Referee Report

AVOIDING TRAFFIC CONGESTION EXTERNALITIES? THE VALUE OF URGENCY

Yihong Liu

April 17, 2021

Section I: Restatement of the Paper

I.I Motivation and Main Question

The motivation of this paper comes from the fact that drivers' willingness-to-pay (WTP) per hour against travel time saved reveals a hyperbolic shape. This pattern is in sharp contrast to the Becker and neoclassical microeconomics frameworks. These frameworks suggest that the WTP for time savings should be constant. Based on this motivation, the central question of this paper is to decompose drivers' willingness to pay for time saved into different sources in order to harmonize the actual data pattern with microeconomics theory and to decide the comparative importance of different sources of willingness to pay. This paper quite convincingly answers this question by showing that drivers' willingness to pay for saved time could be decomposed into the value of urgency, the value of saved time, and value of reliability, where the value of urgency is the bulk of the willingness to pay. This paper defines the value of urgency as a discrete WTP to not miss a scheduled deadline. The deadline is usually associated with a lump sum penalty that only depends on whether the individual misses the deadline or not.

I.II Innovation of the paper

First, previous studies usually hypothesize an "average day" to derive individuals' willingness to pay for saved travel time. This hypothesis incurs a significant problem of ruling out the value of urgency associated with the saved time. This paper resolves this issue by focusing on the AM peak time trips during which individuals usually have a specific schedule constraint.

Second, most previous studies rely on preference surveys to recover individuals' WTP for saved times. However, individuals may be unable to precisely reveal valuations for being late and minimal travel time savings. This study solves these two concerns by using a dataset that records drivers' actual behavior on a highway with real-time changing tolls and different levels of congestion.

Third, previous studies usually focus on toll lanes on separate routes with peak and off-peak price variation. These researchers do not know the demand for the tolled lanes and the actual congestion level of the lanes. Therefore, drivers in those studies may not meet schedule constraints even if they choose the toll lane. The lane considered in this paper solves this problem because its toll adjusts instantaneously to ensure the speed on the lane never falls below a minimum threshold. This property allows the drivers to accurately evaluate whether entering this lane could save sufficient time to avoid being late.

I.III Data

This paper mainly uses two datasets: The first one is the individual-level travel information of all ExpressLanes trips on I-10 provided by the Los Angeles Metropolitan Transportation Authority. The second one is the travel times in mainline lanes from the California Department of Transportation's Freeway Performance Measurement System traffic detector data. This paper's datasets are novel and suitable to the research questions for the following four reasons.

First, the dataset of ExpressLane trips includes detailed information on times, point of entry and exit, the toll charged, the primary vehicle registered to it, and the zip code for the billing address. This allows the researchers to observe individual-level trips associated with the same accounts.

Second, the dataset of ExpressLane trips includes repeated individual-level trips. Repeated observations resolve the identification problem of the hedonic price function because the researchers could observe more than one point on individuals' WTP curves. This is even better than the multi-market data proposed in Mendelsohn's paper because the researchers could actually observe the same individual in the dataset.

Third, the travel times data records real-time speed and flow in the I-10 mainline every five minutes. This detailed record enables the researchers to approximate the counterfactual travel time for each trip if the driver had not taken the ExpressLane. As a result, this paper could calculate a more accurate saved time for each trip by subtracting the counterfactual travel time in the mainline with the actual travel time in the ExpressLane.

Fourth, there are 466,232 observations in the sample of interest. The number of the observation is large enough to construct confidence intervals and generate accurate estimates in the regression.

I.IV Empirical methods and Identification strategy

The empirical method in this paper follows the hedonic price function approach proposed by Rosen (1974) and Roback (1982). The authors claim that the hedonic price function is identified because they observe repeated trips of the same individual facing different tolls and congestion levels.

To be specific, this paper regressed the toll paid on a constant, the driver's expected time saving, and a variable measuring the reliability. This paper regards the estimate of constant as the value of urgency. Moreover, by exploiting the nature of repeated observation of the same individual, this paper estimates a heterogenous agent model by conducting the above regression separately for each account with multiple trips.

