.51	444.5	.110	.159
	(.832)	(5.12)		
Gender (female = 1)	−42.78	−4.470	.388	.393
	(.883)	(.094)		
Children, 1975 (yes = 1)	2.286	341.8	.263	.348
	(.028)	(3.87)		
1975 and 1980 Counties in same SMSA (yes = 1)	64.04	−28.54	.244	1.00
	(1.06)	(.474)		
First marriage prior to 1975 (yes = 1)	−124.4	−127.2	.551	.739
	(1.86)	(1.93)		
In college, 1975 (yes = 1)	−117.6	−225.9	.161	.070
	(1.68)	(3.24)		
Home ownership, 1980 (yes = 1)	100.6	100.2	.476	.631
	(1.89)	(1.92)		
Mills ratio		−1,843	1.51	−.204
		(8.72)		
Intercept	495.2	2,921	—	—
	(1.70)	(7.31)		
R^2	.056	.089	—	—
n	2120	2120	2120	15,658

[a] The dependent varible in the moving cost equation is the sum of WDIFF, HDIFF and QOLDIFF for the county actually chosen. It is an upper bound estimate of the annual costs of moving from the 1975 to the 1980 county. The mean estimated annual moving cost for the sample in 1980 is $212.94. The means for the components of the moving cost variables are: WDIFF = $221.03; HDIFF = −$128.38; and QOLDIFF = $120.29.

rium sources is a $221 increase and the average predicted change in housing costs is a $128.[5] On average the increase in wages and quality of life outweigh the adverse impact of the higher housing costs. These three components are used to construct the dependent variable in the moving cost equation, which has a mean of $213, (120 + 221 − 128 = 213). This amount is the average net gain for movers before accounting for moving costs and is therefore an upper-bound estimate of the average moving costs.

The coefficient on the Mills ratio in the moving cost equation is negative and significant. Thus, as expected, unobservables which increase moving costs (through the choice of a bundle of amenities and disequilibrium characteristics) decrease the probability that an individual moves. Other variables in the moving cost equation produce expected results. For example, if an individual was born in the state of 1975 residence, then moving costs are observed to be higher. (See the second column in Table I.) In other words, individuals are compensated an extra $952.30 per year through higher wages, lower housing costs, or better quality of life for making a move outside the state if they were born there. The opposite is true for moves to an individual's state of birth. Individuals receive $370 less compensation per year to move to counties in their states of birth. These variables can be thought of as proxies for family attachments and sense of place in the move decision. The coefficient on the distance variable is positive and significant while the coefficient on distance squared is negative and marginally significant. This combination suggests that moves of greater distance cost more, but that the compensation increases at a decreasing rate. Moving costs are higher for those who had children in 1975 or are homeowners. Moving costs decrease significantly with greater schooling, and increase with age, perhaps reflecting greater attachments. Moving costs are higher for nonwhites, lower for those who were in college in 1975, and almost identical for men and women.

The results for the moving cost equation that includes the Mills ratio are in general qualitatively similar to those without the Mills ratio. In most cases, however, the parameter estimates without the Mills ratio are closer to zero. For example, not controlling for selection bias, the compensation required for movers to leave a county in the state in which they were born is $425.10. This compares with $952.30 after controlling for selection bias by including the Mills ratio.

[5] Our data set contains amenity and disequilibrium data for only one year, 1979. Thus, any differences in wages, housing costs, or quality of life across counties come from differences in amenities or disequilibrium conditions in 1979. We ignore differences within county from 1975 to 1979, assuming that individuals choose a location in 1980 by comparing the conditions in 1979 of their county of residence in 1975 with the conditions that existed in 1979 in all other counties.

