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Interpreting the Effect of Distance on Migration

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In this paper I discuss the economic (and other) determinants of the adverse effect of distance on migration, which is demonstrated by the negative distance elasticity of migration flows. These determinants are sorted and classified into two groups: (1) increasing (with distance) psychic cost and (2) diminishing (with distance) information. I further discuss how aging and education respectively influence the relative importance of these two groups. Using data on flows of migrants cross-classified by age and by education, I estimate the effect of age and education on the distance elasticity of migration. The statistical hypothesis that aging does not affect the distance elasticity whereas increasing education strongly diminishes the absolute value of the distance elasticity is accepted. The acceptance of this hypothesis, coupled with my theoretical consideration, implies that the adverse effect of distance on migration is basically a diminishing-information phenomena.

I. Introduction

Studies on the determinants of migration give evidence that distance has a strong negative effect. Thus, *ceteris paribus*, the farther two regions are from each other, the lower will be the flow of migrants between them.

Sahota (1968) obtains this result for Brazil; Beals, Levy, and Moses (1967) arrive at similar conclusions for Ghana; Gallaway (1967), Rogers (1967), Sjaastad (1961, 1962), Schwartz (1968), and Nelson (1959) obtain similar results for different areas (or aggregates) in the United States; Courchene (1970) and Vanderkamp (1971) find it in Canada.

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Sjaastad (1962) estimates that the attractiveness of a given destination in the United States is unaffected by a 10 percent gain in earnings if there is a 16 percent increase in distance from origin. Thus, using the means of the income and distance variables in his study, an annual earnings increase of $106.00 (in 1949 dollars)[1] is neutralized by 146 miles of distance. Sahota (1968) estimates that the attractiveness of a 10 percent gain in wage rate in Brazil is neutralized by a 22 percent increase in distance. For the mean of his sample, an earnings increase of 45 cruzeiros per month (in 1949 currency) is cancelled by a distance of 330 kilometers.

However, Sahota estimates the cost of moving 330 kilometers at around 75 cruzeiros; thus the transportation cost can be retrieved by an unmarried person in a little over $1\frac{1}{2}$ months. This figure casts doubt on the relevance of direct transportation cost in explaining the adverse effect of distance. On the basis of such figures, most studies in the field attribute the phenomenon to either the diminishing information on job opportunities or the increasing psychic cost.

We thus have two alternative explanations for the behavior of migrants toward distance. These explanations are not necessarily mutually exclusive, and the deterrence of distance may reflect the combined effect of both. The question, then, concerns the relative importance of each. Courchene (1970) and Beals, Levy, and Moses (1967) leave the question untouched. Gallaway (1967), Nelson (1959), Sjaastad (1962), and Schwartz (1968) tend to emphasize the information variable. In concluding his discussion on migration and distance, Sjaastad (1962) writes: "One is strongly tempted to appeal to market imperfections such as the lack of information, to explain the apparently high distance cost of migration. Unfortunately, no simple way has been devised for testing that hypothesis although attempts have been made."

Since a smooth flow of economic resources is a necessary condition for welfare maximization, identification of the reasons for the adverse impact of distance on migration flows has important implications for policy. If the deterrence is due to diminished information, mobility can be enhanced by supplying information services. Reducing psychic cost, on the other hand, is far more complex.

In this paper I address the economic interpretation of the role of distance in influencing migration flows. In particular, I try to illuminate the question of whether increased distance reflects diminishing information or increasing psychic cost. As a by-product of this attempt, I obtain estimates of distance elasticities of migration for different age-education groups.

[1] It should be emphasized that these income figures were obtained by considerable manipulation.

II. Theoretical Discussion

Recent studies viewing migration as a personal problem of decision making assume that: (*a*) migration is an investment which entails cost but produces a stream of returns; (*b*) the information available to potential migrants on job opportunities is only partial; (*c*) both cost and the returns have some nonpecuniary components; (*d*) a migrant contemplating migration from a given origin to given destinations forms his own subjective prediction regarding his future income stream in his place of origin and the potential destinations, and picks the region that maximizes his net benefit; and (*e*) different migrants have different subjective predictions regarding future income streams—which is one explanation of why not all move if one moves, and why not all migrants are moving in the same direction. The distribution of subjective predictions is crucial to the analysis of this paper. I therefore discuss its sources in more detail.

The subjective predictions are based on observed current earnings in alternative locations, current tightness of the market in terms of job openings and unemployment rates, personal connections, available information, and personal cost of migration to alternative locations. Subjective predictions differ among people for a number of reasons: (*a*) in each location, there is a distribution of earnings rather than equal earnings for all persons; (*b*) there are different degrees of unemployment etc.; (*c*) people differ in their evaluations of their opportunity ranges (which are based on the observed distributions in the alternative locations and on their evaluations of their own personal characteristics); and (*d*) persons may have differing amounts of information on the distribution of the variables on which they base their subjective predictions.

