Abridgment

Interstate Highway System and Development in Nonmetropolitan Areas

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The current revival of development in small urban and rural communities is one of the more dramatic changes in socioeconomic trends in this century. Since other writers have suggested that the Interstate Highway System played a key role, this paper empirically examines the relationship between the location of freeways and migration and employment change between 1950 and 1975 in all nonmetropolitan counties in the United States by using both descriptive statistics and regression models. The results show that, while counties with freeways as a group have higher average growth rates, even after confounding factors such as proximity to metropolitan areas and presence of urban population concentrations are controlled, the presence of a limited access highway is far from an assurance of development for an individual county. Tourist services are the industry most closely associated with Interstates but, contrary to common conceptions, manufacturing and wholesaling are not clearly associated. The Interstate system was less able to explain the spatial pattern of development than nontransportation factors. Its role appears to have been to raise accessibility levels throughout the nonmetropolitan United States, which has benefited many communities, not just those adjacent to Interstates.

In the 1970s, nonmetropolitan areas--i.e., small towns and rural communities beyond the sphere of influence of major metropolitan centers--experienced a major revival in demographic and economic development (1). Several writers (2-4) suggest that changes in transportation, particularly the development of the Interstate Highway System, played a key role in this reversal of trends in existence for much of this century. Unfortunately, most highway impact studies examine urban rather than rural highways, single projects rather than complete systems, and short- as opposed to long-term impacts (5). Apart from Bohm and Patterson (6) and Lichter and Fuguitt (7), the few studies that address the impacts of the Interstate Highway System on nonmetropolitan development (8-13) are limited in scope, contradictory in their findings, or have methodological inadequacies. They do not permit a definite answer regarding the role of the Interstate in nonmetropolitan development, which was the purpose of the research reported on here (14).

DATA AND METHODOLOGY

The study encompassed all nonmetropolitan counties in the coterminous 48 states, that is, counties outside standard metropolitan statistical areas (SMSAs). An Interstate coding, derived from a computerized administrative data file maintained by the Interstate Reports Branch of the Federal Highway Administration, classified counties as (a) with an Interstate, if 50 percent or more of the planned official Interstate mileage was open to traffic by a given date (1960, 1970, 1975); (b) on System without Interstate, if less than 50 percent of the planned mileage was open; or (c) off System, if the county had no open or planned Interstate mileage. An essentially similar freeway coding included all limited access highways and required that a link be complete to a metropolitan center before a county was considered to have an open freeway.

Annualized county net migration rates, based on U.S. Bureau of the Census data, were calculated for 1950 to 1960, 1960 to 1970, and 1970 to 1975. Rates of employment change were similarly calculated by using U.S. Census of Population data for 1950-1960 and 1960-1970 and Bureau of Economic Analysis (BEA) data for change from 1970 to 1975. (Note that the census data are place-of-residence based and count people, whereas the BEA data are place-of-work based and count jobs.) In addition, the industries examined were those that theory or previous empirical study suggested were associated with freeways, and included (a) retailing, (b) tourist-related industry (defined as eating and drinking establishments, lodging places, and amusement and recreation services), (c) manufacturing, (d) trucking, and (e) wholesaling.

The study then proceeded in four main stages. First, a descriptive analysis was undertaken of the effect of Interstates on net migration, controlling for a series of factors that could produce a spurious relationship between demographic change and the presence of Interstates. Second, a similar analysis for employment change was conducted. Third, a simple model of the interrelationship among Interstates, employment change, and net migration was tested by using path-analytic procedures. Fourth, the importance of the Interstate system relative to other factors influencing migration was assessed.

RESULTS

Demographic Change

In every decade counties with an Interstate highway experienced higher average rates of net migration than those without Interstates (Figure 1). The same is true when other migration measures are used, such as aggregate migration rates, proportion of counties gaining by net inmigration, and proportion experiencing turnaround from net outmigration to net inmigration (14). Although this demonstrates a clear association, it is far from proving a causal link proceeding from highways to migration. For instance, Interstates may have been planned or constructed through counties already experiencing higher migration rates. Counties adjacent to SMSAs receive population spillover from these centers and are more likely than nonadjacent counties to have an Interstate since these highways link metropolitan centers. Nonmetropolitan counties with urban population concentrations have generally experienced higher migration rates and again are more likely to have an Interstate because of their larger size. However, there is evidence to suggest a causal effect of freeways on migration that is independent of these possible confounding factors.