C. *The Choice of Move or Stay*

The parameter estimates for the Moving Cost Eq. (5) are used to calculate MOVECOST for each individual for all 252 possible destination counties. The wage and housing expenditure hedonic estimates (Eqs. 2 and 3) are used to calculate WDIFF, HDIFF, and QOLDIFF for each individual for all possible combinations. These four variables are combined to form NETGAIN (Eq. 1) for each county. The counties are ranked for each individual and the top 10, 25, and 50 are used for further analysis.[6] The average MOVECOST, WDIFF, HDIFF, and QOLDIFF are calculated for the top 10, 25, and 50 counties for each individual as measures of the potential attractiveness of relocating to another county. The estimates of the four migration factors are first used as variables in Eq. (7) explaining whether or not individuals changed counties between 1975 and 1980. Then, in order to address the question of where individuals move, these same averages for the top counties are used to estimate Eq. (8) explaining whether individuals who do decide to move choose one of the predicted top counties.

For both analyses we use the predicted MOVECOST obtained from the equations with the Mills ratio. For each individual, MOVECOST is predicted using all of the estimated parameters except for the Mills ratio. This provides estimates of MOVECOST for movers and nonmovers that are not conditioned by the move decision itself and thus are appropriate for use in the probability-of-move estimation.

Table II provides estimates of the MOVE Eq. (8) using probit analysis. In each case the dependent variable is whether or not the person moved (MOVE). The first three columns of results in the table show equations for which the WDIFF, HDIFF, QOLDIFF, and MOVECOST variables are averaged over each individual's top 10, 25, or 50 counties. The variables not shown in the table are an intercept and dummy variables for the age categories 25–34, 35–44, 45–54, 55–64, and 65 years and over to control for differences in expected future periods at the new destination. The first row of results shows the estimates of a mover equation model that does not disaggregate NETGAIN into four categories. In each column increases in NETGAIN significantly increase the probability of changing counties. For example, using the estimates for the gains associated with moving to one of the top 25 counties, a $1000 increase in NETGAIN leads to a 1.45% increase in the probability of moving based on a mean of 0.1192.

The estimated parameters for WDIFF, HDIFF, QOLDIFF, and MOVECOST show a consistent pattern across the first three columns of

[6] We also performed the analysis using only the top-ranked county for each individual and obtained similar results to those reported below.

TABLE II
Probit Estimates of the Probability of Changing Counties between 1975 and 1980
(t Statistics in Parentheses), n = 17,768

	County rankings computed using MOVECOST			
Variable[a]	Top 10 counties[b]	Top 25 counties[c]	Top 50 counties[d]	Ranking computed without MOVECOST for top 25 counties[c]
NETGAIN	.1475	.1511	.1475	−.0215
	(11.3)	(11.5)	(11.3)	(1.54)
−2ln likelihood	838.4	842.6	838.3	711.1
WDIFF	.0919	.1249	.1115	.0600
	(1.84)	(2.47)	(2.19)	(1.23)
HDIFF	−.0292	−.0440	−.0390	−.0680
	(.506)	(.759)	(.672)	(1.20)
QOLDIFF	.0108	.0045	.0006	−.0374
	(.507)	(.225)	(.030)	(1.88)
MOVECOST	−.4709	−.4735	−.4695	—
	(20.9)	(20.9)	(20.8)	
−2ln likelihood	1166.0	1172.8	1165.5	714.3

[a] Each model also includes an intercept term and five age dummies: 25–34, 35–44, 45–54, 55–64, and 65+ years.

[b] The WDIFF, HDIFF, QOLDIFF, and MOVECOST variables are measured as averages across the top 10 predicted counties for each individual in the sample. WDIFF and QOLDIFF are the average annual gain in wages and quality of life that the individual can obtain by moving to one of his or her top 10 counties. HDIFF is the annual average change in housing costs and MOVECOST is the estimated annual average moving cost associated with relocating to one of the top 10 predicted counties. WDIFF, HDIFF, QOLDIFF, and MOVECOST are all expressed in 1980 dollars. For all three of the probit equations reported the dependent variable equals 1 if the individual changed counties between 1975 and 1980 and equals 0 if the individual stayed in the same county. The parameter estimates shown are multiplied by 1000.

[c] Same as Table Note *b* except for the top 25 counties.

