Short and Brenda Shearer are doctoral students in education at the University of Minnesota. Currently Ruth Short is working with teachers in White Bear Lake on the Early Intervention in Reading Program. Brenda Shearer, a reading teacher in Osceola, Wisconsin, is helping first grade teachers in her building implement the Early Intervention in Reading Program. A more technical research report on this reading intervention program is available. For copies write to Barbara Taylor at the College of Education, 330 Peik Hall, 159 Pillsbury Drive S.E., University of Minnesota, Minneapolis, MN 55455.

This study was supported by an interactive research grant from CURA and the Office of the Vice President for Academic Affairs, University of Minnesota. Interactive research grants have been created to encourage University faculty to carry out research projects that involve significant issues of public policy for the state and that include interaction with community groups, agencies, or organizations in Minnesota. These grants are available to regular faculty members at the University of Minnesota and are awarded annually on a competitive basis.

Photos on pages 1, 3, and 4 by Nancy Conroy.

Do Highway Funds Spur Economic Development?

by Yorgos J. Stephanedes

Where should a state spend money if it wants to boost its economy? We recently studied this issue, looking at the effects that highway funds have on economic development. We examined changes in local employment and income after money was spent on Minnesota highways and the influence of local economic changes on highway funding.

Background

Most states in the Upper Midwest have a dispersed population, which means that considerable investment in transportation infrastructure is required. Investment in transportation is typically a major component of the state budget, even though federal aid is also available. In the United States, state spending for highways totaled $38.2 billion in 1986, representing 9 percent of state budgets. Spending on highways rated third, after education and welfare. Recently, most states in the Upper Midwest have been assuming a greater role in designing their own economic development programs. Investment policies directed at improving the transportation infrastructure play a key role in such programs.

Thirty-six states explicitly consider regional economic development as a justification for highway funding and as one factor which influences decisions about the highways in which to invest. In the Upper Midwest, one of the most ambitious programs is Iowa's RISE (Revitalize Iowa's Sound Economy), which provides $27 million in annual funding dedicated to highway construction and improvement projects intended to foster economic development over a five-year period. The inclusion of regional development objectives in highway funding is valid, however, only if highways have a significant impact on regional development. If they create jobs and increase income, then is considerable disagreement as to whether, and in what degree, this is the case.

Our findings indicate that in Minnesota government plays both an active and a reactive role in regional economic development. Government is a reactive player when it improves highways to support economies that are already healthy or improving. It has done this, often effectively, in regional centers, where it rewards development with improved highways that, in turn, act as catalysts for more development by improving access and removing bottlenecks. Government becomes an active player when it attempts to stimulate development in local economies that are weak or deteriorating. Such attempts usually occur in rural areas, but are not always effective. Improved roads tend to hurt the economies of rural areas, in the long run, if the areas are located near regional centers. If they are far from regional centers, on the other hand, the areas may benefit from improved roads, which can provide better access for timber and farm products going to market and improved access for tourists coming into the area.
Earlier Studies

The traditional view in past research has been that improving the transportation infrastructure is a necessary predecessor to economic development in a region. In the last ten to fifteen years, however, this view has come under heavy criticism. New empirical research has shown that transportation can develop concurrently with regional economic development or even as a result of new development. In some places increased investment in transportation has attracted little new industry and its efforts has been minimal.

The inconclusive and occasionally contradictory findings about the relationship between transportation and economic development are the result of three major factors. First, previous studies have considered this issue at substantially different geographic levels and there is no reason to believe that the process works in the same way at different levels. Second, at the level of county and multi-county analysis, most studies have used a cross-sectional correlation analysis, although such analysis is unable to determine the direction of relationships between two variables.

Finally, previous studies have paid too little attention to the long delays that are inherent in transportation-economy interactions. A substantial highway reconstruction project may take two years to complete and it may take another three years before regional industries fully realize the benefits from the highway improvement by restructuring their transportation operations and increasing their competitiveness in the market. Indirect effects from these immediate benefits, such as expansion of headquarters and employee relocation, may happen over an additional three to five years. If we add a one- or two-year waiting period before an approved reconstruction project actually begins, we can see how research results, over a period of ten to twelve years, may differ depending on the year in which the analysis takes place.

