Urban Transportation Ecoefficiency: Social and Political Forces for Change in U.S. Metropolitan Areas

Doctoral Dissertation: Executive Summary

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Purpose of the Study

This study analyzes social structural, economic, and political factors that influence transportation in United States metropolitan areas. Although other studies have examined the influence of specific policy and planning changes on transportation behavior, no study to date has addressed the role of broad, macro-level social forces and state policy.

Measuring Transportation Ecoefficiency (TE)

For this analysis, transportation in U.S. Metropolitan Statistical Areas is measured as the average of four component z-scores: 1) population density, which acts as a proxy for average travel distances; 2) the percent of commuters who drive alone to work (with sign reversed); 3) the percent of commuters who take public transit; and 4) the percent of commuters who walk or ride a bicycle. This index, called transportation ecoefficiency (TE), is designed to act as a proxy for transportation’s environmental impact per unit of travel. With a higher TE index score, more commuters are taking ecologically friendly transportation modes and/or traveling fewer miles, which is more ecologically efficient. The general trend for U.S. metro areas from 1980 to today is declining transportation efficiency due to an increase in the percent of commuters that drive, at the expense of other modes. Because of this trend, the dependent variable in this analysis is constructed as the change in TE index from 1980-2008. In most cases a higher change score indicates a slower decline in transportation ecoefficiency compared to other U.S. metro areas.

Analysis

Independent variables were derived from social theories (hypotheses, social theories, and details on all variables are in the appendix). All independent variables are constructed using data from around 1980, since some transportation features are slow to change. General linear regression produced results that are robust and have high goodness-of-fit. Standard tests for statistical anomalies and model misspecification did not indicate any problems.

Results

Although some social and political forces were not found to influence transportation ecoefficiency, several factors improved TE or slowed its decline: state level policy requiring urban growth management, higher per capita income and income growth, and widespread college education. The influence of government fragmentation, a professional workforce, race, and segregation are more complicated and are discussed below.

Government and Policy:

The overall picture here is hopeful – state level policy requiring urban growth management has a positive influence on change in transportation ecoefficiency. This effect is stronger when combined with community wealth, as shown by the positive interaction between state policy and real per capita income. This confirms that comprehensive planning can affect TE in beneficial ways. However, Wisconsin’s policy has opposite the intended effect, and is associated with a larger decline in TE. In other words, different policies can have extremely different outcomes, so policy must be designed carefully with the local context in mind.
The influence of government fragmentation is more complicated. Local government fragmentation was found to increase beneficial change in TE, while state government fragmentation had the opposite effect. However, measurement of local government fragmentation was hampered by lack of appropriate data and since other results support coordinated planning this does not conclusively demonstrate that local coordination reduces TE. Finally, metro areas that cross state boundaries declined in TE faster than other metro areas, so coordination of state-level policy could influence transportation in ecologically beneficial ways.

Economics and Demographics:
More widespread college education and higher real per capita income both increase beneficial change in transportation ecoefficiency. This connection between wealth and TE supports the idea that at least two of the economic-environmental-equity goals of sustainability planning can be complementary for transportation. Additionally, in metro areas with both high and rising incomes, the two income variables interact to produce an even stronger beneficial effect on TE. Percent professional/technical workers has a quadratic effect: initially it has a positive influence, but after a threshold its effects reverse. This could be due to the influence of workplace status, so that in metro areas with many professional workers the need for status encourages more workers to drive expensive cars rather than take less status-oriented transport modes. In these metro areas corporate and other employer policies could help override this status effect, but more research is needed to determine what policies would be effective.

Race and Segregation:
There is a significant, quadratic effect of percent African American on TE: initially it has a positive influence, but after a threshold its effects reverse. This could be because diversity initially leads to tolerance, but a larger African American population creates perceived racial threat and conflict in politics and housing. Riding public transit likely requires tolerance, since it often involves encounters with diverse people, and racial conflict in politics could reduce the efficiency of transit and land use planning. Next, there is an interaction between percent African American and change in per capita income. This could be because rising income reduces perceived racial threat, and makes White families less likely to flee to the less-diverse suburbs. In metro areas with stable or declining incomes, a larger African American population is perceived as more threatening (driving White flight and longer, more car-dependent commutes), whereas a larger African American population with rising per capita income is less threatening and more associated with tolerance.

Finally, higher racial segregation leads to a larger decline in TE, but only in the Midwest. In other words, the historical processes that created segregation were different in different regions of the country, so segregation’s effects on transportation also vary by region. More research is needed to analyze the interaction between race and segregation, and determine how these forces influence transportation, but the fact that they have an influence is clear.

Conclusions

This study demonstrates that macro-level social forces and policies influence local transportation, which is important because they are so under-studied. Additionally, this analysis shows that one of the keys to more ecoefficient transportation is regionally coordinated planning, as long as this planning involves careful attention to the local context.
Appendix: Theory, Hypotheses, and Independent Variables

Government and Policy:
Planning practice and theory predicts the influence of comprehensive planning, and that more cohesive transportation and land use planning will improve outcomes. State-centered theory also predicts that a more cohesive local governing structure produces more efficient outcomes, including transportation. A related theory predicts the effect of professionalized local government, in the form of council-manager government forms. Specifically, the professional administrators in council-manager governing structures are expected to improve governing efficiency, including transportation planning and policy (this effect was not significant). These processes are tested with 4 variables: 1) the presence of weak or strong state urban growth management policies that require regional metropolitan planning; 2) non-school local governments per 1000 people, measuring local government fragmentation; 3) a dummy variable for whether a metro area crosses state lines, indicating state government fragmentation; and 4) city-management capacity, measured as the average form of government for municipalities in the metro area (high scores indicate more council-manager governments).

Economics and Demographics:
Terry Clark’s New Political Culture theory links demographic patterns to local political culture; an urban area with a New Political Culture places greater emphasis on amenities like public transit and bicycle paths. This culture is more common where the population has higher incomes, more education, and more professionalized workers. This theory is closely related to Herman Boschken’s theory of Upper-Middle class influence, which predicts that the Upper-Middle class (i.e. those with high and rising incomes, and high education) affects local politics in ways that closely align with the New Political Culture. Several independent variables are included to test these theories: 1) professional/technical occupations, as a percent of all workers (linear and quadratic terms included); 2) percent of the population over age 25 with a college degree; 3) real income per capita; and 4) percent change in real income per capita (1979-1989).

Race and Segregation:
Racial residential segregation has left a noticeable imprint on U.S. metropolitan landscapes, and this influence should affect transportation. Although there is currently no social theory that can be expanded to predict the influence of racial diversity or segregation on transportation, they are nonetheless expected to have an effect. Racial diversity is measured as the percent of the population that is African American (linear and quadratic terms included). Segregation is measured as the index of; 1) Black-White evenness (a dissimilarity index representing the proportion of African Americans who would have to change census tracts to achieve an even distribution), and 2) Black Isolation (which represents the probability that African Americans share a census tract with each other).

Controls:
A variety of other variables are included as controls: percent of all households with children; percent of housing built before 1940; percent of families below the poverty line; 1980 population; population change (1980-2008); census region; a dummy variable indicating whether a metro area is considered a “global city”; and a dummy for metro areas that are state capitals.