Putting Your Money Where Your Mouth Is:

Do drivers who favor road pricing pay the tolls?

By

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ABSTRACT

Congestion pricing is a candidate method for managing congestion and compensating for scarce transportation funding. However, many still argue that lack of public acceptance and political support of road pricing policies are still major hurdles to their implementation. This study is the first of its kind to collect data on actual route choices under varying road prices and to relate these data to expressed opinions about the use of congestion pricing. We hypothesize that drivers that are price responsive see themselves as able to avoid road pricing more than drivers who are price non-responsive. Non-responsive drivers may perceive a strategic incentive to reject policies involving pricing they cannot avoid. Support for a pricing policy will then be stronger among the price responsive than among the price non-responsive respondents, reflecting this strategic consideration.

We collect route choice data using GPS recorders in Atlanta and Orlando, manipulating the prices drivers pay for alternate routes, and ask the same respondents about their support for five proposed solutions to congestion. The two cities differ in important ways. Drivers in Orlando are familiar with fixed toll roads, but have also been exposed to a debate regarding introducing toll lanes on the I4. In Atlanta, the exposure to tolls is minimal, but plans to convert High Occupancy Vehicle lanes into High Occupancy plus Toll lanes were debated and executed during the study. We find no evidence that the experience of toll roads in Orlando has resulted in a stronger price responsiveness than in Atlanta. Price responsiveness is fairly strong in both cities and the toll experiences in Orlando have not resulted in a stronger price responsiveness. We find some differences between the cities in the expressed opinions but only for price responsive drivers. In Orlando price responsive drivers are more supportive of adding capacity financed with dynamic tolls and converting lanes into toll lanes than are price non-responsive drivers in Orlando or price responsive as well as price non-responsive drivers in Atlanta. The toll road experience in Orlando may have made the price responsive drivers more aware of their ability to avoid paying the tolls, thus making them more open to supporting pricing policies. The positive correlation implies that effectiveness of pricing policies is sometimes correlated with support for the policies, since a portion of the drivers would respond to the pricing. The lack of correlations between price responsiveness and policy support in Atlanta may reflect the lack of experience in avoiding tolls by taking alternate routes.

KEYWORDS: CONGESTION PRICING, ROAD PRICING, TRANSPORTATION POLICY, PRICING POLICY, OPINION SURVEY, REVEALED PREFERENCE

1. INTRODUCTION

Policy makers consider congestion pricing, in its diverse forms, as a promising approach for managing congestion in urban areas and compensating for increasingly limited transportation funding. Currently, the main source of transportation revenue is a flat rate gas tax that has not increased over the last two decades, and that is funding ever more mileage travelled due to improved vehicle gas mileage. The need for solutions to traffic congestion is undisputed. According to the 2012 Urban Mobility Report (Schrank, Eisele, and Lomax (2012)) in the US alone the estimated cost of excess travel time and wasted fuel consumption was $121 billion in 2011. Road pricing has emerged as a promising solution and in the cases implemented so far traffic reductions in the range of 14-23% have been observed, impacts that greatly exceed most other traffic policy instruments (May, Koh, Blackledge, and Fioretto (2010)). Despite this evidence there are many claims that public acceptance of road pricing is low, although as pointed out by Zmud and Arce (2008) these claims are not supported when reviewing all the evidence. Many studies point to several factors as determinants to public support: the demonstration of clear benefits, credibility of the project by tying the poll to specific details, clear outlining of the use of revenues, simplicity in the schemes, providing non-priced options in the interest of fairness (Harrington, Kruppnick and Alberini (1998), Ieromonachou, Potter, and Warren (2006), Kottenhoff, and Brundell-Freji (2009), Swanson and Hampton (2013), and Ulberg and MacFarland (1995)). In particular, Zmud and Arce (2008) and Swanson and Hampton (2013) both state that the availability of non-priced options make respondents more favorable to pricing solutions.

In this paper we review opinion responses to questions about five options for solving traffic congestion: enhancing capacity with tax funding, fixed toll funding, or dynamic toll funding, and converting lanes into high occupancy (HOV) or tolled (HOT) lanes. We then relate these opinions to actual driving responses by varying road pricing in a field driving study with the same respondents. Self-interested respondents who see the survey response as a way of influencing policy can act strategically and reject road pricing proposals that put the financial burden on themselves, hoping for future proposals where the financial burden will be carried by others. If, further, price non-responsive drivers see the financial burden of the proposed policy as falling on them, such strategic behavior would result in a positive correlation between price responsiveness and support for road pricing options. We test for the presence of such positive correlations. Relating expressed opinions to price responsiveness in driving can also help us answer questions like: Does support for a congestion pricing proposal imply that it would lead to a reduction in congestion? For example, to what extent does support for a proposal to convert lanes into toll lanes actually lead to a reduction in traffic on the tolled lanes? If respondents are strategic in this way, so that support and price responsiveness are positively correlated, then when surveys show a lack of support for road pricing it could be a signal that there is a significant portion of price non-responsive drivers in the population. The implication could be that implementing the proposed road pricing scheme would be ineffective since drivers would not respond to the price manipulations.

Support for this approach can be found in the literature. Hurd et al. (1998) state "Economic theory suggests that when subjects anticipate a possible connection between their response and some economic outcome in which they have an interest, they may have strategic incentives to misrepresent information." Thus, if a survey is perceived as having a possible connection to a policy implementation, such as road pricing in our case, responses may strategically reflect a desire to avoid the personal financial cost of travelling on priced roads. Holt and Eckel (1989) show that people often act strategically in voting situation, understanding how rejecting a proposal can lead to future proposals that are more beneficial. In our case, a driver who is price non-responsive may therefore be more inclined to reject a pricing proposal than a driver who is price responsive, since the latter perceives himself as able to avoid paying. Apart from majority groups influencing inferences from surveys or referenda outcomes, even small groups that are strongly against a proposal can act strategically to block it from passing. An example of how a small group of self-interested, strategic drivers blocked a congestion pricing proposal is the experience of New York City (Schaller (2010)). It may be possible to identify such opposition groups through combinations of surveys and actual behavior, similarly to what we do here. Pronello and Rappazzo (2014) demonstrate how heterogeneous responses are often clustered, resulting in a range of small groups with opposing interests along various attribute dimensions of the policy proposals. One may also see the voting behavior in Stockholm regarding the implementation of the cordon charges to be an example of strategic voting: residents living inside the proposed cordon were favorable while residents living in surrounding counties were unfavorable (Hensher and Li (2013)). Dieplinger and Fürst (2014) provide additional evidence that perceived personal benefits matter to survey responses about acceptability of proposed congestion pricing schemes. Bohm (1972) reports on an influential experiment that includes tests of strategic biases. An evaluation of this data by Harrison and Rutstrom (2008) confirm that there are response biases between tasks with expected downward bias and tasks with expected upward bias.