In addition to differences in subjective predictions of future income stream in alternative locations, persons differ in terms of their evaluation of the cost involved in migrating from a given location to another one—since they differ in their family sizes, their economic and psychic attachments to their locations, etc.

Even if we limit ourselves to more homogeneous groups of persons by classifying them according to some attributes, the variation in subjective predictions of the net benefit of migration (which is a function of the subjective prediction of future income streams and the subjective personal cost) is not eliminated.

This variation may explain the observed phenomenon that people may move from locations with high median income into locations of low median income. Clearly, they may actually improve their lot if they move from a lower portion of the distribution in their original location into a higher portion of the distribution in the new location.[2]

[2] See Schwartz (1971) for a complete discussion and some results which illuminate this point.

We do not know the subjective predictions of net benefits of potential migrants; consequently, we can only make statements on the probability of migrating as a function of observed values of the economic variables involved—expressed in terms of the location of their distributions (mean, median, etc.). For instance, we may state that the probability that a person belonging to a certain group will migrate from a given location to a given destination increases as the present-value-of-earnings differential (computed from median earnings by age for that group in both locations) increases, as the observed-unemployment differential decreases, as the distance decreases, etc.

For econometric reasons I address myself to a more limited question, namely, What is the probability of a person in origin k migrating to destination l, given that he is a migrant? This is a conditional probability where only a subset of persons in k—those who actually move—are considered. Since I am considering only people who actually move, their only decision problem is the choice of a location among the alternative destinations. Thus, all variables related directly to origin alone are dropped from consideration—since the choice of a location is being determined by its relative attractiveness over other alternative destinations only.

Relative attractiveness depends on subjective predictions (for all destinations) of net benefits which themselves depend on subjective predictions of economic (and other) variables, as discussed above. These predictions are distributed around the observed means of the corresponding variables. As the observed mean of a given variable in a given location increases relative to all other locations, the corresponding subjective prediction distribution shifts upward.

Thus, the probability that a migrant choose the lth location (rather than all other locations) increases as the lth location's present value of earnings (computed from mean or median earnings by age) increases relative to the other locations. The probability decreases as the unemployment rate increases relative to all other locations, and as the relative cost of resettling in l (not including transportation cost and other cost elements associated with distance) increases. It decreases as the distance from k to l increases relative to the distances from k to all other locations; again, distance reflects either cost of moving or diminishing information, or both. Some other relevant variables can be introduced.

I measure the magnitude of the present value of earnings in l relative to that of all alternative destinations as a ratio of the present value in l to a weighted average of the present values in all destinations. I do likewise with the unemployment rate, the distance, and other variables.

I obtain more homogeneous groups of migrants by considering only white males, then classifying them by age and education. All relevant economic variables are likewise classified. From median earnings by age, by education, and by regions, I construct the observed present value of earnings for each group in each location. Unemployment rates are decomposed into age-education rates and so are other variables. I express the above discussion formally in the following equation:

$$P\left(\frac{Z_{ijkl}}{Z_{ijk.}}\right) = f\left(\frac{PV_{ijl}}{\sum_{n\neq k} w_n PV_{ijn}}, \frac{U_{ijl}}{\sum_{n\neq k} w_n U_{ijn}}, \frac{C_{ijl}}{\sum_{n\neq k} w_n C_{ijn}}, \frac{D_{kl}}{\sum_{n\neq k} w_n D_{kn}}, i, j\right), \quad (1)$$

where PV, U, C, and D are present value of earnings, unemployment rate, cost of adjustment, and distance, respectively. On the left-hand side we have the probability of a person choosing destination l conditional upon his being a migrant from k belonging to the ith age group and the jth education group. On the right-hand side we have the economic and other determinants of that probability expressed as ratios of the magnitudes involved in l relative to a weighted average of the magnitudes in all destinations. One of these variables is the distance from k to l relative to the weighted sum of distances from k to all destinations. Relative distance is the only ratio for which an index for the origin is specifically included.

