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**Cost-Benefit Analysis of the Highway Infrastructure Investment under the American Recovery and Reinvestment Act**

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# Cost-Benefit Analysis of the Highway Infrastructure Investment under the American Recovery and Reinvestment Act

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## Introduction

### The American Recovery and Reinvestment Act (ARRA):

- The priority of the ARRA has given to ready-to-go (referred to as “shovel-ready”) projects that could start immediately.
- One of the most common shovel-ready projects was transportation spending component.
- \$27.5 billion on highway infrastructure investment out of the \$48.1 billion designated for the contracts/grants/loans for transportation.

### Expected accomplishment:

- The highway infrastructure investment is intended to increase demand for highway system capacity.
- The investment is expected to increase highway usage differently by state based on its purpose and the scale of investment.
- The different level of anticipated increase of highway usage is expected to increase highway usage differently by state.

## Objective

The costs and benefits of highway infrastructure investment under the ARRA, focusing on the social costs of air pollution, water pollution, noise, land use impact, traffic congestion, and the benefit of increased consumer welfare from greater highway usage with the highway investment.

- Hypothesis: the ARRA highway investment causes a demand curve for the highway usage to shift upward, given the *ceteris paribus* condition.
- The hypothesis is tested by estimating the demand equation for the highway usage, where price of highway usage is proxied by gasoline price and quantity demand is represented by highway usage in miles.

## Empirical Model

Highway demand equation is developed at the state level over the period of 1994-2008

$$Q_{it} = \beta X_{it} + \alpha_i + u_{it};$$

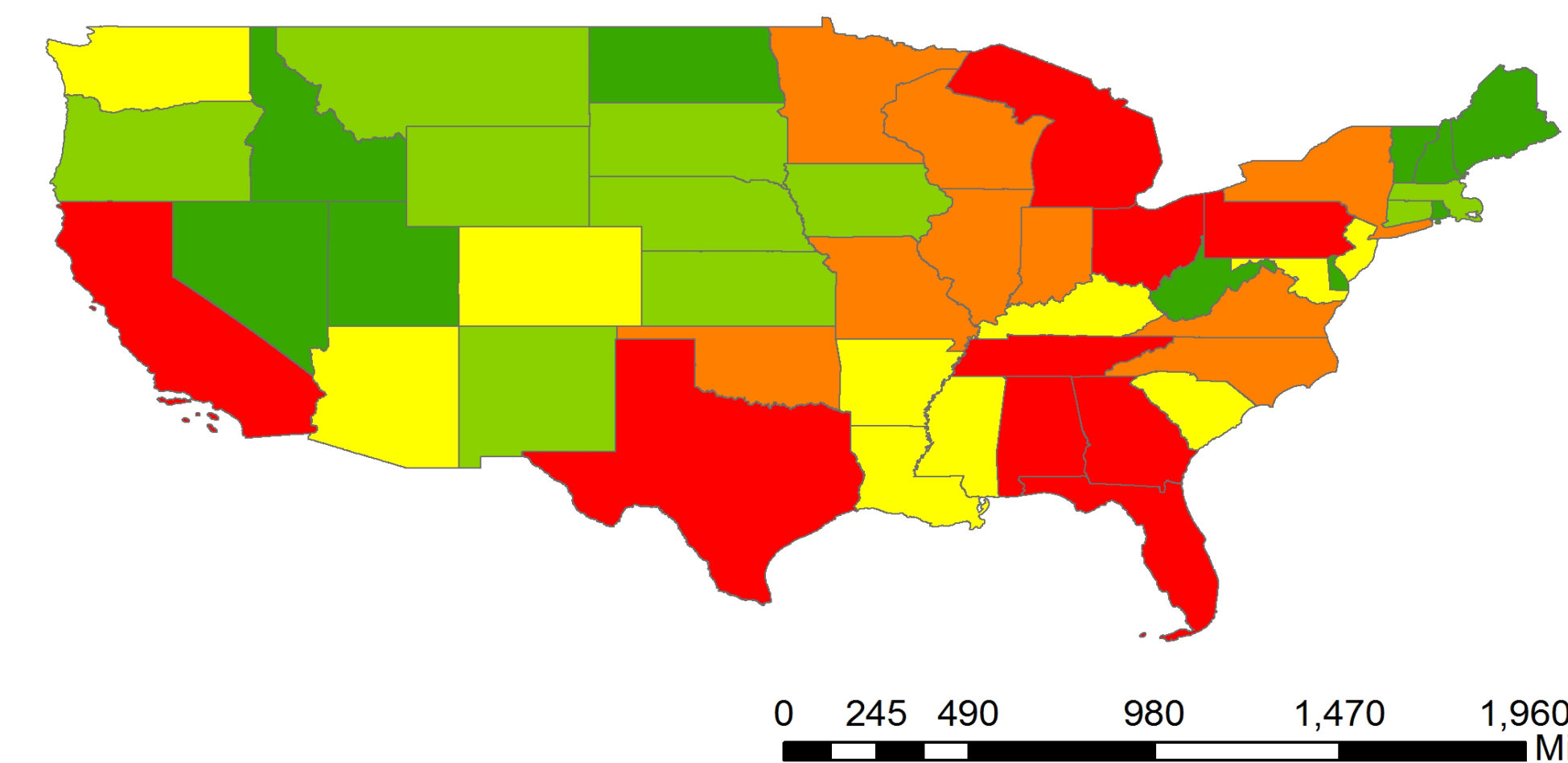
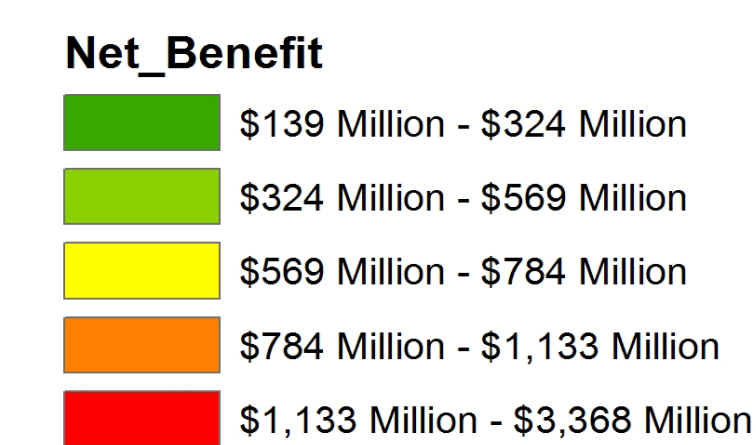
$i = 48$  continental US states,  $t = 1994-2008$ ,

