

Interstate Highway System: Reshaping the Nonurban Areas of Pennsylvania

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In this study are described the economic changes that occurred from 1970 to 1980 in communities adjacent to selected nonurban interchanges on the Interstate highway system of Pennsylvania. These changes are compared with those in the counties in which the interchanges are located and in the state as a whole. Indices of economic growth, both conventional (i.e., housing, income, employment, population) and new (assessed market value of real property), are used. Changes in per capita income at the county level were found to be positively related to the existence of nonurban interchanges in the county. The economies of many nonurban communities near the Interstate system are continuing to be reshaped with large increases in residential, commercial, and industrial growth.

Conventional or traditional indices of economic growth (housing, income, employment, population) have been used in numerous studies of economic development resulting from transportation improvements. A major advantage of these indices has been their availability at low cost from secondary sources. Drawbacks to the data sets on which the indices are based have been the time lags between successive measurements (e.g., census data are collected every 10 years) and the unavailability of certain data sets on a local basis.

Real estate values can also be used as surrogates for changes in the economic climates of local communities. Many studies have avoided indices based on real estate data sets because of the high cost of collection of reliable market values from original sales data and the problems with extrapolation of values for properties that have not been on the market. Local taxing jurisdictions are, however, continually updating the data sets that are used for collection of taxes on real property. Recent changes in data collection and handling of assessment market values for real estate taxation purposes have provided possibilities for constructing new indices. Major advantages are that these indices are available on an annual basis, are becoming increasingly reliable for many taxing jurisdictions, are available on a local area basis, and can be broken down by land use classes.

In this study, the traditional and the new indices will be applied to analyze the possible economic reshaping of nonurban areas in Pennsylvania by the Interstate highway system.

BACKGROUND

The Interstate highway system, authorized by the Federal Highway Act of 1956, contains approximately 42,500 mi of limited-access highways. There is no doubt that the Interstate system has reshaped the economic topography of the United States (1). Although the system was designed to connect the metropolitan centers of the United States, much of the system is located in rural or nonurban areas. Many of these areas were not formerly served by major highways or other intercity transportation systems.

Because of the size of the undertaking (i.e., building a highway system that altered local, regional, and national transportation patterns), it could be expected that it would have significant effects on the economic and social settings of communities along the highway corridors. These effects would probably be more apparent in communities containing interchanges between the Interstate system and the local transportation system.

While the Interstate system was under construction, a portion of the monies designated for the program was devoted to research on the social and economic effects of Interstates on local communities. Because much of this research was conducted while the highways were being constructed or shortly thereafter, these studies were essentially predictive in nature (2,3). Early studies could only give inklings of the types of development that might occur in areas adjacent to Interstate highways. What actually happened can be determined only from a historical perspective.

The main focus of earlier research was to determine the types and levels of highway-oriented and other commercial, residential, and industrial developments that would likely occur in interchange communities. This information was useful to government officials and planners seeking to stimulate orderly growth, to maintain the safety and adequacy of local highways, and to create desirable overall community environments.

Most earlier studies included such variables as population, employment, household income, and housing (4,5). In recent years additional measures of growth have become available. These include newer and better annual measures of income and, as mentioned earlier, of real estate market values. In the case of market values of real estate, the amount and value of income-producing properties such as industrial, commercial, and residential properties are now fairly easy to obtain from most taxing jurisdictions. Thus, with more and better information available coupled with the maturing of the Interstate system, it is possible to provide from a historical perspective a more accurate description of types and levels of economic developments in communities containing Interstate interchanges versus other communities.

SELECTION OF STUDY AREAS

Continuing studies of interchange community development have been conducted by Twark and Eyerly since the early 1960s (6,7). They have had under observation 164 selected nonurban interchanges in Pennsylvania since these interchanges were opened to traffic. The highways studied were I-70, I-78, I-79, I-80, I-81, I-83, I-90, and I-176. When these interchanges were selected, a criterion was that the communities surrounding the Interstate interchange have little or no prior economic development other than traditional rural activities such as farming, forestry, mining, and the like. These interchanges were located in portions of 182 minor civil divisions (MCDs) and 32 counties.