We may have more than one migrant in a group. If we assume that they are independent in their choice of location, the distribution of the number of migrants of a given homogeneous group allocated to the alternative destinations will then be multinomial, with probabilities determined by the function f. A maximum-likelihood estimator of the probabilities of migration into each of the destinations is the observed relative shares of the alternative destinations in the total number of homogeneous migrants from k—to be denoted "allocative shares." Replacing the maximum-likelihood estimates of the probabilities in equation (1) yields

$$Y_{ijkl} = f\left(\frac{PV_{ijl}}{\sum_{n\neq k} w_n PV_{ijn}}, \frac{U_{ijl}}{\sum_{n\neq k} w_n U_{ijn}}, \frac{C_{ijl}}{\sum_{n\neq k} w_n C_{ijn}}, \frac{D_{kl}}{\sum_{n\neq k} w_n D_{kn}}, i, j\right), \quad (2)$$

where

$$Y_{ijkl} = \frac{M_{ijkl}}{\sum_{n\neq k} M_{ijkn}},$$

which is l's allocative share of kth migrants belonging to the ith age and jth education groups; M_{ijkl} is gross outflow of persons belonging to the ith age group and jth education group. Allocative shares of migrants are computed from flows of migrants. Having these figures and the corresponding economic determinants enables us to estimate the contribution of the determinants to the probabilities.[3]

This paper focuses on the economic interpretation of the role of distance as an economic determinant of the choice of a destination; hence, following Sjaastad's procedure, I hold a given destination constant and consider the allocative shares from all regions into that location.[4] It is evident from equation (2) that approximately all the variation in the allocative shares into destination l is obtained by the variation of the relative distance, and by age and education insofar as they directly affect the function and the values of the other determinants in their ratio form.

This is so because all variables except distance (which depends on the origin as well as the destination) are ratios of the value in destination l to a weighted sum of the values in all other destinations. Thus (varying k and) holding i, j, and l constant will not change the numerator of any variable except relative distance. On the other hand, the denominator of each variable (except distance, age, and education) is a weighted sum of $N - 1$ terms out of possible N, the kth term corresponding to the origin being excluded. If N is large enough and if no term is of a different order of magnitude, the sum is approximately the same for all k, producing at

[3] If we assume that the age-education distributions of the population in all regions are approximately the same, and so are the distributions of relative earnings, relative unemployment, relative cost of adjustment in the new location, etc., it can be shown that the subscripts for age and education of the variables in f can be dropped—leaving us with mean values of the variables over age and education instead. With this assumption, equation (2) is simplified into:

$$Y_{ijkl} = f\left(\frac{\overline{PV}_l}{\sum_{n \neq k} w_n \overline{PV}_n}, \frac{\overline{U}_l}{\sum_{n \neq k} w_n \overline{PV}_n}, \frac{\overline{C}_l}{\sum_{n \neq k} w_n \overline{C}_n}, \frac{\overline{D}_{kl}}{\sum_{n \neq k} w_n \overline{D}_{kn}}, i, j\right).$$

Proof: In each region we can compute age-education factors such that $PV_{ijn} = d_{ijn}\overline{PV}_n$, where $\overline{PV}$ represents the region's mean over age-education groups and d_{ijn} is the age-education factor. Under the assumption of equal distributions, the factors do not depend on the regions; thus, the index n can be dropped. It follows that:

$$\frac{PV_{ijl}}{\sum_{n \neq k} w_n PV_{ijn}} = \frac{d_{ij}\overline{PV}_l}{\sum_{n \neq k} w_n d_{ij} \overline{PV}_n} = \frac{\overline{PV}_l}{\sum_{n \neq k} w_n \overline{PV}_n}.$$

The same result holds for all other variables.

[4] "Allocative shares" is a term suggested by Sjaastad (1961) for these normalized figures. In fact, the method described here to isolate the distance impact on migration from all other variables is based on Sjaastad's procedure. This method is superior to a multiple regression having earnings difference as one of the regression variables. First, flows of migrants cross-classified by age and education are tabulated for interdivisional migration, whereas median earnings classified by division, age, and education are nonexistent and must be constructed under arbitrary assumption. Second, median earnings of vast areas such as the U.S. divisions conceal a tremendous internal variability, reducing their qualification to represent the earnings potential that migrants conceive.

most little variation (as k changes). Since neither the numerator nor the denominator changes as k changes, the ratios do not change. The distance variable depends on both k and l; hence both the numerator and denominator change with k to produce variations of the ratio.

I conclude this discussion by stating the following theorem: Holding a given destination constant, the variation in the observed allocative shares from any origin into that destination is generated by variations in relative distance, age, and education, where age and education directly affect the allocative shares and also affect them indirectly via changes in the values of all other determinants of allocative shares. Hence a regression of allocative shares on relative distance, age, and education, omitting all other variables, is legitimate in the sense of being *ceteris paribus*.