We equip respondents' cars with GPS units and track their route choices while we manipulate the pricing on the routes. Our respondents are recruited from the driving population using two commuter corridors in Orlando, Florida, and two commuter corridors in Atlanta, Georgia. These regions differ in the prior exposure to tolling and debates about road pricing. Toll roads were introduced in Orlando as early as in the 1960s and have grown in miles covered since, while in Atlanta the exposure to tolled roads has been more limited with a single gantry on SR400 until the recent introduction of HOT lanes on I85 (winter 2011-2012). In both cities there has been public debate about priced lanes: In Orlando concerning a toll lane on the I4, and in Atlanta concerning converting a HOV (High Occupancy Vehicle) lane into a HOT (High Occupancy plus Toll) lane.

We find the weakest support for the option of enhancing capacity through tax financing, our only option that does not involving some pricing or carpooling restriction on road access. Most options get around 50/50 support, but in Atlanta dynamic toll lanes get weaker support and in Orlando converting lanes into toll lanes get weaker support. The two cities differ in important ways. Drivers in Orlando are familiar with fixed toll roads, but have also been exposed to a debate regarding introducing toll lanes on the I4. In Atlanta, the exposure to tolls is minimal, but plans to convert High Occupancy Vehicle lanes into High Occupancy plus Toll lanes were debated and executed during the study. We find no evidence that the experience of toll roads in Orlando has resulted in a stronger price responsiveness than in Atlanta. Price responsiveness is fairly strong in both cities and the toll experiences in Orlando has not resulted in a stronger price responsiveness. We find some differences between the cities in the expressed opinions but only for price responsive drivers. In Orlando price responsive drivers are more supportive of adding capacity financed with dynamic tolls and converting lanes into toll lanes than are price non-responsive drivers in Orlando or price responsive as well as price non-responsive drivers in Atlanta. The toll road experience in Orlando may have made the price responsive drivers more aware of their ability to avoid paying the tolls, thus making them more open to supporting pricing policies. The positive correlation implies that effectiveness of pricing policies is sometimes correlated with support for the policies, since a portion of the drivers would respond to the pricing. The lack of correlations between price responsiveness and policy support in Atlanta may reflect the lack of experience in avoiding tolls by taking alternate routes.

2. STUDY DESIGN

We analyze route choices by drivers in Orlando and Atlanta during rush hour commutes and their responses to opinion surveys about various solutions to traffic congestion problems. The tasks analyzed here are part of a larger study. In the larger study field participants come to four sessions separated by approximately two weeks and complete a variety of tasks during these sessions. During the three two-week gaps between the four sessions, participants complete paid driving tasks on field routes using their own vehicles. We refer to these two-week periods as drive periods. We collect data using GPS recording devices from these drives. We also analyze data from a demographic survey and from a questionnaire on opinions about traffic congestion solutions that was given out at the beginning and end of the experiment.[1]

[1] For more information about the overall experiment, readers may refer to Rutström (2011).

2.1 Recruitment and Experimental Procedure

Participants in Orlando, Florida, and Atlanta, Georgia, were recruited by invitation letters. Recipients were randomly selected from the United States Postal Service (USPS) mailing lists, with oversampling from mail carrier routes with median income levels below the state-wide median income level. Invitation letters directed recipients to our web page where they were instructed to create an anonymous Gmail account to use exclusively for our study to ensure strict privacy. Admission to participate in the study was contingent on respondents being at least 18 years old and holding a valid driver's license and a vehicle with valid vehicle insurance. Four study sites were selected: east Orlando, west Orlando, north-east Atlanta, and north-west Atlanta. The areas were selected because residents there were likely to commute on the study routes. The following section elaborates on study routes.

Seven cohorts of subjects completed the study; one in each of Atlanta and Orlando during each of the three periods June - July 2011, August - October 2011, and February – April 2012, and a final one in Atlanta only during August- October 2012, for a total of 452 participants. Participants' ages range from 18 years old to 75 years old of which 49% and 47% are female in Orlando and Atlanta, respectively. Table 1 summarizes demographic characteristics of the respondents and introduces several of the variables included in our analysis.

At the first meeting, upon arrival to our study sites, research assistants welcomed participants and verified the validity of their drivers' license and car insurance. Then, an informed consent form (per IRB) was presented to the participants. The consent form briefly explained the general purpose of this study. The data used for the analysis here was collected via a demographic questionnaire split between the first two meetings, two identical opinion questionnaires conducted in the first and last meeting, and GPS downloads from three driving periods. The first driving period was conducted between the first two meetings, the second between meetings two and three, and the final one between meetings three and four. Participants were paid a $25 compensation for each research meeting attended, plus another $100 upon returning their GPS unit in meeting four. All other earnings were performance based and will be explained below.

2.2 Route Choice Task

All participants' cars are outfitted with a Global Positioning System (Trackstick Pro) device that can receive but not send signals. All driving data is downloaded directly from the device to a computer at the experiment session following each drive period. Privacy-sensitive data, such as the home and work locations of the drivers, is not downloaded. Approximately two weeks pass between each meeting; a time frame that is determined by the capacity of the GPS device's ability to store data of participants' travel log.[2]

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[2] Sample instructions given to drivers are available in the online appendix.

We observe driver route choices during peak hours and directions Monday through Friday 7:00AM – 9:30AM and 4:00PM–8:00PM. This serves the purpose of restricting the trip purposes to primarily work related commutes. Each driver faces a choice between two routes during morning or evening commute. The routes were selected so that they could serve the same origin – destination within each of four regions: Orlando East and West, and Atlanta Northeast and Northwest. One route is a multi-lane Expressway and the other an Arterial route, approximately parallel to each other. The portion of a driver's commute that we collect observations on is only about five miles long, and up to 20 drives are paid for during the two weeks between study meetings. Since these drives are usually executed during normal commutes, the driver's origin and destination are usually further apart than 5 miles, however.