Data have been maintained over time on all types of development within a radius of 1/2 mi of each interchange. The data bank also included distance to nearest urban area; average daily traffic on the Interstate and the cross route; and the population, area, and market value of real estate in the local community, the county, and the nearest urban area. In 1980 a model to estimate economic growth at nonurban, limited-access highway interchanges was published (2). This model was

applicable to the study and simulation of the impacts of various interchange sites before the final location and design of a specific interchange. It could also be used in the redesign of obsolete interchanges.

This paper will provide a brief description of the growth and change that occurred in municipalities in which the nonurban interchanges are located. The data bank for the 164 nonurban interchanges is used, but additional data, which are more recent and broader in geographic context, will also be analyzed.

PROCEDURE

Indices of local economic growth will be compared with county and state growth indices. The county and state indices include information from all MCDs within their boundaries and do not exclude the MCDs containing nonurban interchanges. The indices of economic growth will show the percentage changes in population, housing, employment, income, and assessed market value of selected land use categories. Statistics on population, housing, and area in square miles are given in Table 1. The indices are constructed from population, housing, and employment data provided by the Bureau of the Census;

TABLE 1 SELECTED 1980 STATISTICS FOR THE STATE, NONURBAN INTERSTATE INTERCHANGE COUNTIES, AND LOCAL COMMUNITIES

	State (67 Counties)	Non-Urban Interstate	
		32 Counties	182 Local Communities (MCD's)
Population	11,863,895	4,626,026	658,433
% of State	100	39	5.5
% of County		100	14.2
Area in Sq. Miles	44,888	21,204	3,616
% of State	100	47	8.1
% of County		100	17.1
Total Housing Units	4,596,431	1,793,600	249,913
% of State	100	39	5.4
% of County		100	13.9

income data obtained from census data and the Department of the Treasury; general revenue-sharing data for the fifth and fifteenth entitlement periods; and assessed market value data and real estate sales data from the Pennsylvania State Tax Equalization Board. The latter sets showed the assessed market values and sales data for seven land use classes (residential, lots, industrial, commercial, farms, vacant land, and minerals) for each MCD and county in Pennsylvania. These indices of land use change were previously used to measure community growth around nuclear power plants (8) and for second-class townships in Pennsylvania (9). See Table 2 for more detailed information.

It was thought that it would be worthwhile to further examine, using multiple linear regression, the effect on per capita income that the Interstate system has in counties through which it passes. Variables included those used for the indices as well as others that could be used to explain percentage changes in per capita income.

RESULTS

Table 3 gives the economic indices for the period 1970 to 1980 for the state and for 32 counties and 182 MCDs with nonurban Interstate interchanges. From this table it can be seen that the population growth of Pennsylvania has been minimal, 0.5 percent. The counties that contain nonurban interchanges grew at the rate of 6 percent. The interchange MCDs or local communities grew 22 percent. There was a substantial population increase in the interchange communities compared with the counties in which they were located and with the state as a whole.

The state had a 17 percent increase in housing units. Non-urban interchange counties had a 22 percent increase, but the nonurban interchange MCDs grew at nearly twice the county rate with a 43 percent increase in housing units. Analogous to the growth in housing units is the increase in assessed market value of residential property. These residential value indices,

TABLE 2 INDICES OF ECONOMIC GROWTH: DESCRIPTION AND SOURCE OF INFORMATION

Economic Index	Description
(In Percent)	Description
Population:	Change in population from 1970 to 1980 for the state and non-urban interstate interchange counties and local communities. These communities are the minor civil divisions (MCD's) of Pennsylvania, i.e. boroughs, townships or cities. Source: U.S. Bureau of the Census.
Housing:	Change in the number of housing units from 1970 to 1980. Source: U.S. Bureau of the Census.
Income:	Per capita change in income from 1970 to 1980. This measure is derived from the 1970 and 1980 U.S. Bureau of the Census Report for the MCD's of Pennsylvania. The Treasury Department's revenue sharing data for the 5th and 15th entitlement period is used.
Employment:	Change in the local work force from 1970 to 1980. Source: U.S. Bureau of the Census (not available for MCD's).