If counties on the Interstate system are classified according to date of highway opening (Table 1), migration rates for any one time period are (a) highest for the counties where the Interstate opened in the previous decade and (b) highest for the counties where an Interstate opened during the migration period being considered. In other words, the opening of an Interstate during one decade is associated with above average rates of net migration during the following decade. This temporal sequencing, in which the cause precedes the hypothesized effect in time, provides solid evidence for the existence of a

causal impact of Interstates on migration, which cannot be explained by prior growth rates. Similarly, when adjacency to metropolitan centers and size of urban population concentrations are controlled (Figure 2), an effect of Interstates still emerges.

Employment Change

Generally, employment change is also associated with the Interstate System (Table 2), even after adjacency to SMSAs and size of urban population concentrations are controlled (14). The major exception is the lack of association for manufacturing and wholesaling, which is a surprise, given the many statements in the literature that both are accessibility dependent.

Interrelationship of Demographic and Employment Change

Interstates may affect migration directly as well as indirectly through changes in employment opportunities that, in turn, affect migration. In order to assess this interrelationship, as well as identify the types of industries most affected by limited access highways, path-analytic procedures were applied to the simple causal model in Figure 3 (7).

In contrast to the earlier findings, the results suggest a weak relationship at best between freeways and demographic and employment change (Table 3). The partial correlation coefficients (controlled for adjacency to metropolitan areas and size of largest city in county) are very low, as are the standardized regression coefficients (beta weights). Apart from this, the most notable feature is the minor role of manufacturing and wholesaling and, comparatively, the overwhelming effect of tourism employment. (The initially striking differences between the 1960s and 1970s results primarily reflect the way employment is measured.)

Other Factors Affecting Migration

From the literature, five categories of factors influencing nonmetropolitan change were identified: urbanization, industrial base, social base, government activities, and environmental amenities. With net migration for each of the the three time periods as the dependent variable, regressions were run for variables within each of these categories as well as for all variables together. Figure 4 plots the multiple coefficients of determination (R^2) for re-

Figure 1. Annual net migration rates 1950-1960, 1960-1970, and 1970-1975 by presence of Interstate highway at end of migration period.

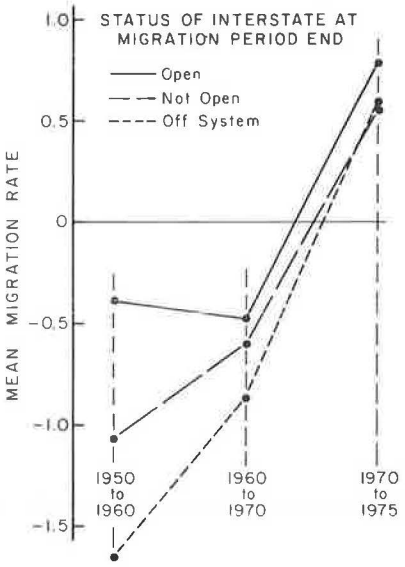


Table 1. Migration rates by date of opening of Interstate highway.

	Interstate System Counties Date of Opening			
	Before 1960	1960-1969	1970-1974	After 1974
Migration Period	4	5	6	7
Mean annual rate of net migration				
1950-1960	-0.393	-1.209	-0.884	-0.874
1960-1970	-0.434	-0.505	-0.585	-0.648
1970-1975	0.370	0.864	0.765	0.538
Number of counties	73	466	160	97

Figure 2. Annual net migration rates for counties with an open freeway compared with counties off the Interstate Highway System and without a freeway, controlled for size of largest place and proximity to metropolitan areas.

