INTERMETROPOLITAN MIGRATION IN HIGH AND LOW OPPORTUNITY AREAS: INDIRECT TESTS OF THE DISTANCE AND INTERVENING OPPORTUNITIES HYPOTHESES*

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A continuing controversy in demography, geography, sociology, and planning is the extent to which a model focussing on intervening opportunities, rather than distance, best accounts for variations in interaction behavior, particularly migration. A great deal of research has been devoted to an examination of these two competing models [*1, 5, 6, 7, 8, 19*], but the choice of the "best" model has been far from unanimous. This is largely due to the difficulty in distinguishing between the results obtained from the application of these models. This difficulty in turn is due to the high levels of intercorrelation between distance and opportunities. The purpose of this paper is to analyze once again these two explanations, but a somewhat novel procedure will be employed. Rather than placing each model in direct competition with the other, we will relate distance to migration *controlling* for opportunities. This technique should permit at least tentative conclusions on the applicability of the distance model under varying opportunity situations.

The Distance and Intervening Opportunities Models

In 1885 Ravenstein [*15, 16*] was one of the first scholars to recognize the relationship between distance and migration.

* The authors are indebted to Jeff Passel, Ronald Briggs and Arthur Getis.

A quarter century later, a more precise statement of the distance-migration relationship was presented by Young [*25*]; his formula hypothesized that "the relative number of migrants to a given area from each of several areas would vary directly with the 'force of attraction' of the receiving area and inversely with the square of the distance between the source and terminal areas" [*1*, p. 287]. This basic model was further refined by Zipf who demonstrated its utility not only when applied to migration streams [*27*], but also to other forms of spatial interaction such as Railway Express goods [*28*], newspaper circulation, and intercity telephone calls [*26*]. Further tests of the model have in general supported this inverse relationship [*3, 7, 21, 17*].

Despite the predictive success of a migration explanation focussing on distance, its underlying rationale met with considerable objection. The principal protagonist was Stouffer who claimed in 1940 that "there is no necessary relationship between mobility and distance . . . the number of persons going a given distance is directly proportional to the number of intervening opportunities" [*18*, p. 846]. And since opportunities may be expected to increase with distance, the Stouffer hypothesis does take into account, albeit indirectly, the distance factor. However, he saw his conceptual framework as a means for attacking the functional aspect of distance and not merely as a simple variant of the distance explanation: "The relations between mobility and distance may be said to depend on an auxiliary relationship which expresses the cumulative (intervening) opportunities as a function of distance" [*18*, p. 847].

In an attempt to decide which explanation was the better predictor of migration, numerous scholars have placed the two models in competition with each other. However, these comparisons have not resulted in similar conclusions. Although Strodtbeck [*21*] found the opportunities model better than one of simple distance, when he added the variable of "persons already at the location" to the distance explanation (i.e., "the number of persons migrating to a given location is proportional to the number of persons already at the location and is inversely proportional to the intervening distance" [*21*, p. 123]), neither the "supplemented" distance, nor the opportunities hypothesis was significantly superior to the other, and neither provided a truly acceptable explanation.

Anderson [*1*] compared these models for intermetropolitan migration and demonstrated that spatial distance was just as accurate as intervening opportunities. In addition, tests executed by Hägerstrand [*9*] with data on Swedish parishes were identical in result with Anderson's. Yet when Stouffer compared his revised opportunities model [*19*] with that of distance, the former was the best predictor of intermetropolitan migration. And in a replication of this study by Galle and Taeuber with 1955–1960 U.S. data, Stouffer's model accounted for 71 percent "of the variance in intercity migration not accounted for by variation in the size of the marginals"; in comparison, the distance model accounted for 35 percent [*8*, p. 11].

The studies in which the opportunities and distance models were compared are not unanimous in their decisions on the "best" migration model. It is at this point that another form of analysis might be introduced by testing one model while controlling for the effects of the other.

A CONTROL FOR OPPORTUNITIES

None of the studies have attempted to separate the universe of metropolitan areas into subsets according to the degree of opportunity density. This was not done despite the fact that the northeastern United States (excluding Maine, Vermont, and New Hampshire) contains close to half of the country's metropolitan areas and 42 percent of the growth in metropolitan areas between 1950 and 1960. The contrasting pattern of opportunity density of this area compared to the rest of the nation is strengthened by noting that this 8.3 percent of the country's territory is the focal point for nearly 70 percent of the nation's industry. In this region where 68 percent of U.S. manufacturing occurs, at least 43 percent of the U.S. population absorbs over 52 percent of the country's total annual income [*23*, pp. 181-82].