TABLE 2 *continued*

Economic Index (In Percent)	Description
Residential:	Change in residential real assessed market value derived from locally assessed values 1970-1980, adjusted for differences between counties and also for inflation. Source: Pennsylvania State Tax Equalization Board (STEB) and The Economic Report of the President.
Commercial:	Change in commercial real assessed market value (same adjustments and sources as in residential).
Industrial:	Change in industrial real assessed market value (same adjustments and sources as in residential).
All Developments:	Change in the real assessed market value for all land use classes: residential, commercial, industrial, lots, farms, vacant land and minerals (same adjustments and sources as in residential).

adjusted for inflation, went up 30 percent at the state level, 35 percent at the county level, and 52 percent at the MCD level.

The housing indices in conjunction with the population indices reflect the national pattern of a changing life-style in which there are more housing units and fewer persons per household. The growth revealed by these indices would indicate a possible preference for living in MCDs with access to the Interstate for work, shopping, and recreational trips.

Two other measures of growth are per capita income and employment. The employment indices grew 9 percent at the state level and 15 percent in counties with nonurban Interstate interchanges. Unfortunately, data do not exist for a comparison at the MCD level. Per capita income, adjusted for inflation, increased 16 percent at the state level, 23 percent at the county level, and 27 percent at the MCD level.

Other studies (2, 10) indicate that the most common form of development that occurs at nonurban interchanges during the first few years is highway-oriented enterprises. At later stages, other commercial enterprises, industries, and residential developments locate in areas near interchanges. The all-developments indices, which consisted of the assessed market values of all seven land use classes, increased 25 percent at the state

level, 32 percent at the county level, and 56 percent at the MCD level as the data in Table 3 indicate.

Because the MCDs in this study are mainly rural and had a relatively low commercial base, any new commercial enterprises would probably be reflected in dramatic increases in the market value of commercial properties. At the state level there has been an 18 percent increase in the assessed market value of commercial properties. At the county level there was a 38 percent increase, whereas the nonurban MCDs with interchanges showed an 86 percent increase in the value of commercial properties.

One of the phenomena that have been taking place in the country has been a deterioration of the industrial base. Therefore it is not surprising to find that at the state level there has been only a 3 percent increase in the market value of industrial properties and at the county level a 6 percent increase. However, at the nonurban MCD level there was a 70 percent increase in the market value of industrial properties. Thus nonurban interchange communities have attracted commercial properties and industry such as light manufacturing facilities at growth rates that exceed those of the county and the state.

TABLE 3 PERCENTAGE CHANGES IN ECONOMIC INDICES FOR THE STATE, COUNTIES, AND LOCAL COMMUNITIES

Economic Indices	State (67 Counties) %	Non-Urban Interstate Interchange Areas	
		32 Counties %	182 Local Communities (MCD's) %
Population	0.5	6	22
Housing	17	22	43
Income	16	23	27
Employment	9	15	*
Residential	30	35	52
Commercial	18	38	86
Industrial	3	6	70
All Developments	25	32	56

*Employment data are not available at the MCD level.

TABLE 4 LIST OF INDEPENDENT VARIABLES CONSIDERED FOR A MULTIPLE LINEAR REGRESSION ANALYSIS TO EXPLAIN CHANGES IN PER CAPITA INCOME

Independent	
Variable	Description
INC	The county income per capita in 1970 adjusted by the gross national product to 1980 dollars.
COM	The proportion of the county tax base in commercial property in 1980.
IND	The proportion of the county tax base in industrial property in 1980.
AGRI	Proportion of the county tax base in agricultural property in 1980.
MIN	Proportion of the county tax base in mineral rights property in 1980.
COAL	A dummy (0-1) variable for a bituminous coal producing county.
INTCO	A dummy (0-1) variable for a county containing one or more non-urban interstate highway interchanges.

Eyerly, Downing, and Twark, in an earlier study (11), found that per capita income had increased more between 1970 and 1980 in Pennsylvania bituminous coal mining counties than in nonmining counties. Much of that effect could be accounted for by the increased costs of energy during the 1970s and the concomitant effects on the economies of energy production areas.