Age and education are very important in determining the probability that a person will be a migrant. This is revealed in the systematic behavior of the rate of migration, which is defined as the ratio of outflowing migrants to the parent population. This rate increases with education; it decreases with age up to retirement, and then increases a bit again.[5]

However, the problem to which I address myself is far narrower, namely, In what way do age and education affect the probability of choosing a certain destination over all others, given that the person has made his decision to move? Obviously, age and education affect that choice insofar as they affect the variables involved—such as relative earnings, relative unemployment, etc., as can be seen in equation (2).[6]

More important (in this paper) is the way age and education affect the sensitivity of the allocative shares with respect to distance. To this question I now turn. Relative distance affects the probability of choosing a location insofar as it affects the amount of information available on that location and the cost of migrating there. It is generally claimed that the amount of information diminishes with distance (alternatively, the cost of obtaining information increases with distance); hence, as the relative distance to a location increases, the probability that it will be chosen (over the others) diminishes.

In the Introduction, I demonstrated that the direct transportation cost of moving a household is negligible; hence, we are left primarily with psychic cost insofar as it depends on the distance migrated.[7] This cost is a

[5] See Schwartz (1968) for empirical findings and discussion of these results.

[6] If we are willing to accept the assumption of equal distributions which led to the simplified version of the allocative-share function in n. 3, age and education will not affect the magnitudes of these variables, as they are in ratio form.

[7] Psychic cost not related to distance is related either to the agony of the move itself or to the agony of settling in a new destination. Since I am considering allocative shares, thus limiting myself to migrants only, the first source of agony is dropped from consideration together with all other variables related to the origin. The second source of agony can be considered part of the cost of settling in the new location, which does not vary if we hold a destination constant.

result of the departure from family and friends. The longer the distance migrated, the lower will be the frequency of reunion; hence, the higher will be the psychic cost. This source of psychic cost can be transformed into quantifiable transportation cost. Assuming that a *given frequency of visits* to the old location will suffice to eliminate psychic cost, we can compute the annual transportation cost required to do so. Certainly this cost increases with distance migrated—and, unlike the transportation cost of moving a household, this is not at all negligible.

Neither psychic cost nor information levels are observed; theoretically, however, their impact on allocative shares is demonstrated by the negative effect of distance. Can we make qualitative statements such as: "In a country with a single language and homogeneous culture, diminishing information is more important in reducing the allocative shares than is psychic cost"? Or a stronger statement such as: "Psychic cost associated with distance is nil; the adverse effect of distance on allocative shares is due solely to decreasing amount of information"? Introducing the impact of age and education on information and psychic cost will carry us in that direction. To that end, I first catalog all possible ways by which age and education affect information and psychic cost.

a) *Information Hypothesis*

The sources of information on job opportunities include interpersonal communication with friends, relatives, neighbors, co-workers, and potential employees, plus long-distance correspondence, labor exchanges, placement offices, and local communication media (newspapers, radio stations, etc.). The lower the sophistication of the method by which information is sought, the faster will be the decline in the amount of information as distance increases. The cheapest and least sophisticated method is that of local interpersonal communication, which produces the fastest decline in the amount of information with distance.

Education certainly increases a person's capability of obtaining and analyzing published information, and of using more sophisticated modes of information. Moreover, as education increases, the market (for individual occupations at each level of education) tends to become geographically wider but quantitatively smaller. The market for dishwashers is local, and many are needed; on the other hand, relatively fewer space scientists are needed—but the market is international. Thus, both the sophistication of the modes of information and the geographical size of the market increase with education—producing a higher homogeneity of information over the area and diminishing adverse effect of distance on allocative shares.

In the process of aging, people gather experience on the job—which, to some extent, substitutes for schooling. Hence it may be claimed on the basis of the discussion above that the process of aging generates more homogeneous spatial information, thereby diminishing the adverse effect of distance. However, there are strong reservations about this conclusion. While it is true that experience is gathered over time, it should be recognized that this experience is generally limited to improving the person's skills in a given profession—which, in turn, is largely determined by his education level. Hence the argument about the increasing geographical size of the market (which is true for increasing education) does not hold for aging. It is also quite likely that increased professional skills (through experience) do not necessarily increase the sophistication of the usage of information modes. Therefore, if aging increases information, it does so to a limited extent.

b) *Psychic Cost*

As stated above, psychic cost can be transformed into permanent transportation cost by figuring the needed frequency of visits to the place of origin so as to negate the agony of departure from family and friends. This frequency is certainly a function of age, and most likely increases with it for adult persons; in the process of aging, more is invested in relations with family members and friends, and thus the higher is the agony of severing these relations. This implies that, in psychic cost, aging amplifies the adverse impact of distance on allocative shares.