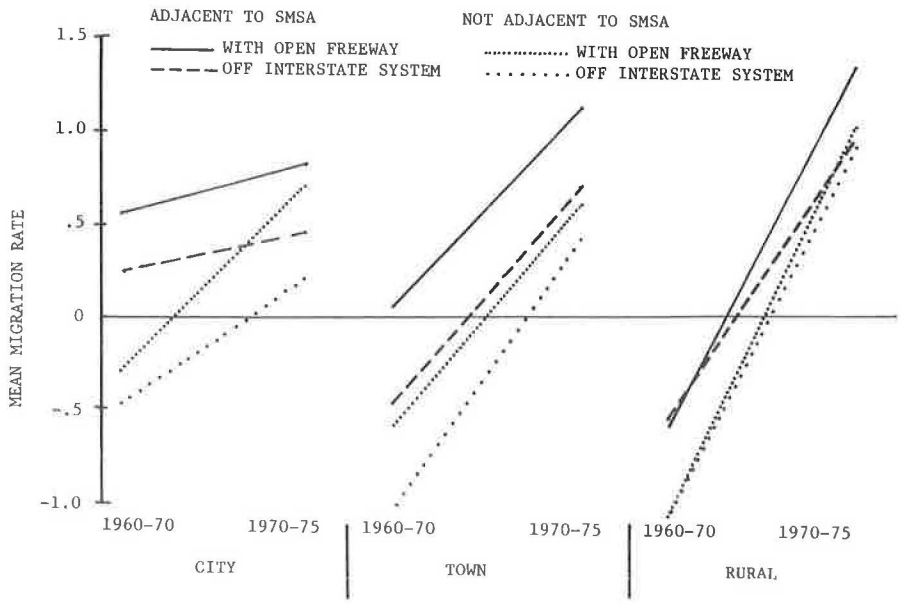


Table 2. Aggregate annual employment growth rates for counties with and without freeways.

Industry	1960 to 1970[a]			1969 to 1975[b]		
		Without a Freeway			Without a Freeway	
	With a Freeway	On System	Off System	With a Freeway	On System	Off System
Total	1.95	1.59	1.09	1.50	1.76	1.36
Retail	2.49	2.07	1.62	2.90	2.17	1.83
Manufacturing	2.48	2.63	2.82	-0.50	1.25	-0.04
Tourist	2.76	2.23	1.71	4.07	3.04	3.19
Trucking	2.14	1.92	1.05	2.92	3.66	2.37
Wholesaling	3.45	3.15	2.44	8.99	7.60	11.60

[a]1960 SMSA definition.
[b]1970 SMSA definition.

Figure 3. Model of the impact of limited access highways on employment and demographic change in nonmetropolitan areas.

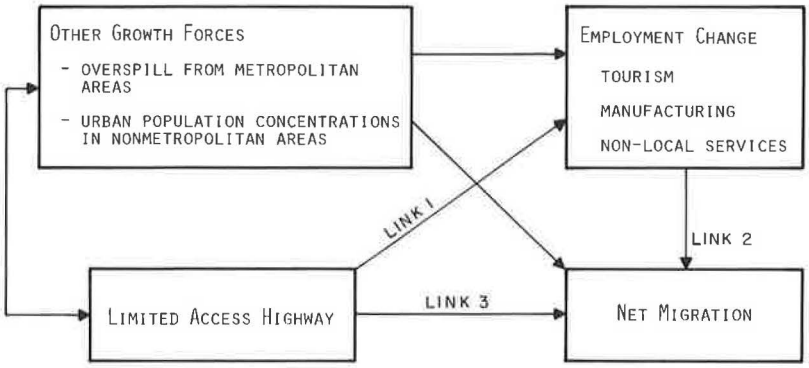
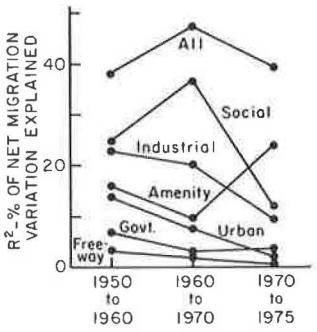


Table 3. Effects of freeways on employment growth and net migration: path-analysis results.