[d] Same as Table Note *b* except for the top 50 counties.

results of Table II.[7] The direction of the effect of changes in housing costs and quality of life on the probability of migration is as expected, but neither coefficient is statistically significant. On the other hand, individuals do appear to respond to wage gains that can be realized by moving.

[7] The models estimated in Table II include age category dummies to partially control for differences in time horizon, but the effects of WDIFF, HDIFF, QOLDIFF, and MOVECOST variables are constant across the sample. In order to address whether the results are sensitive to this assumption, we experimented with interacting these variables with age, since time horizons at the new location in general are likely to decrease with age. In the interactive models, the positive effects of wages and quality of life are reduced with

Increases in wage gains for the top-ranked counties significantly increase the probability of changing counties between 1975 and 1980. The top 25 county estimates imply that a $1000 increase in WDIFF increases the probability of moving by 1.14%. Individuals also respond to differences in moving costs. Increases in moving costs to one of the top ranked counties significantly reduce the probability of changing counties. A $1000 increase in MOVECOST decreases the probability of moving by 4.32%.

The last column of Table II shows the importance of incorporating MOVECOST into the analysis. In this column we present estimates of probability-of-move equations which include (1) NETGAIN and (2) the components of NETGAIN excluding MOVECOST. In other words, alternative rankings of the counties are obtained for each individual in the sample based on estimates of NETGAIN excluding MOVECOST. This alternative ranking is then used in estimating the average NETGAIN for the top 25 possible destination counties. Using the alternative estimates, increases in NETGAIN are *negatively* related to the probability of moving, and the estimated effect of WDIFF becomes insignificant. This specification is inferior to our specification with estimated moving cost included. The specification with estimated moving cost has the expected signs and a higher likelihood value.

D. The Choice of Destination

In Table III, we present probit estimates of the Destination Eq. (9) for movers. The question is whether or not people who move actually choose one of their highest-ranked counties according to their overall net benefits, Eq. (1). The results are consistent across the first three columns. Increases in NETGAIN raise the probability of choosing highly ranked counties. Using the estimates for the top 25 counties, a $1000 increase in NETGAIN raises the probability of choosing one of the top 25 counties by 4.26% based on a mean of 0.1443. Those movers who choose one of their top 25 counties receive on average $785 higher NETGAIN than those movers who did not choose to locate in one of their top 25 ranked counties.

Similar to the decision of whether or not to move, individuals are more likely to choose a highly ranked county the larger the disequilibrium wage gains that can be realized by moving. A $1000 increase in WDIFF raises the probability of choosing a top 25 destination by 9.31%. Unlike the

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age, while the effects of housing and moving costs become less negative with age. However, the ages at which the effects change direction are well above the sample mean. Thus, the main results reported in Table II are not substantially affected by the addition of the age interactions. For a study of the influence of age on migration rates due to earnings, amenities, and taxes, see Clark and Hunter (1992).

TABLE III
Probit Estimates of the Probability of Movers Choosing Highly Ranked Counties
(t Statistics in Parentheses), n = 2120

Variable[a]	County rankings computed using MOVECOST: Top 10 counties[b]	Top 25 counties[c]	Top 50 counties[d]	Ranking computed without MOVECOST for top 25 counties[c]
NETGAIN	.4174	.4897	.5225	.4696
	(7.55)	(12.2)	(15.5)	(9.86)
−2ln likelihood	71.44	177.3	281.4	116.8
WDIFF	.8542	1.238	1.333	1.061
	(3.53)	(6.73)	(8.85)	(5.80)
HDIFF	−1.119	−1.394	−1.428	−1.240
	(4.62)	(7.31)	(8.97)	(6.40)
QOLDIFF	.6519	.7161	.7710	.4577
	(7.16)	(11.7)	(14.2)	(7.36)
MOVECOST	−.0585	.0247	.0868	—
	(.659)	(.380)	(1.55)	
−2ln likelihood	104.8	288.6	487.1	134.6

[a] Each model also includes an intercept term and five age dummies: 25–34, 35–44, 45–54, 55–64, 65+ years.

