Equity Implications of Future Road Usage Charge Programs

Funding and Financing Surface Transportation: What Will the Future Bring?, TRB Annual Meeting, January 15, 2020

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Background

Motivations for considering road usage charges (RUCs)

- Fuel excise taxes represent most state's primary transportation revenue source.
- Revenues are forecast to decline due to improving fuel economy of gasoline vehicles and growth of alternative fuels and electric cars.
- Total number of vehicle miles traveled (VMT) in the U.S. continues to grow, underlying the need for continued investment in infrastructure to maintain existing roads and increase their capacity
- Wide range of fuel economy options for new vehicles breaking down the relationship between road use and revenue contribution.

Study objectives and purpose

- Examine how transitioning from a fuel excise tax to a road usage charge changes who contributes to revenue.
- Identify whether conventional wisdom holds that rural households would be disadvantaged.
- Expand upon previous research by analyzing the impact of this policy change on different areas with different income classifications in addition to geographic considerations.

Data Fusion Methodology

The research ties together various travel behavior studies, demographic data, spatial classifications, and vehicle characteristics to build a dataset for testing various revenue policies. While this use of the dataset is highly focused on fuel taxes and geographic equity, it is well positioned to be used for other revenue instruments like registration fees that can be tied to vehicles and households.

Prior studies have utilized NHTS vehicle and trip sample records to estimate RUC effects. However, most states contain insufficient sample sizes to provide the resolution desired to describe geographic equity effects.

Geographic Classification
- Census urban areas data
- USDA Rural-Urban Commuting Area (RUCA) codes
- American Community Survey - Poverty Rates and Mean Household Income

Vehicle Characteristics
- State vehicle registration data
- NHTSA vPICs tools
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NHTS Travel Patterns
- BTS Transferability Statistics
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- Validation to state data

Revenue Policy Analysis
- Tax rates across fuel types
- Bottom-up estimates of fuel tax payments
- Revenue neutral RUC rate estimates

Acknowledgements: The authors gratefully acknowledge RUC West for supporting state data collection and permission to use data and analysis developed under contract to them. Opinions expressed in this paper are the views of the authors and are not representative of RUC West or any of their member states. The authors also thank Derek Cutler of EDR Group for database processing support for this study.

Geography

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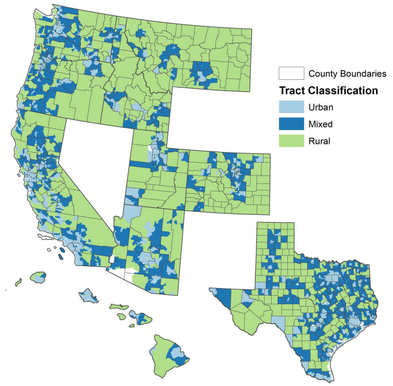
As travel behavior varies significantly within counties, they were considered too large to be the ideal level of geography for this study. Instead, classifications were developed at the census tract level using RUCA codes, which considers both the spatial form of a census tract and how tightly tied to urban economies they are based on travel patterns.



Poverty Area Designation

For purposes of this study, US Census Bureau computations for the percentage of households at or above the National poverty level were used to categorize overall household poverty characteristics of each census tract. Poverty classifications were determined for each census tract using the following criteria:

- Low Poverty: Census tracts with household poverty rate less than 11% of all households (2016 Poverty Rate).
- Moderate Poverty: Census tracts with household poverty rate equal to or greater than 11% but less than 20% of all households
- High Poverty: Census tract household poverty rate equal to or greater than 20% of all households