These restrictions in time and location serve to limit the variability in traffic conditions and trip purposes so that drives are more comparable. The five mile segments were selected because they were highly congested, and because it was more likely that the recipients of our invitations frequently used these segments in full. This ensured that our study drivers were highly familiar with the routes and their congestion conditions. If we had used longer segments it would have increased the likelihood that many drivers would need to enter or exit the segments in their interiors, thus not making the routes comparable across drivers. To be observed, a drive must involve continuous travel on either of the two routes during the valid times. If the participant stopped or deviated in any way the drive would not be included as an observation. These segments also allowed us to present Arterial and Expressway route options that were reasonably close to each other and parallel so that they could serve as substitutes for the same trip purpose and be similar in access cost. If the two routes were too far apart, conditional on where the participant is arriving from, the distance to the start of one would be longer than the distance to the start of the other, and access cost on the former would be higher.

Participants on the west side of Orlando can either choose to drive on SR408, an existing Expressway toll road, or on SR50, the Arterial toll-free road, to travel between Good Homes Rd and John Young Parkway. The toll collected by the toll authorities for the 5 miles observed in our study was $1.75. The two routes are 0.3 and 0.8 miles apart at the end points (See Figure 1a). The Expressway has 2 or 3 lanes in either direction with a speed limit of 55 mph, whereas the Arterial road has 2 or 3 lanes with a speed limit of 45 mph and 12 traffic signals. Drivers on the east side of Orlando travel either on SR408 or SR50 between Goldenrod and Mills Ave. where again SR408 is a tolled Expressway and SR50 is a toll-free Arterial road (See Figure 1b). The toll collected by the toll authorities for the 5 miles observed in our study was $1.00. The two routes are 1.2 and 2 miles apart at the end points. SR408 has 4 or 5 lanes in each direction with a speed limit of 55 mph and SR50 has 2 or 3 lanes in each direction, a speed limit of 45 mph and 15 traffic signals. Drivers in north-east Atlanta travel either on the Expressway SR400 or on the Arterial road SR9 (See Figure 1c). The two routes are 0.5 and 1.3 miles apart at the end points. SR400 has 4 lanes in each direction and a speed limit of 55 mph, and SR9 has 2 lanes in each direction plus a middle turning lane, a speed limit of 35 – 45 mph and 15 traffic signals. Finally drivers in north-west Atlanta travel either on the Expressway I75 or on the

Arterial road SR41 (See Figure 1d). The two routes are 0.5 and 0.70 miles apart at the end points. I75 has 5-7 lanes in each direction and a speed limit of 55 mph whereas SR41 has 2 lanes in each direction plus a center turning lane, a speed limit of 35 – 45 mph and 19 traffic signals. Neither of these Expressways in Atlanta have a toll.

We observe a total of 17,020 drives across our 452 participants. The routes can be characterized according to the travel times that are recorded for these drives. Figure 2 shows the distributions of travel times by region and time of day, pooled across cohorts and weekdays, and Table 2 summarizes the means and standard deviations of the travel times. We can see that in all four regions, both in the AM and in the PM, the Arterial route is about twice as slow as the expressway. Thus we would predict that adding road pricing on the Expressway should shift drivers to the Arterial. Generally the Arterial route is also riskier than the Expressway, and this is particularly apparent in Orlando where the Expressway distribution is very tight. The exception is the standard deviation for Orlando East AM shown in Table 2, where the two routes are similar. Looking at the graph for Orlando East AM in Figure 2 the Expressway has a much tighter distribution around the mode than the Arterial, so the similarity in standard deviations reflects the outliers of very long travel times with low probabilities on the Expressway. Once we add and subtract one standard deviation from each of the means in Table 2, we find that the shortest travel time is 3.1 minutes (3 minutes and 6 seconds) in the morning timeslot on the Orlando East Expressway, and the longest travel time is 20.4 minutes (20 minutes and 24 seconds) found on the Atlanta West Arterial in the PM.

During the first two- week drive period each driver is simply paid a fixed reward (*Drivepay*) each time we have a valid recorded drive, up to the maximum of 20 drives. These rewards are either $2.50 or $5 per drive, randomly allocated to each driver. The driver is then paid the same base reward during each of the three driver periods. The subsequent two drive periods also involve a variety of surcharges and subsidies that vary by route. We randomly allocate these surcharges and subsidies across drivers, and keep them constant within but change them between drive periods two and three. The highest surcharge on the Arterial is $1 and the highest surcharge on the Expressway is $5.75, including any toll authority charges that are present on the Orlando routes. The highest subsidy on the Arterial is $0.50 and the highest subsidy on the Expressway is $2.00. Table 3 shows how the surcharges and subsidies on the Expressways were combined with the surcharges and subsidies on the Arterial roads. It was possible for drivers to have a surcharge on both routes, although it would not be same, a subsidy on both, or a surcharge on one and a subsidy on the other. Surcharges are collected individually from each participant and subsidies are paid individually and do not involve any toll agencies, except for the fixed tolls in Orlando that are collected directly by the toll authorities.

The variable *Exprprice* in Table 1 shows the average of the resulting ratio between the net earnings a driver is paid if taking the Expressway or the arterial. The net earnings consist of the *Drivepay,* which is the same for both routes, minus the surcharge or plus the subsidy on either or both of the routes. The higher the value of *Exprprice*, the higher are the earnings on the Expressway relative to the Arterial. The variable *tTE* shows the proportion of subjects who participated in drives involving a surcharge on the Expressway and *tTL* the proportion who participated in drives involving a surcharge on the arterial. These two variables allow us to measure whether the responses to price changes are different when surcharges are involved as compared to subsidies.

2.3 Opinion Survey

At the beginning of the first meeting participants are given an opinion survey to explore their attitudes towards various ways of solving traffic congestion problems including options for financing the solutions. The same survey is repeated at the end of the last meeting and we include a dummy variable for Session 4 in our analysis (*Sess4*). Participants are also given a demographic questionnaire split across the first and the second meeting. In the opinion survey, participants were asked how they you would vote in a referendum to reduce traffic congestion. In particular they were asked to answer the following questions by *more likely to vote for it, or less likely to vote for it, or would not care*[3]:

Q1: Financing enhanced road capacity through increased gas and property taxes?
Q2: Financing enhanced road capacity through toll lanes with a fixed toll charge?
Q3: Financing enhanced road capacity through toll lanes with toll charges that vary by the time of day or by the traffic volume?
Q4: Converting more lanes into carpool lanes with no additional taxes or tolls?
Q5: Converting more lanes into toll lanes with no additional taxes?