Education's impact on psychic cost of departure from family and friends is a most problematic issue. Obviously, education does not increase the psychic cost. It is also likely that higher education groups are more homogeneous over space in terms of culture and manners, and thus are more receptive to new environments. This is one of the explanations for the observed increase in the rate of migration as the amount of schooling increases. However, we are considering only the choice of a destination from among alternative destinations, for which the increased general receptiveness of a more educated person is irrelevant. The question is therefore whether the agony of departure from friends and family (and hence the frequency of visits needed to negate that agony) is unchanged or diminished with education. The simultaneity of this relationship should not be overlooked. The attitude of people toward psychic cost of mobility *may* in part contribute to the choice of occupations; among other things this may affect their decision regarding the amount of education they wish to have in view of the greater mobility associated with higher education. Thus, *ceteris paribus*, those with lower psychic cost of mobility may invest more in their education.

In view of these arguments, the functional relationship between psychic cost—associated with distance moved—and education is nonincreasing. The answer to the question of whether psychic cost actually declines with education, and if so to what extent, remains at best vague. The only definite position that can be taken on this issue is that if psychic cost (in the narrow sense defined above) declines with education, its range for the education domain is of smaller magnitude than its range for the age domain. In other words, variation in psychic cost due to variation in age exceeds the variation in psychic cost due to variation in education.

From this discussion some testable implications are drawn.

1. If the observed adverse impact of relative distance on the probability of migrating is primarily due to diminishing information, then, as education increases, relative distance loses its deterrent impact and allocative shares become less sensitive to relative distance changes. At the point where perfect spatial information is obtained, distance may cease to influence the choice of destinations. Aging may contribute to more homogeneous spatial information due to accumulated experience, but if it does so, its contribution is of a smaller magnitude than that attributed to formal education.

2. If the observed adverse impact of distance is primarily due to psychic cost (more accurately, that component of psychic cost attributed to distance), the sensitivity of the choice of a destination to changes in relative distance should vary strongly with age; most likely it will increase with age at least up to some point near retirement age. Education may reduce psychic cost (the portion related to distance) and thus reduce the distance sensitivity of allocative shares. Yet, if the adverse impact of distance stems from psychic cost, it seems that the variation in age is more important in generating variations in the sensitivity of allocative shares to relative distance than is the variation in education.

III. Empirical Evidence

From the theoretical discussion it is evident that age and education affect the allocative shares of migrants by altering the sensitivity of migrants toward distance. Also, age and education affect the allocative shares by altering the values of all other variables in equation (2).

With this in mind, and for estimation purposes, I assume that equation (2) is Cobb-Douglas separable into two groups: one includes relative distance as the only variable; the other includes the remaining variables.

$$Y_{ijkl} = f\left(\frac{PV_{ijl}}{\sum_{n\neq k} w_n PV_{ijn}}, \frac{U_{ijl}}{\sum_{n\neq k} w_n U_{ijn}}, \frac{C_{ijl}}{\sum_{n\neq k} w_n C_{kn}}\right)\left(\frac{D_{kl}}{\sum_{n\neq k} w_n D_{kn}}\right)^{\eta_{ij}}, \quad (3)$$

where η_{ij} is the distance elasticity of the ith age group and the jth education group, which I further assume to be decomposed linearly into an age effect and an education effect.

$$\eta_{ij} = \mu + \alpha_i + \beta_j, \quad (4)$$

where μ is the elasticity of a reference age-education group which has been chosen to be the lowest age group and the lowest education group in our sample, α_i is the differential contribution of age group i to the elasticity, and β_j is the differential contribution of education group j to the elasticity. Substituting (4) in (3) and transforming to logarithms yields

$$Y^*_{ijkl} = f^*\left(\frac{PV_{ijl}}{\sum_{n\neq k} w_n PV_{ijn}}, \frac{U_{ijl}}{\sum_{n\neq k} w_n U_{ijn}}, \frac{C_{ijl}}{\sum_{n\neq k} w_n C_{ijn}}\right) + (\mu + \alpha_i + \beta_j)X^*_{kl}, \tag{5}$$

where asterisks denote logarithms and X is the relative distance. Holding l constant and varying k, i, and j will produce variations in $\log f$ only for variations in age and education—since, given l, i, and j, each ratio in f is a constant, as discussed in the preceding section. Let A be the value of f^* for a reference group which is taken to be the lowest age and lowest education group. Let γ_i be the ith age effect on $\log f$, and let δ_j be the jth education effect on $\log f$—both measured from the given reference group.[8] Let U_{ijkl} be the statistical disturbance. Equation (5) is then transformed into its final estimable form:

$$Y^*_{ijkl} = A + \gamma_i + \delta_j + (\mu + \alpha_i + \beta_j)X^*_{kl} + U_{ijkl}. \tag{6}$$