I.V Caveats to estimation and Identification

This paper also discusses three caveats to estimation and identification. The first caveat is that the measurement error of saved time may lead to a biased estimate of both the value of time and the value of urgency. The measurement error comes from the researchers' measurement error and drivers' misperception of travel time saved. This paper deals with the first source of error by arguing that their sample focuses on the AM peak. Hence, the main lanes have enough congestion to prevent passing, so using 5-minute average speed in the mainline may not obscure the estimate of counterfactual travel time in the mainlines. This paper manages the second source of

error by eliminating trips with negative (or small) travel time savings and conducting a robustness check by estimating the same regression restricted to the sample after October 20th, 2013. After that day, signs are set up to indicate the expected time savings by using the ExpressLanes so that drivers are unlikely to estimate the travel time saved falsely.

The second caveat is that the estimate of the constant term may also capture the time-invariant amenity of the ExpressLanes, such as smoother pavement or a feeling of superiority. The paper resolves this problem by adding weekend samples as a control group and specify a weekday indicator in the regression.

The last caveat is sorting. One might concern that the hyperbolic pattern in the data is not due to the value of urgent, but because higher-income individuals use the ExpressLanes for shorter time savings and lower-income individuals use it for longer time savings. This paper addresses this concern by arguing that drivers with the highest WTP use the ExpressLanes least frequently, and these drivers usually own cars like Toyota Corollas and Honda Accords.

I.VI Results and Policy Implications

The main result of this paper shows that the mean value of urgency in the sample is $3.24. Compared to the average toll of $3.71, the value of urgency represents 87% of the value for the average toll. Half of the estimates of the value of urgency fall between $2.30 and $4.05. The mean value of time is $0.51, and the mean value of reliability is $0.62. These estimation results are quite convincing because the estimates of the coefficients do not alter much in the robustness check. The robustness check includes eliminating the sample before October 20th, 2013, incorporating trips with negative time saving, and adding weekend trips as a control group.

This paper has three main policy implications. First, the cost-benefit analysis for road infrastructures with level-of-service pricing should take the value of urgency into account. Ignoring urgency will miss a large bulk of the value of the toll paid for using a ExpressLane, which could lead to a severe underestimate of the benefit of a new ExpressLane.

Second, the result of this paper questions the use of stated preference to derive drivers' preference for travel time savings. To improve the predictability of the survey, future researchers should design surveys to reveal drivers' willingness to pay to avoid being late and the frequency at which individuals are late.

Third, the paper suggests that the Pigouvian congestion pricing may not be the best pricing structure to regulate congested infrastructure matters. A real-time, level-of-service pricing that guarantees a minimum speed could better solve drivers' uncertainty of predicting the travel time saved by using a tolled lane.

Section II: Critiques and Comments

First, there is a caveat to claim that ignoring the value of urgency would severely underestimate the benefit of a new ExpressLane. The reason is that this paper only examines the ExpressLane trips happening during the AM peak. However, a considerable number of ExpressLane trips (about a half) happen in other periods when the schedule constraint is not binding. In these trips, the value of urgency vanishes to almost zero. Therefore, ignoring the value of urgency alone may not underestimate the benefit of a new ExpressLane as severely as it mentioned in the paper. At the same time, future research could focus on ExpressLane trips without urgency values to investigate the following questions: First, are the drivers' willingness to pay in these periods reconciles the microeconomics theory framework? Second, if the answer to the previous question is no, what factors impact the individuals' willingness to pay for saved times?

Second, although the dataset contains repeated trips of the same accounts, the researchers may still not observe the behavior of the same driver under different tolls and congestion levels as the paper claims. One reason is that individuals with repeated trips may mostly be workers using this highway to commute every day. In this case, the individual would face a highly similar congestion level repeatedly, and the toll prices are also highly similar because the congestion level inherently determines the toll. That said, the researchers may still end up only observing one point on the

individuals' WTP curves even though they have data on repeated trips. The authors could solve this concern by providing additional statistics such as the variance of toll price and saved time to show that the observed individuals actually face different levels of prices and congestion.

Third, the grey dash line in panel B, figure 2, is difficult to follow. The authors had better change it to a more distinguishable color.

Fourth, on pages 31 and 32, the authors use the abbreviation VOT. However, neither is a bracket to explain this abbreviation, nor does the author use it in previous context.

Fifth, there is a typo on page 26, line 3. "In column III" should be "In column II".