Employment Areas	Partial Correlation Coefficient[a]	Direct Effect of Freeway on Endogenous Variable (Beta Weight)	Indirect Effect of Freeway on Endogenous Variable (Beta Weight)	Indirect Effect as a Percentage of Total Effect
1960-1970				
Migration	0.07	0.020	-	-
Manufacturing	0.04	0.051	0.005	6.6
Tourism	0.07	0.090	0.042	57.1
Trucking	0.04	0.044	0.004	4.9
Wholesaling	0.02	0.028	0.003	4.8
1970-1975				
Migration	0.08	0.053	-	-
Manufacturing	0.005	0.005	0.0001	0.2
Tourism	0.03	0.030	0.0178	25.3
Trucking	0.03	0.029	0.0001	0.2
Wholesaling	-0.02	-0.016	-0.0005	-

Note: All regression equations include three dummy variables as exogenous controls indexing adjacency to metropolitan areas, counties with cities of more than 10 000 population, and counties with cities between 2500 and 10 000 population. The total effect of freeways is the regression coefficient in a model regressing net migration against the three exogenous control variables and the freeway variable. The results were 1960-1970, beta = 0.074 and 1970-1975, beta = 0.071.
[a]Between freeway and endogenous variable controlled for adjacency and size of largest place.

Figure 4. Relative ability of different factors to explain nonmetropolitan county net migration rates, 1950-1975.



gressions within each category, and Table 4 gives the beta weights and R^2s for all variables together. The break-in-slope in Figure 4 between the 1960s and 1970s indicates a change in the processes underlying migration in the 1970s. However, the consistently small R^2s for the Interstate variables and the small beta weights and negligible increments to R^2 suggest that the Interstate Highway System is less able to explain variation in county migration rates than any other factor examined.

CONCLUSION

Two primary questions are raised by this research. First, why did the first two parts of the study suggest an impact of Interstates on nonmetropolitan development, whereas the last two parts suggest little influence? The resolution of this apparent

Table 4. Standardized regression coefficients for variables hypothesized to influence net migration rates in nonmetropolitan counties: 1950-1960, 1960-1970, and 1970-1975.

Factor	1950s	1960s	1970s
Urbanization			
Adjacent to SMSA	0.056	0.105	0.087
City present	0.125	-0.075	-0.162
Town present	0.053	-0.043	-0.105
Industrial base			
Agriculture (%)	-0.146	-0.239	-0.413
Mining (%)	-0.145	-0.248	-0.200
Manufacturing (%)	-0.134	-0.068	-0.239
Social base			
Median income	0.351	0.240	-0.061
Black (%)	-0.069	-0.087	-0.227
Retired population	0.053	0.438	0.195
Government			
Administration (%)	0.013	0.017	-0.026
College present	-0.048	0.093	-0.037
Military (%)	0.043	-0.054	-0.182
Amenity			
Warm winter	0.096	0.015	0.109
Mountain	0.070	0.091	0.109
Coast	0.216	0.022	0.074
Lakes	-0.002	0.019	0.011
2nd homes	-0.009	0.079	0.227
Recreation	0.055	0.031	0.170
Other transportation			
Rail present	-0.062	-0.011	-0.018
Air present	0.050	-0.028	0.046
Freeways			
Open	-0.003	0.015	0.073
New	-	0.026	-0.230
Not yet open	0.061	0.003	-0.006
Coefficients of determination			
All variables	0.383	0.471	0.389
Freeways excluded	0.380	0.469	0.385

contradiction is that, on average, counties with an Interstate have indeed experienced higher rates of migration and employment change. However, the experience of individual counties has been extremely varied with much overlap in growth rates between counties with and without Interstates. The policy planning implication is that the presence of an Interstate is no guarantee of community development, but neither is its absence a precursor of community demise as might have been the case in an earlier era with the railroad. Second, why is there a generally weak relationship between the Interstate system and development, especially in manufacturing, for example? The major effect of the Interstate may have been to raise accessibility levels throughout the nonmetropolitan United States. Consequently, their effect has not been as locationally specific to areas in close proximity to freeways as is commonly expected.

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