[b] WDIFF, HDIFF, QOLDIFF, and MOVECOST are averages across each individual's top 10 predicted counties. The dependent variable equals 1 if the individual moved to one of the counties which is ranked in the top 10 for that individual and equals 0 if the individual moved to a county which is not in the top 10 for that individual. The parameter estimates shown are multiplied by 1000.

[c] Same as Table Note *b* except for the top 25 counties.

[d] Same as Table Note *b* except for the top 50 counties.

decision of whether or not to move, differences in housing costs and quality of life are important in choice of destination. Increases in housing costs at preferred locations lower the probability of choosing them. Increases in the quality of life at highly ranked locations significantly raise the probability of moving to one of them. An increase of $1000 in HDIFF lowers the probability of choosing a top 25 destination by 10.7%, while the same increase in QOLDIFF raises the probability of choosing a top 25 destination by 5.38%. Thus, while differences in quality of life do not significantly affect directly the decision to move, once an individual has decided to move, quality-of-life considerations become important. This evidence sheds new *light* on the debate about the effects of quality of life on migration.

Differences in moving costs appear unimportant among movers in the choice of destination. In each case the MOVECOST coefficient is insignificantly different from zero. Consistent with this evidence, the results in the last column that exclude MOVECOST from the NETGAIN ranking produce results similar to those shown in the other three columns. Thus incorporating MOVECOST into the analysis is important in explaining whether or not individuals move, but is not crucial for the choice of destination among movers.

One final test of whether the model is useful in predicting where an individual moves can be carried out by comparing the results to what would be expected if individuals randomly chose a county. Our sample is constructed so that movers have 252 possible destinations. Between 1975 and 1980, 5.2% of the movers relocated in one of their top 10 counties, 13.6% moved to one of their top 25 counties, and 26.8% moved to one of their top 50 counties. This compares to 4.0, 9.9, and 19.8% if individuals were randomly relocating. Using a binomial approximation to the normal, all of these differences are significant at the .01 level or better.[8]

V. CONCLUSIONS

This paper examines the role of earnings, quality of life, and housing prices in the decisions of individuals to move from one county to another between 1975 and 1980. We measure differences in quality of life across counties by differences in the amounts of location-specific characteristics from county to county (such as crime, school quality, climate, and environmental quality), weighted by the implicit prices that individuals must pay for these characteristics through the housing and labor markets.

In the process of estimating whether individuals move, we estimate moving cost equations using the behavior of individuals who actually do move. Our moving cost equation controls for selection bias, in addition to demographic characteristics and sense of place variables such as distance to the new location and whether or not the individual was born in the premove state of residence. Moving costs are proxied by the wage and quality-of-life gains observed less any increases in housing costs. This net amount provides an upper-bound estimate of moving costs for movers. A framework that includes this estimate is shown to provide a better explanation of move decisions than one that ignores moving costs.

We estimate the probability of moving and find that earnings and moving cost differences matter in the decision. The probability that an individual changes counties increases with the potential wage gains from moving

[8] The z-scores are 2.879 for the top 10 counties, 5.644 for the top 25 counties, and 8.025 for the top 50 counties.

and decreases with increases in moving costs. Quality-of-life and housing cost differences do not appear to matter.

In addition, we begin to address the more difficult question of where individuals move. We estimate models that explain whether or not movers choose one of a set of counties highly ranked for that individual on the basis of wages, housing costs, quality of life, and moving costs. We find that wage, housing cost, and quality-of-life differences are important in explaining where an individual locates. We find that the number of individuals choosing one of the predicted top counties is significantly greater than that which would be observed if individuals moved randomly from one county to another. While quality of life does not significantly affect the decision whether or not to move directly, it does influence an individual's choice of destination once the decision to move has been made.