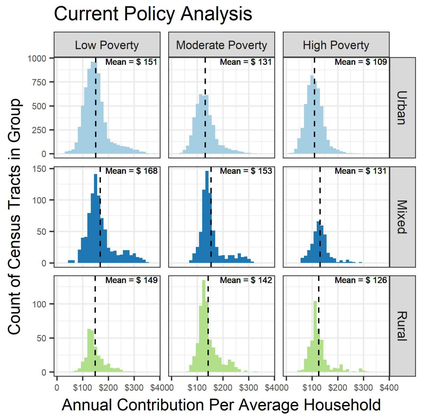
Geographic Designation	Low Poverty	Moderate Poverty	High Poverty	Total Number of Tracts
All	8224 (41.8%)	5586 (28.4%)	5867 (29.8%)	19677
Urban	7083	4333	5142	16558 (84.1%)
Mixed	847	644	336	1827 (9.28%)
Rural	294	609	389	1292 (6.65%)

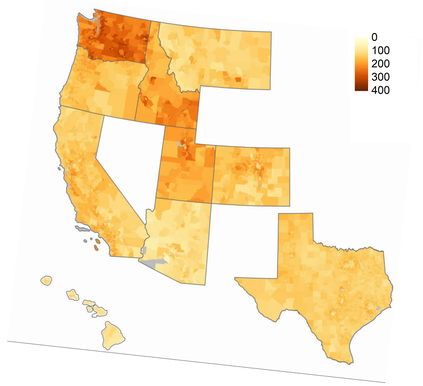
Equity of The Fuel Tax

Analysis of the current fuel tax policy showed that households in geographic areas classified as mixed paid more than households in either urban and rural areas.

Additionally, this analysis also revealed that rural households pay more than urban areas per household, except for in low poverty areas. Households in low poverty areas pay more under the fuel tax than higher poverty areas regardless of geography.

An ANOVA test showed that the differences in household payments between these geographic and economic classes were statistically significant.



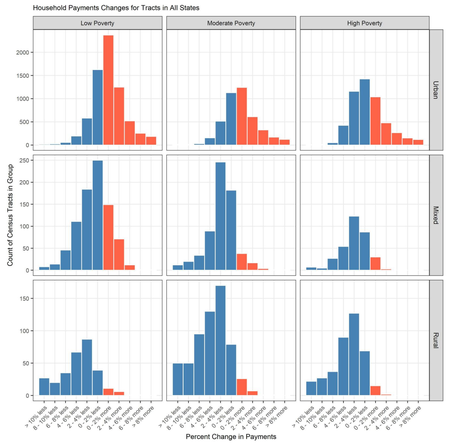


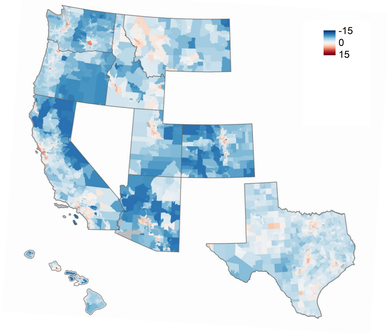
Change in Household Payments

In addition to the histogram and map below, a series of paired t-tests were used to analyzed whether the estimated changes in household payments from moving from a fuel tax to road-usage charge system would be statistically significant. A selection of the results are in the table to the right.

The decline in payments for rural areas was both larger in magnitude and more statistically significant than changes for other geographic area classifications. However, low poverty rural areas did see a greater magnitude of the decrease in household payments than higher poverty rural areas.

The histograms below show that the impacts of switching to a RUC system would result in some urban areas seeing increased payments, while others see a decline. In general, most high poverty urban tracts would see a decrease in average payments, while most low poverty urban areas would see an increase. However, the results are much more mixed than in rural areas.