Taking the northeastern United States and the remainder of the country as two areas of contrasting opportunity density, it is then possible to compare indirectly the opportunities and distance explanations of intermetropolitan migration. One would expect that if distance were the primary explanation for migration, a line correlating distance (X) with number of movers (Y) would produce a slope not significantly different in either of the areas of high or low opportunity density. Conversely, if intervening opportunities were the primary explanation for migration, the slope in the area of high opportunity density would be significantly steeper than the corresponding slope in the other area.

The only previous applications of this approach were conducted by Clark and Peters [*4*] in a study of intrametropolitan traffic flows, and Haynes [*11*] in an analysis of intermetropolitan migration employing individual sample survey data. In both cases the results must be regarded as inconclusive owing to analytic problems and mixed substantive findings.

For the analysis here, we have selected all Standard Metropolitan Statistical Areas (SMSAs) in the continental United States with a population of at least 500,000 in 1960, a total of 52. Coincidentally, half of these are located in the northeastern United States so that each of the areas of high and low opportunity density contains 26 SMSAs. Road mileage was then determined between each of the 312 pairs of SMSAs in first the high, and then the low opportunity density areas. Migration data were taken from the 1960 Census of Population and refer to movers reporting a different SMSA of residence in 1955 from that reported in 1960 [*24*].

Since the greatest possible distance between a pair of SMSAs in the high density opportunity area was 1,200 miles, and the greatest distance in the low density opportunity area was almost three times greater, two approaches were employed. The first and simpler approach considered the maximum migration distance in the low opportunity areas as less than or equal to the greatest possible migration distance in the high area. The second approach set the greatest distance in one area equal to that in the other.

For each area we correlated the number of intermetropolitan migrants with distance. Both variables were transformed to logarithmic functions; this is a common practice in interaction research since various types of interaction over distance have been shown to be a Pareto type function which transforms to linearity when both axes are logged [*22*]. Although linearity is obviously a requirement for the regression model utilized here, there is still another reason which would lead one to expect a Pareto function, i.e., the relationship between the area of a circle and its radius (distance):

$$A = \pi r^2 \qquad (1)$$

If opportunities were distributed randomly over a surface, the probability of adding new opportunities within any circle A with radius r increases with the total area inscribed by that radius. Therefore, although people migrate a given distance, their access to alternative opportunities increases as a function of area (i.e., the square of distance, r, times a constant, π), and not as a simple linear function of distance. Since opportunities are a function of area, and not distance *per se*, the probability of new opportunities does not increase linearly, but with the square of distance times the constant.

TABLE 1

REGRESSION ANALYSIS RELATING DISTANCE WITH NUMBER OF MIGRANTS IN HIGH AND LOW OPPORTUNITY DENSITY AREAS (DISTANCE TRUNCATED IN LOW DENSITY AREA)

Area	*Correlation (r)*	*Slope (b)*	*Standard Error*	*Intercept*
High opportunity density	–.61	–1.61	.47	8.43
Low opportunity density	–.66	–.65	.16	6.10

Tables 1 and 2 present the first set of results from the regressions of distance on migrants in the high and low density opportunity areas. It is clear that the two sets of slopes are significantly different from each other with the high density opportunity area exhibiting the steepest slope in both comparisons. Thus, despite the fact that the correlations are of relatively the same magnitude in the two areas of contrasting opportunity density, the more important consideration is the least-squares line representing this relationship. If distance were the prime determinant of migration behavior, the migration slopes (b) for areas of differential opportunity density should not be significantly different from one another.

TABLE 2

REGRESSION ANALYSIS RELATING DISTANCE WITH NUMBER OF MIGRANTS IN HIGH AND LOW OPPORTUNITY DENSITY AREAS (DISTANCES EQUAL IN LOW AND HIGH DENSITY AREAS)

Area	*Correlation (r)*	*Slope (b)*	*Standard Error*	*Intercept*
High opportunity density	–.61	–1.61	.47	8.43
Low opportunity density	–.58	–.54	.28	5.85

The regression evidence in Tables 1 and 2 shows that the slopes in the high density areas are significantly steeper than those in the low, suggesting that distance is not the "best" predictor of migration behavior. The fact that the slopes are higher in the high density areas suggests that the intervening opportunities variable is an important explanatory one, and hence a relevant predictor of intermetropolitan migration.