To estimate μ, α_i and β_j, and γ_i and δ_j, I introduce dummy variables for age: $W_{i, i=2,\ldots,5}$ such that $W_i = 1$ if the age is i, and zero otherwise. Likewise, $Z_{j, j=2,\ldots,5}$ is a dummy variable such that $Z_j = 1$ if the education level is j, and zero otherwise. The regression equation is thus

$$Y^*_{ijkl} = A + \sum_{i=2}^{5} \gamma_i W_i + \sum_{j=2}^{5} \delta_j Z_j + \mu X^*_{kl} + \sum_{i=2}^{5} \alpha_i W_i X^*_{kl} + \sum_{j=2}^{5} \beta_j Z_j X^*_{kl} + U_{ijkl}. \tag{7}$$

My empirical estimation is based on data on interdivisional flows[9] of nonreturnee white male migrants (U.S., Bureau of the Census 1963, table 8), aggregated into five age groups and five education groups. The age and education intervals are given in the column headings of table 1.

I assume the population of each division to be concentrated in the major city of the division. Interdivisional distances are measured between these cities. (The divisions, the corresponding cities, and the distances appear in the Appendix.) The relative distance from k to l is computed

[8] In this study I focus on η_{ij}. I introduce age and education shifters of the intercept in order to prevent specification bias in estimating η_{ij}.

[9] The United States are divided into nine divisions.

TABLE 1

Regression Results

Region No.	Division of Destination	Constant	Distance Elasticity of Reference Group	Shifters of Age Groups (Years) 30–34	35–39	40–54	55–64	Shifters of Education Groups (Years) 5–7	8	9–12	13–16	R^2	F-Value Education	Age
1	New England	−1.803		−0.021	−0.031	−0.118	−0.148	0.095	0.169	0.366	0.588			
				(0.083)	(0.083)	(0.083)	(0.083)	(0.083)	(0.083)	(0.083)	(0.083)			
			−1.392	−0.101	−0.082	−0.219	−0.372	0.324	0.510	0.837	0.820	.6215	4.0	0.19
			(0.237)	(0.249)	(0.249)	(0.249)	(0.249)	(0.249)	(0.249)	(0.249)	(0.249)			
2	Middle Atlantic	−1.390		0.041	0.033	−0.012	−0.010	0.041	0.035	0.159	0.422			
				(0.075)	(0.075)	(0.075)	(0.075)	(0.075)	(0.075)	(0.075)	(0.075)			
			−1.657	0.140	0.258	0.120	0.016	0.441	0.615	0.867	0.911	.5721	4.8	0.51
			(0.227)	(0.239)	(0.239)	(0.239)	(0.239)	(0.239)	(0.239)	(0.239)	(0.239)			
3	East North Central	−0.956		−0.103	−0.118	−0.209	−0.225	0.114	0.070	0.019	0.079			
				(0.081)	(0.081)	(0.081)	(0.081)	(0.081)	(0.081)	(0.081)	(0.081)			
			−2.123	−0.191	−0.230	−0.435	−0.471	0.503	0.434	0.898	1.291	.4440	1.7	0.28
			(0.493)	(0.520)	(0.520)	(0.520)	(0.520)	(0.520)	(0.520)	(0.520)	(0.520)			
4	West North Central	−1.596		−0.037	−0.062	−0.169	−0.163	0.031	0.072	0.213	0.332			
				(0.080)	(0.080)	(0.080)	(0.080)	(0.080)	(0.080)	(0.080)	(0.080)			
			−1.374	−0.471	−0.407	−0.875	−0.756	0.520	0.558	0.279	0.483	.5366	1.9	1.06
			(0.446)	(0.470)	(0.470)	(0.470)	(0.470)	(0.470)	(0.470)	(0.470)	(0.470)			
5	South Atlantic	−1.048		−0.077	−0.034	−0.078	−0.062	0.132	0.164	0.330	0.342			
				(0.090)	(0.090)	(0.090)	(0.090)	(0.090)	(0.090)	(0.090)	(0.090)			
			−0.963	−0.386	−0.206	−0.587	−0.411	0.456	0.603	0.660	0.661	.2018	0.53	0.33
			(0.514)	(0.542)	(0.542)	(0.542)	(0.542)	(0.542)	(0.542)	(0.542)	(0.542)			
6	East South Central	−1.937		−0.070	−0.163	−0.193	−0.227	0.111	0.161	0.411	0.438			
				(0.081)	(0.081)	(0.081)	(0.081)	(0.081)	(0.081)	(0.081)	(0.081)			
			−1.546	−0.316	−0.566	−0.532	−0.501	0.077	0.376	0.849	0.772	.6492	3.01	0.23
			(0.276)	(0.291)	(0.291)	(0.291)	(0.291)	(0.291)	(0.291)	(0.291)	(0.291)			
7	West South Central	−1.205		−0.013	−0.008	−0.035	−0.081	0.019	0.000	0.114	0.103			
				(0.040)	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)			
			−2.169	−0.125	0.175	−0.053	−0.345	0.832	1.194	0.874	0.806	.6368	4.9	0.9
			(0.270)	(0.285)	(0.285)	(0.285)	(0.285)	(0.285)	(0.285)	(0.285)	(0.285)			
8	Mountain	−1.042		0.039	0.087	0.113	0.120	0.012	0.092	0.118	0.031			
				(0.046)	(0.046)	(0.046)	(0.046)	(0.046)	(0.046)	(0.046)	(0.046)			
			−1.979	−0.077	0.076	−0.164	−0.248	−0.120	0.109	0.347	0.496	.7797	2.2	0.54
			(0.231)	(0.243)	(0.243)	(0.243)	(0.243)	(0.243)	(0.243)	(0.243)	(0.243)			
9	Pacific	−0.159		0.007	0.015	0.034	0.047	−0.028	−0.059	−0.116	−0.194			
				(0.091)	(0.091)	(0.091)	(0.091)	(0.091)	(0.091)	(0.091)	(0.091)			
			−1.546	−0.024	−0.017	−0.065	−0.179	0.343	0.602	0.712	0.676	.5423	2.6	0.02
			(0.247)	(0.261)	(0.261)	(0.261)	(0.261)	(0.261)	(0.261)	(0.261)	(0.261)			