Data and Methods of This Study

A time-series analysis was used in this study to take into account the variation in economic effects of highway reconstruction over as long a fifteen-year period. This should increase the accuracy and consistency of the findings and bring us closer to being able to distinguish between cause and effect.

The study is based on highway expenditure data compiled by the Minnesota Department of Transportation as part of their annual project funding system. The data are broken down by county, for all eighty-seven Minnesota counties, for the years 1957-1982, and are limited to the state trunk highway system. This includes the major highway projects funded by the Minnesota Department of Transportation and constitutes the overwhelming majority of the highway budget. Employment data used came from County Business Patterns (Bureau of the Census) and represent employment in the middle of March each year, for the years 1964-1982. The analysis includes nine different levels of employment, by place of work, and eight different levels of income by place of residence.

Before the analysis, effects reflecting the dominance of the size of county, regional or national trends, inflation, and other effects that are common across several counties were filtered out. To accomplish this filtering, groupings of counties were formed based on county characteristics. The assumption is that, within these groupings, counties will react in similar ways to highway changes. We grouped the counties by local features and by interactions between counties, recognizing that, in part, counties depend for their growth on their neighbors.

We sought to classify the counties by features that are familiar to the transportation policy analyst; that can be easily quantified with existing data; that can capture the socioeconomic, demographic, and accessibility differences across counties; and that are least correlated with each other. The six most important features used to classify the Minnesota counties were:

- **Accessibility within a county**... measured by the percent of county area covered by paved and unpaved roads.
- **Accessibility between counties**... measured by the number of roads crossing county borders divided by the county perimeter. No weighting was provided for the number of lanes per road.
- **Population density.**
- **Population dominance**... measured by the average of population densities of adjacent counties. This feature can indicate the potential for increased travel between counties given improved accessibility.
- **Average salary income per household.**
- Median age...age can indicate the potential for mobility. For example, people in certain age brackets are expected to more easily travel across counties to find work if there is access. Additional features could have been considered. While this filtering process does not guarantee that all the effects of outside factors have been eliminated, it reduces the potential influence of the factors we considered most likely to distort our analysis.

Classifying the eighty-seven counties into groups based on their characteristics is an essential element of the filtering process. In addition, the classification makes analysis of the results more meaningful as it allows us to focus on each group of counties separately. Since possible relationships between highway expenditures and economic development are likely to differ across groups, we developed and evaluated these relationships separately for each group.

The classification process led us to identify four county groups (Figure 1):

- **Regional center counties** are characterized by low median age and high values in the other five features used for the classification. There are nine counties in this cluster: the Twin Cities metropolitan area and Olmsted County, where the city of Rochester is located.

- **Urban-influenced counties** have median values in all six features. There are twenty-eight counties in the cluster.

- **Agricultural counties** show high median age and low values in all other features. There are thirty-seven counties in the cluster.

- **Natural resource counties** are distinct because of low values in all features except age (median age is at a middle point). The cluster has thirteen counties.

Dominating the regional center counties is the Minneapolis-St. Paul metropolitan area. It has been described as the finance, insurance, service, and market center for the Upper Midwest. However, with 10 percent of the nation's computer manufacturing in Minnesota, the Twin Cities' reputation in technologically-oriented services stems primarily from its involvement with computers. Also contributing to this technological reputation are the companies that have corporate headquarters in the area. The Twin Cities tie with San Francisco-Oakland for seventh place in housing the nation's 500 largest industrial firms. One factor contributing to the Twin Cities' impressive development as a service economy may be its central location within the airline network. Benefiting from this, consumer services have also grown, especially tourism and health services. In Olmsted County, the Mayo Clinic and IBM have created a high concentration of health and computer manufacturing services. The county has substantial interaction with the rest of the world via air.

Urban-influenced counties are characterized by concentrations of light manufacturing. They form a corridor of robust economic activity in the southeast corner of the state. The western part of the state is dominated by the agricultural counties, while the north-northeast (where the economy depends heavily upon timber, mining and tourism), contains all the "natural resource counties." Although the lumber and wood products industry is evenly dispersed throughout the state, the majority of lumber is harvested in the northeast and paper producers have tended to locate there. Tourism is also most heavily concentrated in northern Minnesota.