A crucial element not considered in the above analysis is the fact that neither the distance nor intervening opportunities explanations is independent of the size of the SMSAs of origin and of destination. That is, in the tests reported above, no allowances were made in the regressions for the populations of each pair of SMSAs. To account for this we constructed two matrices of pair-wise intermetropolitan migration flows, one for the high and one for the low density opportunity areas. The following linear equation was then fitted to both areas:

$$Log\,(migr) = a + B\,log\,(P) - \lambda\,log\,(D) \quad (2)$$

where: a and B are the regression parameters,

λ is the coefficient (slope) of distance,

P is the product of the populations of the SMSAs of origin and destination, and

D is distance (shortest road mileage).

If the intervening opportunities hypothesis is the better predictor of migration, distance should play a different role, i.e., have a different slope, λ, in the two areas of contrasting opportunity density. More specifically, the distance slope should be steeper in the high density opportunity area than in the low.

When we fitted equation (2) to the two areas of high and low opportunity density, the distance slope was indeed steeper in the high area, a value of -1.06 versus $-.84$ in the low density opportunity area (see Table 3). Thus, even when the actual populations of the SMSAs of origin and destination are en-

TABLE 3

REGRESSION ANALYSIS RELATING DISTANCE AND SMSAS POPULATION OF ORIGIN AND DESTINATION TO NUMBER OF MIGRANTS IN HIGH, AND LOW OPPORTUNITY DENSITY AREAS

Area	*Correlation*	*Slope* (λ)	*Standard Error*
High opportunity density	.91	−1.06	.29
Low opportunity density	.77	−.84	.37

tered as variables in the equation relating distance with number of migrants, the distance slope in the high density opportunity area is significantly steeper than that in the low density opportunity area, providing indirect evidence once again of the critical importance of the intervening opportunities method.

There is still another procedure that one might invoke to compare the distance and intervening opportunities explanations of migration behavior. Stated simply, it would involve using the linear equation (2) for, say, the low density opportunity area to predict migration behavior in the high density opportunity area. The reasoning here is somewhat similar to that expressed above, i.e., if distance plays the same role in both the high and low density opportunity areas, taking equation (2) from the low density area and using it to predict migration in the high density area would produce no difference between the means of the actual and expected distances traveled by migrants in the high density opportunity area. Conversely, if opportunities are a primary element of migration distance differentiation, then equation (2) from the low density opportunity area should *overpredict* intermetropolitan migrant distance in the high density opportunity area. In other words the average distance the migrant travels in the low density opportunity area should be greater than the average distance in the high density area.

The evidence reported is a result of our applying equation (2) from the low density opportunity area to predict migrant distance in the high density opportunity area. The fact that this equation substantially overpredicts mean migrant distance (an expected mean of 3.48 versus the actual of 2.72) suggests once again the fact that distance does not play the same role in two areas of contrasting opportunity density, and that intervening opportunities might be the better explanation.

The only methodological problem with the above test is the fact that, as mentioned earlier, the maximum distance a migrant may travel in the high density opportunity area is 1,200 miles, while in the low the maximum is 3,600, a difference of a factor of 3. In interpreting the above evidence one might argue that the choice of migrant distance is substantially more constrained in the high density opportunity area than in the low owing to the maximum amount of travel distance possible. It should be no surprise that the low density version of equation (2) should overpredict migrant distance in the high density area since the former area has a maximum distance three times as large as the latter area. To compensate for this problem we have taken the distance variable (D) from equation (2) and divided it by 3. Since this is the equation originally fitted in the low density opportunity area, the division process places D in greater conformity with the distance in the more constrained area of high density opportunity.

Taking this equation in which the distance variable has been modified, we then employed it in the high density opportunity area to predict migrant distance. The results are that it still overpredicts distance from the actual by a statistically significant amount (a predicted mean of 3.08 versus the actual mean of 2.72). This evidence suggests once again that an explanation of migration behavior based solely on distance is an inadequate predictor in areas of contrasting opportunity density. Distance, to be sure, does not occupy the same position in the two areas, and even when distance in the low density equation is made comparable with that in the high density area, the equation still overpredicts mean migrant distance in the high density opportunity area.

CONCLUSION

The contribution of this paper to migration theory lies in the fact that one explanation of migration behavior was tested while controlling for the effects of the other. And the tests reported here were clearly in support of the intervening opportunities hypothesis as a significantly different explanation of migration behavior at the aggregate level. The results were quite explicit in suggesting that distance does not occupy the same position with migration in areas of contrasting opportunity density. But then this is precisely Stouffer's point when he argues that "the relation between mobility and distance may be said to depend on an auxiliary relationship which expresses the cumulative (intervening) opportunities as a function of distance" [18, p. 847].

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