Note.—The results for each regression are arranged in two rows. The first row includes the constant term (intercept) and the age and education shifters of the intercept. The second row includes the distance elasticity and the age and education shifters of the elasticity. Numbers in parenthesis are standard errors. Each regression has 182 degrees of freedom. The reference group is the group of persons who are 25–30 years old and have 0–4 years of schooling.

as the ratio of the distance from k to l to a geometric mean of the distances from k to all destinations. Nine regressions are run; in each, one division is held as the constant destination. The results obtained for airway distances[10] are represented in table 1.

The results in table 1 can be summarized as follows:

a) A considerable portion of the variation in allocative shares is explained by the specified equation. The R^2 is over .5 for all regressions except that for the South Atlantic and East North Central.

b) The relative distance elasticity is negative in all regressions. For the youngest group in our sample (25–30) and the least educated (0–4 years of schooling), the distance elasticity ranges between -1.0 (which is obtained when holding the South Atlantic division as the constant destination) and -2.17 (which is obtained when the West South Central is the constant destination).

c) Education strongly affects the distance elasticity. As education increases, distance elasticity declines in absolute value—thus reducing the adverse effect of distance on the choice of location. This direction of the education impact on distance elasticity is preserved in seven out of nine regressions. At most, there is a slight reversal (which is insignificant) of the last education group relative to the preceding one. For example, in the regression for Middle Atlantic, where the distance elasticity of the least educated and youngest group is -1.65, we should add .61 to obtain the elasticity of the group of youngest persons having elementary school education. To get the elasticity of the youngest age and partial or complete college education group, we add .91—which reduces the absolute value of distance elasticity to a mere .74. The elasticity range for the youngest and most educated group in all regressions stretches between $-.30$ and -1.48, and excluding the Mountain and West South Central, the range stretches from $-.30$ to $-.89$, which is remarkably lower than that of the youngest and *least educated* persons.

I checked the relevance of education in determining the elasticity by testing the hypothesis that all education coefficients affecting distance elasticity (β_i, all i) are zero. The F-values appear in the last two columns of table 1. Except for the South Atlantic regression, in which the hypothesis (of irrelevance of education) is rejected at the 10 percent level of significance, in all other regressions the hypothesis is rejected at less than .5 percent!

d) Age appears to be irrelevant to the determination of the distance elasticity. Testing the hypothesis that all age coefficients affecting the distance elasticity (α_i, all i) are zero, I conclude that the hypothesis

[10] Similar results were obtained for highway distances; the correlation coefficient of airway distances and highway distances is .995. Also, some other analytical forms with and without intercept shifters (besides the one presented in eq. [7]) were tried. In all, I obtained qualitative results which are similar to these reported here.

cannot be rejected for any reasonable significance level. The F-values for the test in all regressions are less than 1.0, except for the F-value of West North Central (which is 1.1).[11] Checking the coefficients reveals that in different regressions these coefficients behave differently. For instance, in the Middle Atlantic regression the coefficients are all positive. The coefficient increases from .14 to .26, then declines to .12 and then to .01. With a standard deviation of .238, all are insignificantly different from zero. In all other regressions, the age coefficients of the distance elasticity are negative and generally increase in absolute value as age increases, though some exceptions are noted.