We include two presentation orders of these questions, Q1 – Q5 and Q5 – Q1, randomly allocated to the respondents. We include a dummy variable to control for question order in the analysis (*OpinionOrder*). A subset of the respondents were only given an opinion questionnaire in Session 4 and we include a dummy variable (*Nosurvey*) to control for these responses.

[3] We convert all opinion responses to binary by treating “would not care” as “less likely to vote for”, implying that the analysis should be interpreted regarding likelihood to vote in favor. A sample of the questionnaire is included in the online appendix at: (http://dbel.robinson.gsu.edu/publications.

3. EMPIRICAL ANALYSIS

3.1 Description of Raw Data

Figure 3 shows the distribution of the favorable votes for each opinion question in Atlanta and Orlando separately. Votes are binary variables and a value of 1 is a favorable vote. The least popular option in both cities is the tax financing (Q1), getting considerable less than majority support. All the other questions are close to 50% support, although we see in Orlando that the option to convert lanes to toll lanes (Q5) is less popular and in Atlanta there is somewhat less support for dynamic tolls (Q3). Table 4 reports Probit models that estimate differences across Atlanta and Orlando and across Session 1 and Session 4 responses. There is no significant effect from the session 4 dummy variable (*Sess4*), implying that responses in Session 1 and Session 4 are similar. In Atlanta we see more support for Q2 and Q5 and less support for Q3 and Q4, compared to Orlando. Thus, there is relatively weaker support in Orlando for the type of road pricing that the participants have been exposed to: toll lanes with a fixed toll charge, and relatively stronger support for solutions that participants have not been exposed to: dynamic toll lanes and converting existing lanes into carpool lanes.

Table 5 shows the raw proportions of Expressway choices across our four regions. Route choices are binary and are coded as 1 if the driver uses the Expressway. We immediately see that the Expressway is a more popular choice in Atlanta than in Orlando. Figure 4 shows how route choices depend on variations in the *Exprprice* variable. The solid line shows the raw responses and the dashed line is a simple descriptive Probit model. The left graph is for Orlando and the right graph is for Atlanta. There is a great deal of heterogeneity in responses, but the regression line is definitely upward sloping, implying increased demand for the Expressway as the relative earnings increase in relation to the Arterial. We can also see that our participants in Atlanta appear to be more responsive to the pricing changes as the fitted line has a greater slope.

3.2 Route Choices

Table 6 shows the results of bivariate Probit estimations for Atlanta and Orlando.[4] We use a bivariate estimation model because, if our hypothesis is true, the valuation of route choices in the driving task are correlated with the valuation of driving choices implied by the opinion questions. The bivariate Probit model accommodates recursive structures so we can directly estimate interaction effects between price responsiveness in route choice and expressed opinion about road pricing. In addition the model estimates correlations between the residual disturbances. Standard correlation measures between price sensitivity and opinions will give biased estimates if the residual correlation is significant Greene (2012, pp. 738 – 739).

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[4] All estimations were done using STATA (2013) vs. 12 biprobit function with robust error computations that allows intra-subject correlations, since each subject performed multiple tasks. See Greene (2012, 738-752) for discussions of bivariate Probit models.

The basic model is a random utility model of two binary choice variables: stated opinions (favoring or not favoring an option), and route choice (Expressway or Arterial). We follow Greene (2012, p 686 and p 17.5) in the presentation of our econometric model. The latent marginal utility function for stated opinions can be expressed as:

$$U_Q{}^* = \alpha_1 + \boldsymbol{Q}_1'\boldsymbol{q}_1 + \boldsymbol{x}_1'\boldsymbol{\beta}_1 + \varepsilon_1 \quad (1)$$

where $\boldsymbol{Q'}_1$ is a row vector with dummy variables for the policy options, *Q1 – Q5*. The subscript 1 indicates equation 1. The coefficient vector $\boldsymbol{q}_1$ is the marginal utility to the individual of implementation of each policy option. It is positive if the policy benefits the individual and negative if it does not. We use *Q2* as our reference policy option in Table 6 so the marginal utility for this option is given by the constant term α_1. $\boldsymbol{x'}_1$ is a row vector consisting of the dummy variables *Sess4*, *OpinionOrder,* and *Nosurvey,* explained in section 2.3. U_Q* is the latent net utility of expressing support for the various pricing options in the survey. The observed choice is $z = 1$ if $U_Q^*>0$ and $z=0$ if $U_Q^*<0$.

The latent marginal utility for the route choice can be expressed as:

$$U_E{}^* = p_2\alpha_2 + \boldsymbol{\theta}_2'\boldsymbol{\vartheta}_2 + \boldsymbol{y}_2'\boldsymbol{\gamma}_2 + \boldsymbol{\eta}_2'\boldsymbol{\delta}_2 + \varepsilon_2 \quad (2)$$

Subscript 2 indicates equation 2. p_2 is a scalar of *Exprprice*, the relative price of Expressway to local. $\boldsymbol{\theta'}_2$ is a row vector of interaction variables between the relative price and the opinion responses (*P-Q1, P-Q2, P-Q3, P-Q4*, and *P-Q5*. $\boldsymbol{y'}_2$ is a row vector of route and task characteristics (*TTdiff, Drivepay, Dearnings, Driverecord, tTE, and tTL*). $\boldsymbol{\eta'}_2$ is a row vector of interactions between route characteristics, or demographics, and the relative price (*P-Education, P-Female, P-Age, P-Africanamerican, P-TTdiff, P-tTE, and P-tTL*). Variables are introduced in Table 1 or explained in the footnote to Table 6. U_E* is the latent net utility of expressing support for the various pricing options in the survey. The observed choice is $r = 1$ if $U_E^*>0$ and $r=0$ if $U_E^*<0$, where $r = 1$ is the choice of the Expressway.

The first three columns of Table 6 show the estimations for the first equation of opinion responses. The next three columns show the results for the route choices, equation 2. These are estimated jointly, allowing for correlation in residual disturbances, captured by the parameter *rho*. We do not see a significant residual correlation for either Atlanta or Orlando, after controlling for the direct correlations captured by the interaction variables.