The specific economic sectors of Minnesota's economy are compared with the United States as a whole in Figure 2. Contrary to some beliefs, the Minnesota economy is not more service-oriented than the United States as a whole, and manufacturing is not really the general trend in the United States. However, Minnesota seems to be a financial and insurance center, probably because the administrative headquarters of several financial firms are in the Twin Cities. In addition, Minnesota still exceeds the United States economy in agriculture and forestry. Overall, the Minnesota economy seems to be very close to the United States economy. Within specific sectors, however, there may be very substantial differences, as with computer manufacturing, already mentioned, where employment remains ten to twenty times above the United States as a whole.

After the filtering process was completed through this system of grouping Minnesota counties, we proceeded with a time-series analysis of the data. This analysis was enhanced from time to time with causality tests, used as an aid in determining the impact of one variable on another. Though the analysis is not perfect, it may have erred on the side of being too conservative.

### How Highway Funds Influence Economic Development

Our analysis resulted in a number of conclusions about the way highway funds interact with the local economy. The effect was different among the county groups. It should be noted at the outset that highway construction jobs were not included in the analysis since they disappear after construction.

The data demonstrate that in regional center counties and urban-influenced counties, money spent on improving highways causes an increase in total employment above the normal trend. These counties include the economic centers of the state and, therefore, are most likely to have the economic activity necessary for absorbing highway improvements. A few of the new jobs are created in the second year after the improvement, but most are created between the fifth and the tenth year. We found that urban-influenced counties

![Figure 2. Minnesota's Economy Compared with the National Economy, 1986](image-url)
such as St. Louis (Duluth), Clay (Moorhead), Stearns (St. Cloud), and Blue Earth (Mankato)—are as likely to benefit from highway investment as are the regional center counties.

Improved highways generate income and employment in the natural resource counties as well. In particular, they generate growth in the service and retail sectors.* While these effects are in general agreement with past studies, the growth in service indicators is long-term and this was not entirely expected. Such growth indicates that the service sector in these counties is eager to provide more jobs and that its expansion can be hampered by the lack of good quality roads. To be sure, the density of the highway system is low in the natural resource counties so that improvements on highways in these counties are much more conspicuous than in some other areas of the state.

We found that retail activity is affected by highways in every group of counties. While highway construction can impede business in the urban-influenced and regional center counties, it stimulates business in agricultural and natural resource counties. There retail activity represents a large part of the local economy—up to 31 percent of total employment as compared with a maximum of 25 percent in the more urbanized counties. Figure 3 illustrates the impact of a one-time, above the trend, increase in highway funding on retail employment in the natural resource counties. As the figure suggests, following an increase in highway expenditures by 10 percent in the first year, retail employment also increases, by 2.5 percent. While most of the employment increase occurs in the first six years, the effect lasts approximately ten years.

How Economic Development Influences Highway Funding

Our analysis shows that highway investments are made throughout the state whenever total employment increases. This is especially true in agricultural and natural resource counties and indicates the eagerness of state government to aid any increasing economic activity in Minnesota. An increase of jobs above the trend by a given percentage attracts additional state investments of almost double that percentage. Thus a 10 percent increase in jobs will attract an 18 percent investment over ten years, or, to put it another way, an extra 100 jobs will attract an extra $28,500 in highway investment. Our detailed accounting of this effect leads us to conclude that approximately one of every sixty new jobs in Minnesota is created by the Minnesota Department of Transportation.

In general, government reacts to economic improvements and does not seek to play an active role by stimulating a contracting economy. Natural resource counties and farm-related activities in certain agricultural counties, represent the major exception. In these counties, government plays an active role which tends to stimulate the local economy through highway expenditures when income drops. While the policy does not always succeed in the agricultural counties, it seems to be effective in the natural resource counties.

Some Conclusions

The effectiveness of the active government role in the natural resource counties indicates that state policy makers appreciate the needs of the timber and tourist industries in the north-northeast part of the state, and their potential benefit from road improvements. At the same time, the local industry knows how to take advantage of the improvements. This regional relationship appears to carry the ingredients of a success story.

