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Final Report

Project Title:

Linking Mileage to Auto Accident Risk and Urban Form

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Project Description

Pricing auto insurance on a per-mile basis provides a beneficial, cost-based incentive to reduce vehicle miles traveled compared with traditional rating plans that charge annual premiums with little or no consideration of miles driven.

The research project is a continuation of UTC Project MITR21-4 which combines spatially detailed information about vehicle miles traveled (VMT), urban form, and automobile accidents into the most extensive analysis yet undertaken of mileage based risk and the influence of urban form.

We combined spatially detailed GIS data layers for housing, infrastructure, and demographic factors with two unique Massachusetts State datasets for millions of vehicles in order to associate accident experience both with actual miles driven (for private passenger vehicles) and with driver and place-of-garaging characteristics. The work involved close collaboration with MassGIS (the State's GIS Office) and with the Boston Metropolitan Area Planning Council (MAPC), two key state and regional planning agencies involved in the policy analysis and modeling of land use, growth management, and transportation strategies for reducing greenhouse gas emissions. These per-mile estimates are then combined with price elasticity of demand for gasoline and with MAPC projections of regional growth in order to estimate the VMT savings from mileage-based insurance pricing and from alternative metropolitan growth scenarios.

Method

The work was made possible through the availability of three unique datasets that have been assembled for administrative purposes by Massachusetts state agencies: annual safety inspection records that include odometer readings and are reported to the Registry of Motor Vehicles (RMV), private passenger automobile insurance premium and claims records reported to the Massachusetts statistical agent, Commonwealth Automobile Reinsurers (CAR), and spatially detailed land use and demographic data that have been prepared by the State's GIS Office (MassGIS).

We combined the annual VMT estimates from safety inspection data and the auto accident claims data from CAR with the land use, infrastructure, and demographic data from the MassGIS data layers. The primary goals of the data processing were (a) to develop credible annual VMT estimates at the 250x250 meter grid-cell scale; (b) to relate these VMT estimates to spatial patterns of land use, infrastructure, and demographic data, and (c) to examine whether auto accident risk tracks VMT estimates, after controlling for the spatial effect of a vehicle's principal place of garaging.

Findings

The research developed the most extensive and spatially detailed analysis of annual vehicle miles traveled (VMT) and automobile accident risk by type of vehicle, driver

characteristics, place of residence, and land use pattern. We combined unique, near 100% samples of Massachusetts State data containing annual odometer readings (since 2001) and auto insurance claims records (since 2005) with GIS data layers of housing, infrastructure, and demographic characteristics. By cross-referencing, at very fine grain spatial detail, actual miles driven (for private passenger vehicles) with place of garaging and with auto accident claim costs, we quantified the VMT impacts of mileage-based insurance pricing and of metropolitan growth strategies for encouraging compact development.

The work provided spatially detailed baseline data about Massachusetts driving patterns and per-mile accident risks plus a related set of indicators and calibrated analytic models that assist in 'what if' analyses of changing land use and transportation circumstances in metropolitan areas throughout the country.

Conclusions

The first phase of the research (performed in UTC Project MITR21-4) focused on descriptive statistics and thematic maps that examined the annual mileage estimates from the safety inspection data at town, TAZ, and grid-cell levels on a per vehicle and per household basis.

In this project, we completed phases two and three. The second phase of the project involved more sophisticated modeling of the land use and transportation interactions. The detailed GIS layers allowed us to compute, at several different scales, many of the land use, accessibility, and demographic characteristics that have been shown to be correlated with travel behavior. These analyses are helpful at two levels: they help us cluster neighborhoods into a small set of types that differ significantly in their travel patterns; and they also help us identify controllable factors that are associated with relatively low VMT experience and might be a desirable part of GHG reduction strategies.

In the third phase of the project we prepared an 'anonymous' dataset to be released for further analysis by other researchers. There are many data visualization and multivariate modeling possibilities that are worthwhile for so large and rich a set of data.

Outputs

[Pay as you drive car insurance? New study says a good idea](#), The Green Blog on boston.com, posted by Beth Daley, December 2, 2010.

Joseph Ferreira, Jr., Diao, Mi and Xu, Jingsi. [Estimating the Vehicle-Miles-Traveled Implications of alternative Metropolitan Growth Scenarios: A Boston Example](#), John Wiley & Sons, Ltd., 2013.

Joseph Ferreira, Jr. and Minikel, Eric. [Pay-As-You-Drive Auto Insurance in Massachusetts](#), A risk assessment and report on consumer, industry and environmental benefits, November 2010.