Route choices depend on the relative net earnings of the route options (*Exprprice*), as expected. For Atlanta the coefficient is positive and significant at 2.185 (with a p-value of 0.008), implying that for every extra dollar earned on the Expressway (relative to the Arterial) the propensity to choose the Expressway increases by 72 percent.[5] This may seem large, however this is the response by individual drivers when the total traffic volume is kept constant on each route and does not reflect the strong dampening effect that changes in relative traffic volumes would have. In Orlando this variable is 1.781 (with a p-value of 0.014), and with significant interactions with the opinion responses *Q1, Q3*, and *Q5*. These interactions will be discussed further below. Thus we see statistically significant price responses in both Atlanta and Orlando.

The variable *tTE* picks up any changes in the route choice that is associated with using a surcharge rather than a subsidy on the Expressway, and *tTL* similarly for the Arterial route. The latter is positive and significant in Orlando (coefficient is 0.603 with a p-value of 0.036). This implies that the use of surcharges on the Arterial results in an increase in demand for Expressway capacity. However, we do not see a similar effect in the opposite direction: the use of surcharges on the Expressway, as indicated by *tTE*, does not decrease demand for Expressway capacity. In addition, the price response is weaker when surcharges are used on the Expressway, as indicated by the negative and significant sign on *P-tTE* (coefficient is -1.105 with a p-value of 0.020). The latter effect is consistent with the idea that negative incentives may not be as effective as positive ones (Zhu et al. (2013), Merugu et al. (2009), Pluntke and Prabhakar (2013), and Tillema et al. (2012)).

We do not see a significant route choice reaction based on variations in travel time differences: the coefficient on the variable *TTdiff* is insignificant. This may be due to the fact that we are not manipulating travel times in the task and their natural variations are likely correlated with other factors that confound the effect. Since we vary the base amount that we pay per drive we also include the variable *Drivepay* to control for any influence this may have on route choice. Similarly the variable *Dearnings* picks up influences from past drive period earnings, and *Driverecord* any changes in behavior over time, within each drive period. None of these have a large and significant effect on route choice.

We find some demographic heterogeneity in both the route choices and the pricing responses, although we do not include those in the model in Table 6, where we only control for the interactions between demographics and our main treatment variable, earnings. All variables with prefix *P-* are interactions with net earnings *Exprprice.*[6] The coefficient on *Female* is positive and significant in both Atlanta and Orlando. When also interacting with the pricing variable, *P-female*, we see a negative and significant effect in both cities.[7] Thus, women in our study are more inclined to take the Expressway than men, but they are also less responsive to the pricing than men are. Drivers older than 30 years are less likely to use the Expressway, and in

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[5] We convert the estimated coefficient using the delta method. See Oehlert (1992). Notice this is not the percentage point increase, but the percentage increase of the base propensity. Thus, if the base propensity is 0.5, a dollar change in relative earnings would result in a propensity of 0.83.

[6] These results are reported in Table A1 in the online appendix. Adding demographics reduces the significance of many of our key variables.

[7] The insignificance of P-female in Table 6 is because we are not controlling for the base influence of Female.

Orlando they also respond more to price variations than those who are younger.[8] We find more route variations due to income in Orlando than in Atlanta, with an increased use of the Expressway for the higher income groups. Of course, most demographic variables are likely to serve as proxies for other, underlying individual variations in responses, and the interpretation of the coefficients should be made with caution.

3.3 Opinion Responses

Turning now to the last three columns in Table 6 we find the least support for tax financing (Q1) in both Atlanta and Orlando. These effects are strongly significant with p-values<0.001. The low support for tax financing is consistent with the literature that points out that the public generally does not understand the prevailing funding shortfalls. The second least favored option in Atlanta is Q3, financing of enhanced capacity using dynamic tolls. This is interesting because this is exactly the type of policies being discussed and introduced in Atlanta during the study period, although on different routes. The coefficient is -0.189 with a p-value of 0.012. In Orlando, on the other hand, there is not such a dislike for this option, but instead the second lowest support is seen for Q5, converting lanes into toll lanes (the coefficient is -0.196 with a p-value of 0.067). This weaker support for Q5 may have been influenced by the negative, debate about introducing dynamic toll lanes on the I4.[9] These effects confirm what we saw in the raw data, although here the differences between the two cities are not significant.[10]

Q2 (financing capacity with fixed tolls) does not get support that is significantly different from 50/50 in either city, as shown in Figure 3, and in Table 4 we even saw slightly less support for this option in Orlando than in Atlanta. Thus, we find no evidence that the experience of fixed toll roads in Orlando generate more support for additional capacity funded with fixed tolls.

We find virtually no variation in support across demographic characteristics, including income.[11] Since we repeated the opinion survey in the last session we can also see if opinions changed throughout the experimental participation. We find no evidence here that this is the case.[12] One effect worth mentioning is that our last cohort in Atlanta from fall 2012, about half a year after the introduction of the HOT lane, is significantly less supportive of any of the type of solutions we proposed, compared to other cohorts in either Atlanta or Orlando.

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[8] Again, in Table 6 the negative coefficient on *P-age* in Atlanta reflects that we are not controlling for the base *Age* effect in that model.

[9] An article in the Orlando Sentinel (http://articles.orlandosentinel.com/2012-06-29/news/os-congress-lexus-lanes-20120629_1_toll-lanes-lexus-lanes-free-lanes) in June of 2012 and the comments on the paper's facebook page around this article reflect these negative sentiments.

[10] Using simple linear hypothesis tests we find p-values of 0.426, 0.177, 0.307, and 0.532 for model differences of the coefficients on Q1, Q3, Q4, and Q5, respectively.

[11] See Table A1 in the online appendix. There is a weakly significant negative effect on support among African-Americans in Atlanta (p-value 0.089) and a weakly significant positive effect on support among college graduates in Orlando.

[12] See Table A1 in the online appendix.

3.4 Correlations between Road Price Responses and Opinions

Our main question regarding whether opinion responses are correlated with price responsiveness in route choice can be answered based on the interaction variables between road prices (as reflected in the net earnings variable *Exprprice*) and opinion questions, *P-Q1, P-Q2, P-Q3, P-Q4,* and *P-Q5*. We hypothesize that those who are less price responsive in their route choice are also more opposed to road pricing. However, just like experiences and exposure to road pricing debates affect opinion responses directly, as discussed in section 3.3, they may also affect the interactions between price responsiveness and opinions resulting in differences between the two cities.