A regression model employing mining-related variables coupled with the nonurban Interstate highway variables might

better explain the increases in per capita income at the county level in Pennsylvania. The list of independent variables considered is given in Table 4. An equation using statistically significant variables is given in Table 5. From this table it can be seen that, in addition to the coal and mineral variables, the existence of an Interstate highway in the county is an important factor, as was earlier suggested by the economic indices. The industrial base and level of income were also significant factors.

TABLE 5 REGRESSION RESULTS FOR THE PERCENTAGE CHANGE IN COUNTY PER CAPITA INCOME, 1970-1980

Variance	Regression Coefficient	Student "T"	Level of Significance		
			10%	5%	1%
INC	-0.0078	-3.57			X
IND	43.39	1.75	X		
MIN	39.45	2.28		X	
COAL	6.32	3.36			X
INTCO	4.14	2.42		X	
CONSTANT	33.25	5.43		X	

$$R^2 = .479$$

$$\text{"F" Ratio} = 11.24$$

Number of Observations = All 67 Counties.

TABLE 6 PERCENTAGE CHANGES IN SELECTED ECONOMIC INDICES FOR THE STATE, COUNTIES, AND LOCAL COMMUNITIES, 1970-1984

Economic Indices	State (67 Counties)	Non-Urban Interstate Interchange Areas	
		32 Counties	182 Local Communities (MCD's)
	%	%	%
Residential	35	44	64
Commercial	21	44	95
Industrial	-13	9	90
All Developments	27	39	65

MORE RECENT COMPARISONS

One advantage in using the assessed market value data to measure local economic change is that this information is readily available and is updated every year by county assessment offices. This is in contrast to census data that are limited to 10-year time cycles leaving open to speculation the fluctuations of census indices between collection dates.

Table 6 gives the percentage changes in selected assessed market values of real estate indices for the state, county, and MCDs from 1970 to 1984. From this it can be seen that residential property value is continuing to increase but more so at the nonurban interchange MCDs than at the county or state levels. Commercial property values are continuing to grow in a similar manner. Industrial properties at the state level have, however, been reduced in value by 13 percent. Counties and MCDs with nonurban Interstate interchanges have continued to grow, 9 percent for the counties and 90 percent for the MCDs. This strongly suggests that new industrial growth is linked to the presence of an Interstate highway interchange in the community.

CONCLUDING REMARKS

The findings of this study substantiate the early hypothesis that the Interstate highway system would encourage growth in local communities. An advantage of this study is that the Interstate system has been in place long enough to provide documentation of the reshaping of the economic structures of many local communities. All indices examined provide evidence of strong growth, particularly industrial growth, at the nonurban interchange community level compared with the county and the state levels.

In addition to the traditional indices of economic growth such as population, income, housing, and employment, new indices were constructed and used. These indices are based on the assessed market value of real estate and can be obtained in some states on an annual basis for large and small communities or even parts of these communities. These new indices can have wide application in studies measuring community change.

The study reported here was conducted in Pennsylvania, which has strict legal requirements for disclosure of sales prices because of a realty transfer tax; statewide monitoring and collection of sales and assessment data by a State Tax Equalization Board (STEB), which is required by law to provide formula funding to school districts; and publication of STEB data and assessment-sales ratios. The assessment-sales ratios are required by a "Common Level of Assessment" law and can be used to test the reliability of the assessed market values in a county.

It is important for researchers to identify the sources and the reliability of sales price data and assessed market value data when working in other states. Assessment practices vary widely from state to state and within states. Reliability of sales data also varies because of differences in laws requiring disclosure of sales price of real estate. A recent study by Majchrowicz (12) provides insights on a state-by-state basis into the adequacy and quality of sales price data for estimating real estate market values.

As a further note, in many assessment jurisdictions, the assessment market value records contain location codes such as block and lot number, tax map and parcel number, and so forth. With location codes, the researcher can start with an individual property location and add additional properties to achieve any size or configuration of the research area. This procedure is more difficult without location codes but can be accomplished with extra effort on the part of the researcher. It is also extremely helpful to have access to computerized assessment records but they do not always exist.

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