

Congestion Costs and Scheduling Preferences of Car Commuters in California: Estimates Using Big Data

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Introduction

How large are the congestion costs from morning commutes in California? The standard economic model of congestion, the bottleneck model, defines each commuter’s congestion delay as excess travel time over and above the individual’s congestion-free time. The present research combines travel diary and Google Maps data to measure each morning commuter’s congestion delay and compute the total time loss from traffic congestion for car commuters in California.

Study Methods

To measure each individual’s congestion delay, this research develops an innovative method that combines travel diary data on actual trips and data on counterfactual trips obtained from Google Maps. The travel time diary data report each commuter’s home and work locations as well as their chosen departure and arrival times for a commute trip. Taking the pair of home and work locations as the origin-destination pair in Google Maps queries, the

authors construct the full menu of expected travel times by alternate trip timing choices. Because the travel time outcomes are available even for arrival timings that were not actually chosen by the commuter, the authors can correctly measure the congestion delay.

The other important element estimated in this research is car commuters’ utility function, which provides information on the subjective cost of schedule delay (i.e., the difference between desired arrival time and actually chosen arrival time). Using the standard discrete choice econometric method assisted with machine learning prediction, this research is able to produce more accurate estimates for these parameters, improving on earlier studies.

Findings

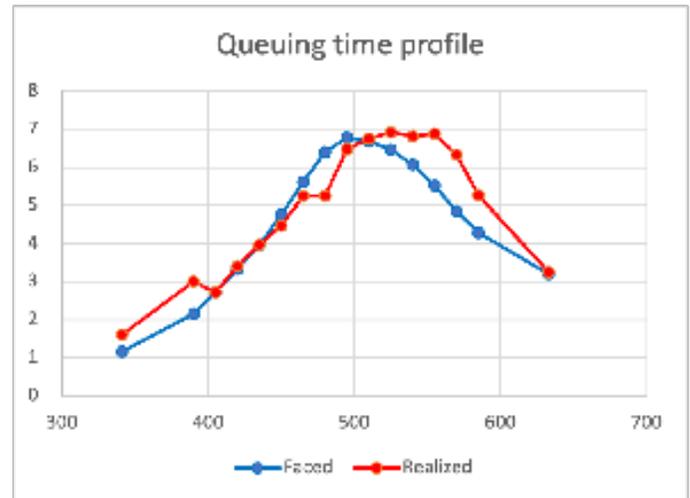
Our constructed travel-time profiles exhibit an average congestion delay of about 4.7 minutes per trip (about 18% of the sample mean of travel time), which implies that morning commuters in California bear efficiency

costs of about \$6 billion. We also discover that travel-time profiles are much flatter than estimated scheduling utilities. Because travel time falls too slowly to compensate for corresponding increases in schedule delay cost (i.e., the decreasing scheduling utility upon moving from the peak time to a non-peak time), a majority of commuters tend to arrive at their own desired arrival times.

The cost of congestion is substantial, but commuters adjust well to congestion by appropriately choosing their trip timings.

Policy/Practice Recommendations

A congestion toll could be designed based on the shape of the travel-time profile (which is quantified in this research) and imposed on each individual commuter. However, although the standard model of congestion suggests a time-varying tolling approach, the results of this research suggest that a more effective policy approach would be to spread the desired arrival times (e.g., work start times) over a wider time interval in the morning.



Notes: The curves indicate the expected queuing time (in minutes) of commuters in California as a function of faced (blue) and realized (red) arrival time. The expected queuing times (congestion delays) are estimated using Google Maps.

About the Authors

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To Learn More

For more details about the study, download the full report at transweb.sjsu.edu/project/2031.html



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