We do not find any correlations between opinion responses and *Exprprice* in Atlanta where none of the variables, including *rho*, are significant. Thus, while drivers in Atlanta are price responsive, this does not seem to correlate with their opinions. In Orlando, on the other hand, we do see that there are positive correlations between responses to road pricing and three of the opinion questions: enhancing road capacity with funding from either taxes (Q1) or dynamic tolls (Q3), and conversions of lanes to toll lanes (Q5).[13] Thus, those who are in favor of enhancing capacity with dynamic tolls (Q3) or who are in favor of converting lanes into toll lanes (Q5) are also more price responsive in their route choices. This is consistent with our prior expectations that price responsiveness in route choices may be correlated with acceptance of pricing solutions, since price responsive drivers are better able to avoid using the priced options. The lack of correlations in Atlanta may reflect the lack of experience drivers there have in avoiding to pay tolls by taking alternate routes.

We see that while both price responsive and price non-responsive Atlanta drivers express less than 50% support for adding dynamic toll lanes (Q3 in OPINION with a p-value of 0.012), in Orlando average support is not significantly different from 50% (Q3 in OPINION with a p-value of 0.983) and a positive correlation between expressed support and price responsiveness (P-Q3 in ROUTE with a p-value of 0.017). Thus, price responsive drivers in Orlando show more support for adding dynamic toll lanes than either price non-responsive drivers in Orlando or both price responsive and price non-responsive drivers in Atlanta. The support of price responsive drivers may be essential for a policy such as Q3 to pass in a referendum in Orlando.

In addition, there is less than 50% support for converting lanes into toll lanes (Q5 with a p-value of 0.067) in Orlando, but also a positive correlation between support for this option and price responsiveness in route choice (P-Q5 in ROUTE, p-value of 0.006). Thus, price nonresponsive drivers in Orlando show less support for converting lanes into toll lanes than either price responsive drivers in Orlando or both price responsive and price non-responsive

[13] P-values are 0.05, 0.02 and 0.01 for P-Q1, P-Q3 and P-Q5, respectively. The coefficients on P-Q3 and P-Q5 are significantly different across the two cities.

drivers in Atlanta. Price non-responsive drivers in Orlando may perceive a lane conversion into toll lanes as bringing additional congestion costs to the non-priced lanes.

One question that can be raised is whether the price responsiveness in route choice is correlated with income, since we would expect low income drivers to be more inclined to avoid relatively expensive options. In separate models[14] we directly investigate the interactions between income and road pricing responses, as well as how these interact further with opinion. We find that the price responsiveness gets stronger, not weaker, with income, and this effect does not interact significantly with the expressed opinion. Thus, we have no evidence that drivers with lower incomes react more strongly to pricing, or that they therefore would also be in the group expressing support for dynamic toll lanes or converting lanes into toll lanes. However, we cannot draw any convincing conclusions regarding how low income households respond to pricing since we have a very low proportion of participants with household incomes below the median, and almost no participants below half the median income.[15]

4. CONCLUSIONS

We collect route choices using GPS recorders from 452 study participants and manipulate the road pricing to measure price sensitivity in route choice. From the same participants we also collect responses to five questions regarding their support for various road pricing solutions to traffic congestion. We recruit participants who drive on two popular commuter routes in each of Orlando, Florida and Atlanta, Georgia, during 2011-2012.

We investigate whether price responsiveness in route choices is correlated with the responses to opinions about various congestion solutions. Responses to opinion surveys may partly reflect strategic considerations if the intent of the response is to create a policy outcome that is favorable to the respondent. Thus, if a survey is perceived as having a possible influence over a congestion policy implementation, responses may reflect a desire to avoid the implementation of a policy that would result in a personal financial cost. A driver who is price non-responsive may therefore be more inclined to reject a pricing proposal than a driver who is price responsive, since the latter may perceive himself as able to avoid paying.

The experience of toll roads in Orlando does not translate into a significantly stronger price responsiveness than in Atlanta, as one might have expected. However, we do see significant differences between these cities in support for the options of adding capacity financed with dynamic tolls, and converting lanes into toll lanes, among those who are price responsive. The toll road experience in Orlando may have made the price responsive drivers more aware of their ability to avoid paying the tolls, thus making them more open to supporting pricing policies. These respondents therefore do not put their money where their mouths are: their mouths say yes

[14] See Table A2 in the online appendix for these estimations.

[15] In Orlando 5.8% of our participants were at or below the national median income of $25,000, and in Atlanta the percentage was as low as 1.5%.

but their wallets say no. The positive correlation between price responsiveness and support for pricing implies that effectiveness of pricing policies is sometimes correlated with support for the policies, since a portion of the drivers would respond to the pricing. The lack of correlations between price responsiveness and policy support in Atlanta may reflect the lack of experience in avoiding tolls by taking alternate routes.

Table 1: Description of Respondents and Variables

			Orlando	*Atlanta*
Respondents	N who completed S1 and S2		203	376
Respondents	N including only those who completed full study		183	269
Female		Proportion	49%	47%
Age	<30	Proportion	32%	15%
2	30-55	Proportion	61%	68%
3	>55	Proportion	7%	17%
African american		Proportion	12%	19%
Income	<$35,000	Proportion	16%	8%
2	$35 - $65,000	Proportion	35%	24%
3	$65 - $100,000	Proportion	30%	36%
4	>$100,000	Proportion	19%	32%
Education	High School or less	Proportion	13%	6%
2	Less than College but more than highschool	Proportion	20%	8%
3	College or more	Proportion	67%	86%
Cohort	Summer 2011	Proportion	20%	21%
2	Fall 2011	Proportion	46%	24%
3	Spring 2012	Proportion	34%	13%
4	Fall 2012	Proportion	0%	42%
TTdiff	Arterial minus Expressway average traveltime difference	minutes	5.02	3.91
Drivepay	$2.50	Proportion	50%	45%
	$5.00	Proportion	50%	55%
Exprprice	Expressway net earnings / Arterial route net earnings	mean	$0.68	$0.90
Exprprice	Expressway net earnings / Arterial route net earnings	standard deviation	$0.42	$0.32
Dearnings	Payment for drives in previous drive period	dollars	$35	$36
Driverecord	average number of drives per drive periods		14	14
tTE	tTE=1 if toll charge on Expressway, else subsidy or neither	Proportion	77%	76%
tTL	tTL=1 if toll charge on Arterial route, else subsidy or neither	Proportion	42%	37%

Table 2: Mean and Standard Deviation of Travel Times (in Minutes) by Region and Am/Pm