Geographic Designation	Mean Difference in Household Payments	t-statistic	Total Number of Tracts
All	-0.375	-10.524	19,677
Urban	0.493	14.407	16,558 (84.1%)
Mixed	-3.915	-32.808	1,827 (9.28%)
Rural	-6.502	-42.649	1,292 (6.65%)
Low Poverty	0.359	6.0909	8,223 (41.8%)
Moderate Poverty	-0.755	-10.626	5,585 (28.4%)
High Poverty	-1.044	-20.357	5,866 (29.8%)
Low Poverty Rural	-7.243	-18.913	293 (1.49%)
Moderate Poverty Rural	-6.832	-31.193	608 (3.09%)
High Poverty Rural	-5.425	-24.029	388 (1.97%)
Low Poverty Urban	1.132	19.881	7,082 (35.9%)
Moderate Poverty Urban	0.656	9.794	4,332 (22.0%)
High Poverty Urban	-0.523	-10.427	5,141 (26.1%)

Conclusions and Implications

Who benefits from a RUC?

The high poverty rural areas that pay more per household than their peers in urban areas would see significant reductions to their payments under a RUC system.

Mileage-based fees offer the opportunity to more closely match vehicle demand for highway transportation infrastructure with usage. They also offer an option to implement positive incentives for adopting and accommodating a more energy-efficient vehicle fleet and addressing both geographic and income equity issues surrounding transportation revenue generation.

Limitations

This study was limited to only household passenger vehicles, however commercial vehicles provide a significant proportion of state fuel tax revenues.

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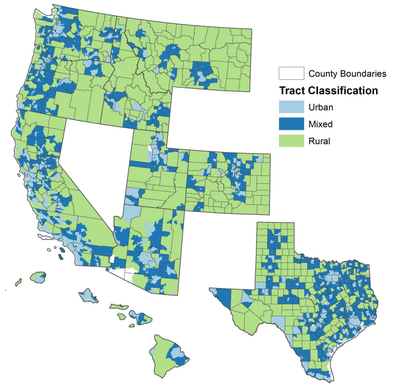

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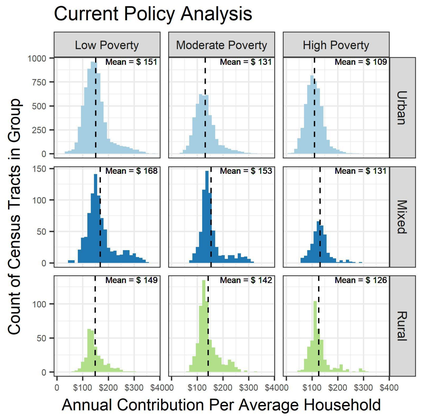

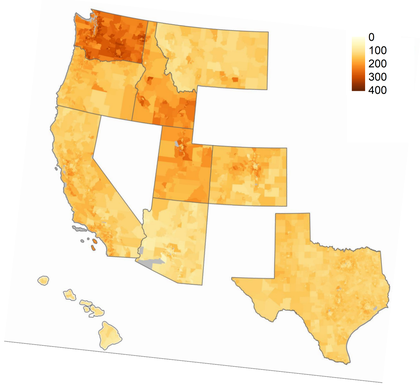

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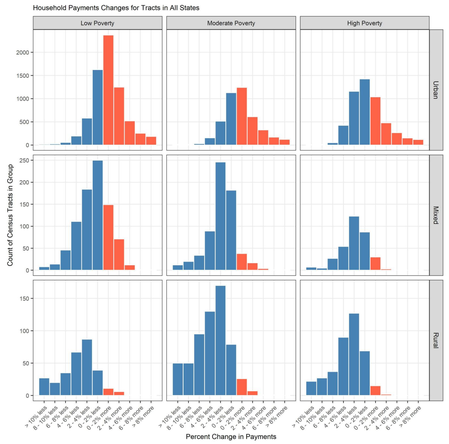

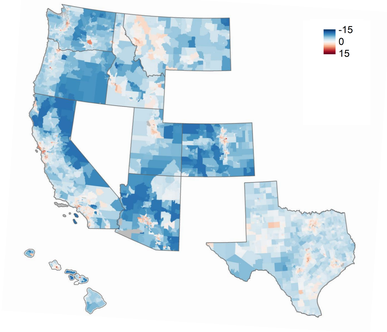

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