APPENDIX

Wage and Housing Expenditure Hedonic Estimates and Full Implicit Amenity Prices
(*t* Statistics in Parentheses)

Variable[a] (mean and units)[b]	Wage hedonic[c]	Housing hedonic[d]	Amenity price[e]
Precipitation (32.0 in./year)	−.00189	−.00544	$22.07
	(3.24)	(5.00)	
Humidity (68.3%)	.000215	−.0250	−44.19
	(.216)	(13.5)	
Heating degree Days (4326 per year)	−.00000141	−.0000769	−.10
	(.360)	(10.3)	
Cooling degree Days (1162 per year)	−.0000448	−.000634	−.30
	(5.43)	(40.1)	
Wind speed (8.89 m.p.h.)	.0186	.106	−131.69
	(5.44)	(16.4)	
Sunshine (61.1%)	−.00205	.0105	50.54
	(2.19)	(6.10)	
Coast (yes = 1, .334)	.00234	.343	519.42
	(.236)	(18.6)	
Central city (yes = 1, .290)	−.0648	−.268	621.24
	(6.50)	(14.5)	
Violent crime rate (646 crimes/100,000 pop.)	.000106	.000400	−1.07
	(9.25)	(18.8)	
Teacher–pupil ratio (.0799)	−1.05	.968	18,672.30
	(3.60)	(1.80)	
Visibility (15.8 miles)	−.00128	−.0118	1.60
	(2.84)	(13.9)	
Total suspended particulates (73.2 μg/m^3)	−.000148	−.00169	−.33
	(.641)	(3.94)	
NPDES dischargers (1.51)	.00234	−.0230	−75.57
	(1.19)	(6.41)	

APPENDIX—*Continued*

Variable[a] (mean and units)[b]	Wage hedonic[c]	Housing hedonic[d]	Amenity price[e]
Landfill waste (477 hundred mil. metric tons)	.0000118	.0000643	−.09
	(3.80)	(10.7)	
Superfund sites (.88)	.0163	.0983	−106.36
	(6.20)	(19.4)	
Treatment, storage, disposal sites (46.4)	.000165	.000252	−2.29
	(1.65)	(1.35)	
County unemployment rate (6.42%)	−.00459	−.0917	—
	(2.30)	(24.7)	
County population growth 1970–1980 (12.5%)	.00136	.00472	—
	(5.03)	(9.18)	
R^2	.314	.670	—
n	46,004	34,414	—

[a] Several control variables are also included in the wage and housing hedonics. Included in the wage hedonic are: experience (age − schooling − 6), experience squared, gender, race, marital status; gender interactions with experience, experience squared, race, marital status, and children under 18; schooling, disabled, school enrollment status, dummies for 5 of 6 broad occupation groups, and percentage of industry covered by unions. Included in the housing hedonic are: units at address, age of structure, stories, rooms, bedrooms, bathrooms, condominium status, central air, sewer, lot size exceeds 1 acre, renter status, and renter interactions with each of these variables.

[b] Means are given for the wage hedonic sample of 46,004.

[c] Wages are measured as annual earnings divided by the product of annual weeks worked and usual hours per week. The mean wage in the sample is $8.04 (1980 dollars). A Box–Cox search yielded a dependent variable for the wage hedonic of $(\text{WAGE}^{.1} - 1)/.1$.

[d] Monthly actual (renters) or imputed (owners) housing expenditures are used. The mean monthly housing expenditures (RENT) in the sample are $462.93 (1980 dollars). A Box–Cox search yielded a dependent variable for the housing hedonic of $(\text{RENT}^{.2} - 1)/.2$.

[e] The full amenity price is the sum of the implicit annual compensation in the wage and housing market. The full price for amenity i is calculated as $P_i = b_{Hj}(462.93^{.8})(12) - b_{wi}(8.04^{.9})(1.54)(37.85)(42.79)$, where b_{Hi} and b_{wi} are the parameter estimates for amenity i in the housing and wage hedonics, 462.93 is the mean monthly housing expenditure, 12 is the number of months per year, 8.04 is the mean wage, 1.54 is the mean workers per household, 37.85 is the mean hours per week, and 42.79 is the mean weeks worked per year. The $(462.93^{.8})$ and $(8.04^{.9})$ terms convert the hedonic parameter estimates into dollars per unit. The full amenity prices are expressed in 1980 dollars per unit.

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