	Express AM	Arterial AM	Express PM	Arterial PM
Orlando East	5.1 (2.0)	9.6 (2.1)	5.5 (2.2)	12.5 (3.3)
Orlando West	5.2 (0.6)	9.3 (1.4)	5.3 (0.7)	10.9 (2.7)
Atlanta East	5.6 (1.5)	9.7 (2.2)	6.3 (2.1)	11.6 (3.7)
Atlanta West	7.9 (3.1)	11.7 (5.0)	10.8 (4.9)	15.3 (5.1)

Table 3: Road Prices on Expressways and Arterials

	Arterial Road Prices ($)							
Expressway Road Prices ($)	*-1*	*-0.5*	*-0.25*	*0*	*0.25*	*0.5*	*1*	*1.5*
-5.75	0	0	0	5	0	0	0	0
-5	0	0	0	69	0	0	0	0
-4.75	0	0	0	25	0	0	0	0
-4	0	0	0	387	0	0	0	0
-3.75	0	0	0	111	0	0	0	0
-3.5	0	0	0	176	0	0	0	0
-3.25	0	0	0	47	0	0	0	0
-3	0	0	0	607	0	113	0	0
-2.5	0	105	0	124	0	113	0	0
-2	0	158	0	1,149	0	0	0	0
-1.5	0	158	0	781	0	265	0	0
-1	0	223	0	510	0	237	0	0
-0.5	0	263	13	674	0	405	0	0
-0.25	0	0	0	0	506	0	0	0
0	371	577	0	5,667	0	367	417	349
0.2	0	0	18	0	0	0	0	0
0.25	0	0	318	0	5	0	0	0
0.5	0	368	0	581	0	0	0	3
1	0	0	0	298	0	0	13	0
1.5	0	16	0	310	0	0	0	0

A negative value in a label for a row or column shows the charges used and a positive value shows the subsidies used. The entries in the table are the number of observations, i.e. drives, with that combination of prices on the Expressway and the Arterial.

Table 4: Probit Models of Opinion Responses by City and Session

	Q1	Q2	Q3	Q4	Q5
Constant	-.48 (<.001)	.02 (.089)	.01 (.271)	.16 (<.001)	-.18 (<.001)
Atlanta	-.01 (.438)	.10 (<.001)	-.08 (<.001)	-.06 (<.001)	.18 (<.001)
Sess4	-.03 (.053)	-.01 (.590)	.01 (.395)	.02 (.303)	.01 (.680)

Opinion responses were obtained in Sessions 1 and 4.

Table 5: Raw Observations of Expressway Choice

	Orlando East	Orlando West	Atlanta East	Atlanta West
Summer 2011	61%	66%	89%	83%
Fall 2011	72%	76%	87%	88%
Spring 2012	66%	69%	76%	67%
Fall 2012	NA	NA	84%	77%

The fall 2012 cohort did not include any participants in Orlando, only in Atlanta.

Table 6: Bivariate Probit of Opinion Responses and Responses to Road Pricing

OPINION	Atlanta	Orlando	ROUTE	Atlanta	Orlando
rho	0.081	-0.093			
	(0.365)	(0.165)			
cons	0.086	-0.137	cons	-1.002	-0.738
	(0.315)	(0.196)		(0.147)	(0.185)
Q1	-0.640***	-0.513***	P-Q1	0.128	0.401**
	(<.001)	(<.001)		(0.579)	(0.046)
Q3	-0.189**	0.002	P-Q2	-0.093	0.158
	(0.012)	(0.983)		(0.545)	(0.235)
Q4	-0.022	0.153	P-Q3	-0.121	0.322**
	(0.834)	(0.255)		(0.463)	(0.017)
Q5	-0.115	-0.196*	P-Q4	-0.131	0.164
	(0.119)	(0.067)		(0.380)	(0.160)
Sess4	-0.001	-0.002	P-Q5	-0.131	0.383***
	(0.980)	(0.877)		(0.376)	(0.006)
OpinionOrder	0.0909	0.196**	TTdiff	0.028	0.0300
	(0.248)	(0.048)		(0.585)	(0.492)
Nosurvey	-0.066	0.484***	Drivepay	0.042	-0.0191
	(0.654)	(<.001)		(0.486)	(0.807)
			Exprprice	2.185***	1.781**
				(0.008)	(0.014)
			Dearnings	-0.004**	-0.002
				(0.026)	(0.315)
			Driverecord	-0.003	0.006
				(0.565)	(0.264)
			tTE	0.222	0.644
				(0.735)	(0.159)
			tTL	0.185	0.603**
				(0.603)	(0.036)
			P-tTE	-0.226	-1.105**
				(0.741)	(0.020)
			P-tTL	-0.172	-0.383
				(0.637)	(0.212)
			P-Education	0.270**	-0.225
				(0.028)	(0.118)
			P-Female	0.0672	-0.085
				(0.664)	(0.687)
			P-Age	-0.270**	0.209
				(0.013)	(0.257)
			P- Africanamerican	-0.379**	-0.640**
				(0.019)	(0.016)
			P-TTdiff	-0.027	-0.002
				(0.661)	(0.970)

*Significant at 10%, ** Significant at 5%, *** Significant at 1%, p-values in parentheses. Variables with prefix P- are interaction variables with Exprprice. Sess4 is a dummy variable for responses in the last meeting, OpinionOrder is a dummy variable for whether subject was in treatment with opinion questions presented in order Q1-Q5 rather than the inverse order Q5-Q1, Nosurvey is a dummy variable for subjects who did not receive opinion questions in the first meeting but only in the last. 62% of the 17,020 drives are in Atlanta and 65% of the 452 participants.

Figure 1: Study Routes in Orlando Florida and Atlanta Georgia

Figure 1a- East Orlando Routes SR50 and SR408 between N. Goldenrod Rd. and Mills Avenue

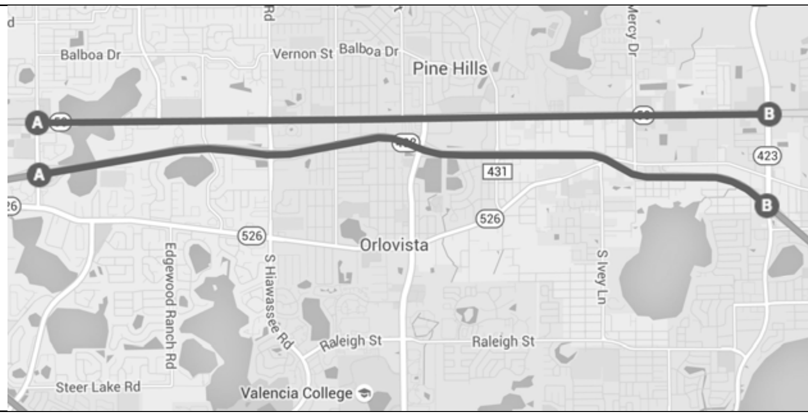


Figure 1b- West Orlando Routes SR50 and SR408 between Good Homes Rd. and John Young Pkwy.