The finding that improved highways tend to help the economy of urban areas but may hurt certain of their adjacent counties should not be surprising. In particular, counties adjacent to urban areas tend to depend on these areas for the infrastructure necessary for development; better highways may allow rural residents to conduct more of their economic activities in nearby centers. Further, a comparison of the percentage of people working (66 percent) and living (47 percent) in the regional center counties strongly suggests that highways are helping the residents of the adjacent counties to get to work as well as providing jobs for them.

The distributional nature of the effects of better highways is evident when analyzing the different parts of the state. In particular, while certain counties are likely to gain from improved roads, others are likely to lose, so that the statewide effect is not significant. This finding agrees with conclusions from a geographic study which reported that where the highway network is good and most services are widely available, any effects of highway improvements on services are likely to be more dramatic in competition among service locations than on the overall disposition of the consumer who purchases goods.*

The negligible economic effect of highway funding on a statewide basis indicates

More Snowbirds, More Money
by William J. Craig

Yorgos Stephanedes is a professor of civil engineering at the University of Minnesota. His major research interest is in the application of advanced technologies (such as automation, robotics, image processing, automatic control, guidance and navigation, communications, and driver information systems) to transportation and the effect of these applications on economic competitiveness. He is currently chairing an international conference on advanced technologies that will be held in Minneapolis next summer.

The research presented here followed a major study prepared for the Minnesota Department of Transportation (Mn/DOT) by Stephanedes and a number of other University of Minnesota researchers, including David Eagle, a Ph.D. student in the Department of Economics and graduate research assistant in the Department of Civil and Mineral Engineering at the University of Minnesota, and a professor in the Department of Geography. The results of that study have been published in nine volumes under the general title Transportation and Economic Development. Copies may be obtained by writing Mn/DOT. This study is an extension of the Mn/DOT study and provides a closer look at Minnesota, county by county.

This study was supported by an interactive research grant from CURA and the Office of the Vice President for Academic Affairs, University of Minnesota. Interactive research grants have been created to encourage University faculty to carry out research projects that involve significant issues of public policy for the state and that include interaction with community groups, agencies, or organizations in Minnesota. These grants are available to regular faculty members at the University of Minnesota and are awarded annually on a competitive basis.

Photos on pages 5 and 8 by Robert Friedman.

Last December we reported our estimate of 73,000 seniors leaving Minnesota each winter for extended stays in warmer states. While out of state, we estimated they spent $110 million dollars. This article provides an update and is based on new survey information and an extensive newspaper series in Arizona, the favorite destination for Minnesotans. Based on the new information, we estimate the number of snowbirds has increased to 83,000 and the dollars spent to $150 million.

Snowbirds is a term used in southern states to describe the flocks of seasonal migrants that arrive each winter and leave each spring. The first known use of the term is traced to a 1967 New York Times article. This seems to be about the time that people began making these winter escapes in large numbers.

Our earlier research showed that about 9 percent of Minnesota's senior households leave the state for a period of at least five weeks during the winter. We estimated that this represents 73,000 people. Arizona accounted for one-third of the trips; California, Florida, and Texas followed and combined for another half of the destinations. Although people begin to leave in November, January is the biggest departure month. Among seniors we found snowbirds more likely to be: younger, married, well educated, middle income, healthy, and living in outstate Minnesota.

New Survey Data
The Wilder Research Center has collected new data as part of their Senior Study. Data for our first analysis came from a 1988 Wilder survey that interviewed 1,500 households, sampled by region in proportion to their numbers across the state. Since then Wilder has supplemented this survey with two others, one of more outstate households and one of minority households.

The outstate survey was conducted in the summer of 1989. Its purpose was to expand the number of households interviewed in each development region of Minnesota to 200, a sufficient number to complete a "needs assessment" for each of the ten regional area agencies on aging (see map). Data from those 1,536 new surveys allow us to look at recent trends, regional differences, and more detailed analysis.

The most significant finding from the new outstate survey is growth in the number of snowbirds. In 1989, 11.2 percent of the outstate elderly were snowbirds, compared to 9.8 percent in 1988. In this calculation data were weighted back to regional-level proportions. This 1.4 percentage point rise is a relatively large shift for a single year amounting to a 14 percent gain. This change might be due to sampling error, but we doubt it. We know that snowbird activity is increasing, and this is our best estimate of the rate of change, at least for this one period. If this same increase was made by all Minnesotans, the number of seniors leav-