It seems that though on the whole age is insignificant, there is a tendency of aging to increase the adverse effect of distance on the choice of a destination. This may be taken as evidence of increasing psychic cost with age, but the weakness of this tendency casts doubt on this possibility. Another possibility, which is more in line with the age effect, is associated with the quality of education. In this study I do not correct education (which is measured in number of years at school) for quality changes over time. Thus, 16 years of schooling for persons belonging to the 55–64 age groups may represent an inferior amount of education compared with persons with the same amount of schooling in the 25–30 age group. In this respect, age may "correct" for the quality of education—instead of representing the direct impact of age on psychic cost.

e) Finally, a glance at the age and education shifters of the intercept (which capture the variation of the function f as age and education vary) reveals that age is completely erratic and on the whole insignificant, whereas education is significant but has different impact on different regions. In the regression for the Pacific, for instance, increasing education decreases the intercept, whereas in the regressions for the South Atlantic and New England, increasing education increases the intercept. In the Middle Atlantic, the size of the intercept alternately increases and decreases as education increases. In view of the variables appearing in f, I conclude that the economic pull effect of the Pacific is *relatively* stronger for less-educated persons than for more-educated persons, whereas the opposite is true for Northeast. While these findings are interesting in themselves, they are not the center of interest in this paper and thus will not be discussed further.

IV. Conclusions

Nine independent regressions of allocative shares on distance, age, and education have been run. Seven out of nine reveal identical qualitative

[11] West North Central and West South Central are the destinations for which the absolute value of the distance elasticity of migration does not diminish with education.

and quantitative results. In all, the age effect on distance elasticity is weak but is more or less systematic in increasing the adverse effect of distance on the choice of a location. In contrast, education strongly affects this elasticity—diminishing the adverse impact of distance on the choice of destination. A striking result is the similarity of the magnitudes of distance elasticity in all regressions. As mentioned in (*e*) in the preceding section, one may be tempted to attribute the age effect to "correction" for quality of education, leaving education as the single explanatory variable determining the distance impact on the choice of a destination. Even if we reject the assumption that the weak age effect represents quality correction for education and that it actually reflects psychic cost, the weakness of the age effect relative to that of education supports the hypothesis that the distance effect is really an information effect. This is so since (in view of the theoretical discussion in Section II) the psychic-cost hypothesis implies a stronger age effect than education effect, whereas the information hypothesis implies the opposite—which is what I found.

My conclusions are based on U.S. data. Their generality is subject to verification by confronting the hypotheses tested in this paper with other sources of data in other countries having similar characteristics. Supporting evidence (not statistically tested, however) is obtained from Canadian data. Courchene (1970) finds that the trade-off[12] between income and distance is very sensitive to and increases with education, whereas it is less sensitive to variation of age. These results are implied by my results on distance elasticities.

[12] See Courchene (1970, table 4, p. 566). Trade-off is defined as minus the ratio of the income coefficient to the distance coefficient. Given the income coefficient, a higher trade-off is obtained for lower absolute value of the distance coefficient.

Appendix

Distance (in Miles) between Representative Cities of the Nine Divisions of the United States

	Boston (1)	New York (2)	Chicago (3)	Kansas City (4)	Birmingham (5)	Memphis (6)	Dallas (7)	Denver (8)	Los Angeles (9)
Boston (New England)	...	...	...	...	...	....	...	...	...
New York (Middle Atlantic)	188	...	...	...	...	...	...	...	...
Chicago (East North Central)	841	718	...	...	...	...	...	...	...
Kansas City (West North Central)	1,251	1,097	414	...	...	...	...	...	...
Birmingham (South Atlantic)	1,052	864	578	579	...	...	...	...	...
Memphis (East South Central)	1,137	957	269	369	217	...	...	...	...
Dallas (West South Central)	1,551	1,374	803	451	581	420	...	...	...
Denver (Mountain)	1,769	1,631	920	558	1,095	879	663	...	...
Los Angeles (Pacific)	2,596	2,451	1,745	1,356	1,802	1,603	1,240	831	...

Source.—*The 1970 World Almanac and Book of Facts*, edited by Luman H. Long. Baltimore: Newspaper Enterprise Assoc., 1969.

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