$Q$ : Road usage per capita in miles.

$X$ : Price of road usage per mile (sum of cost of travel time, gas price, and depreciation of cars), per capita income, per capita length of road, % of licensed drivers.

$\alpha$ : unobserved effect,  $\beta$ : coefficient parameter,  $u$ : error

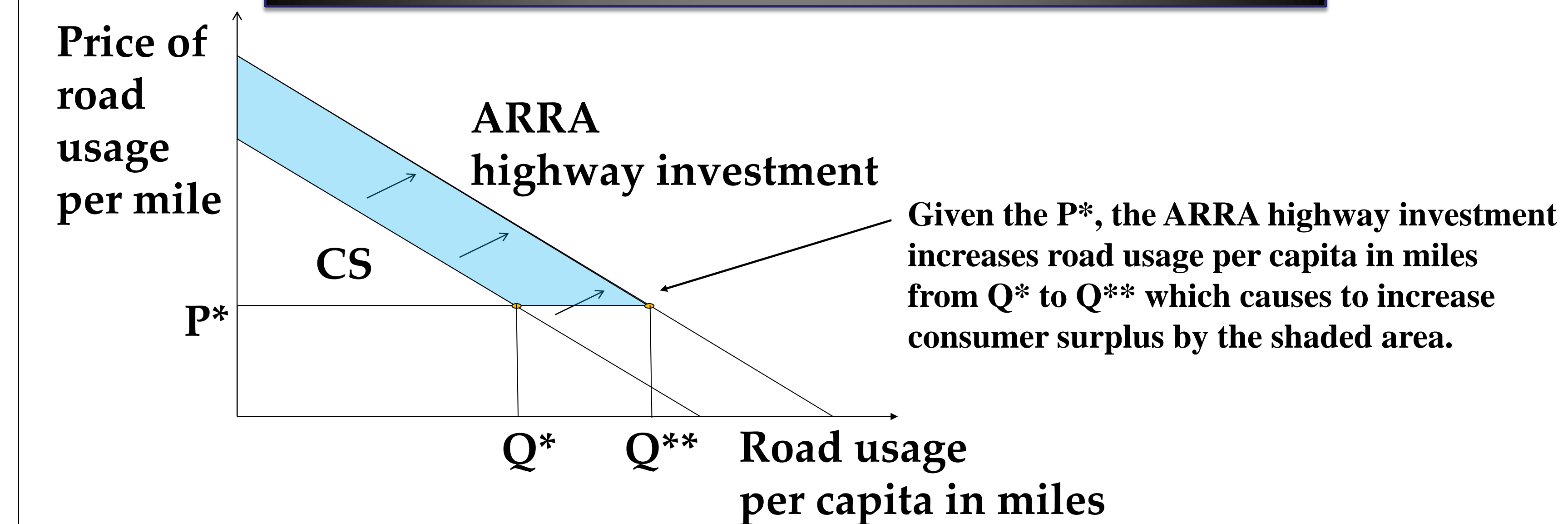
## Net Benefit Distribution



## Results/Conclusion

- It is found that increased highway usages under the ARRA investment is estimated to cause \$12.7 billion of cost of removing negative externalities (i.e., air pollution, water pollution, noise, etc.) and \$50.9 billion of additional consumer surplus, which result in \$38.5 billion net gain (or \$0.012 net gain per mile).
- States of California, Texas, Florida, Georgia, Tennessee, Ohio, Pennsylvania, Michigan, Alabama, North Carolina, Indiana, and Missouri are among the recipients of the most beneficiary of the ARRA highway investment (\$3.37 billion-\$1.09 billion).
- These estimates offer direct and relevant information to the question in regards to improving welfare of increasing demand for highway system capacity, which is one of the main goals of the ARRA highway investment.

## Cost & Benefit



- **The benefit** is captured by gain of consumer surplus by the upward shift of demand curve due to ARRA highway investment (shaded area) for each state.
- **The cost** is measured by additional indirect costs (e.g., costs for removing air pollution and traffic congestion costs) that are converted from additional road usage due to the ARRA highway investment.

## Benefit Change

	Without ARRA	With ARRA	Change by ARRA
Total Road Usage (Miles)	3.10 Trillion	3.13 Trillion	31.7 Billion (1.02%)
Consumer Surplus (\$)	2.44 Trillion	2.49 Trillion	50.9 Billion (2.08%)
External Cost (\$)	1.21 Trillion	1.22 Trillion	12.7 Billion (1.02%)
Net (Social) Welfare (\$)	1.23 Trillion	1.27 Trillion	38.5 Billion (3.12%)