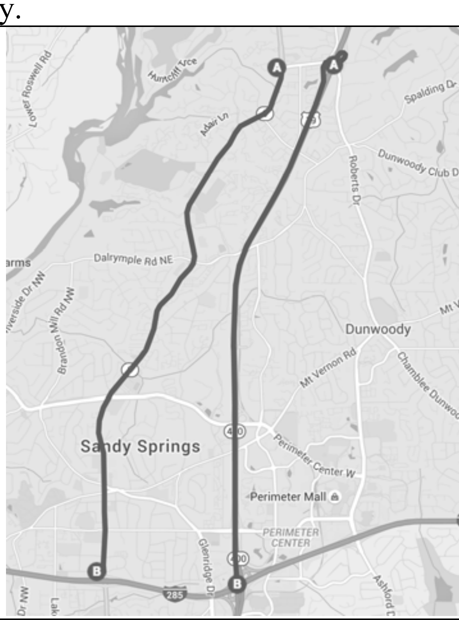


Figure 1c- North-East Atlanta, SR400 Expressway and SR9 between Northridge Rd and I285

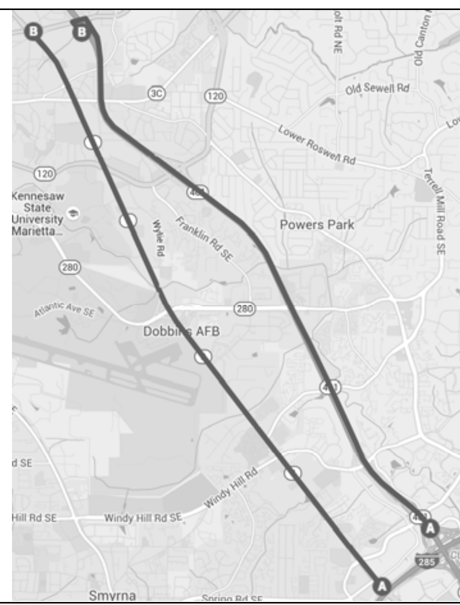


Figure 1d- I75 Expressway and SR41 between North Marietta Parkway and I285

Figure 2: Travel Time Distributions in All Four Travel Regions

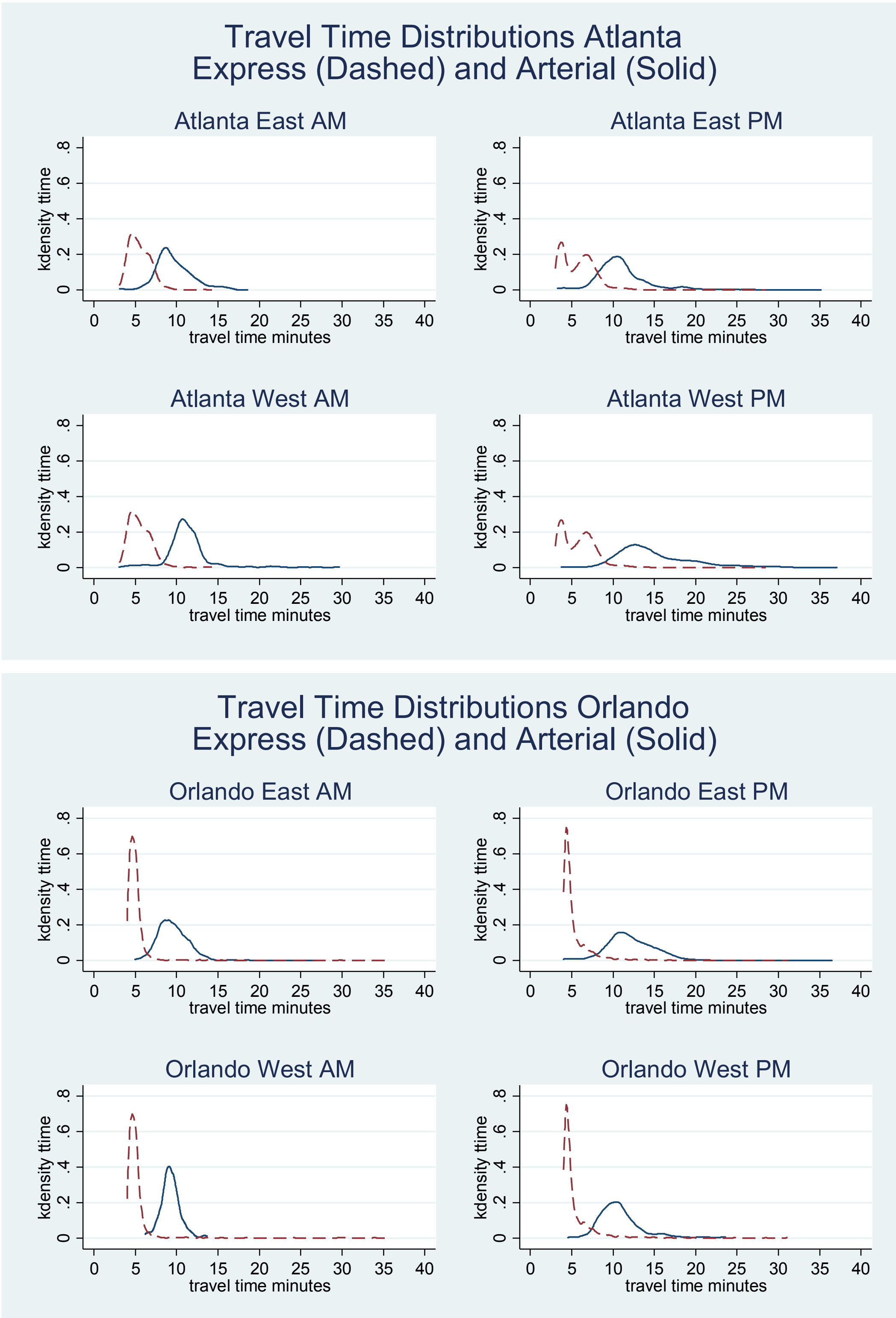
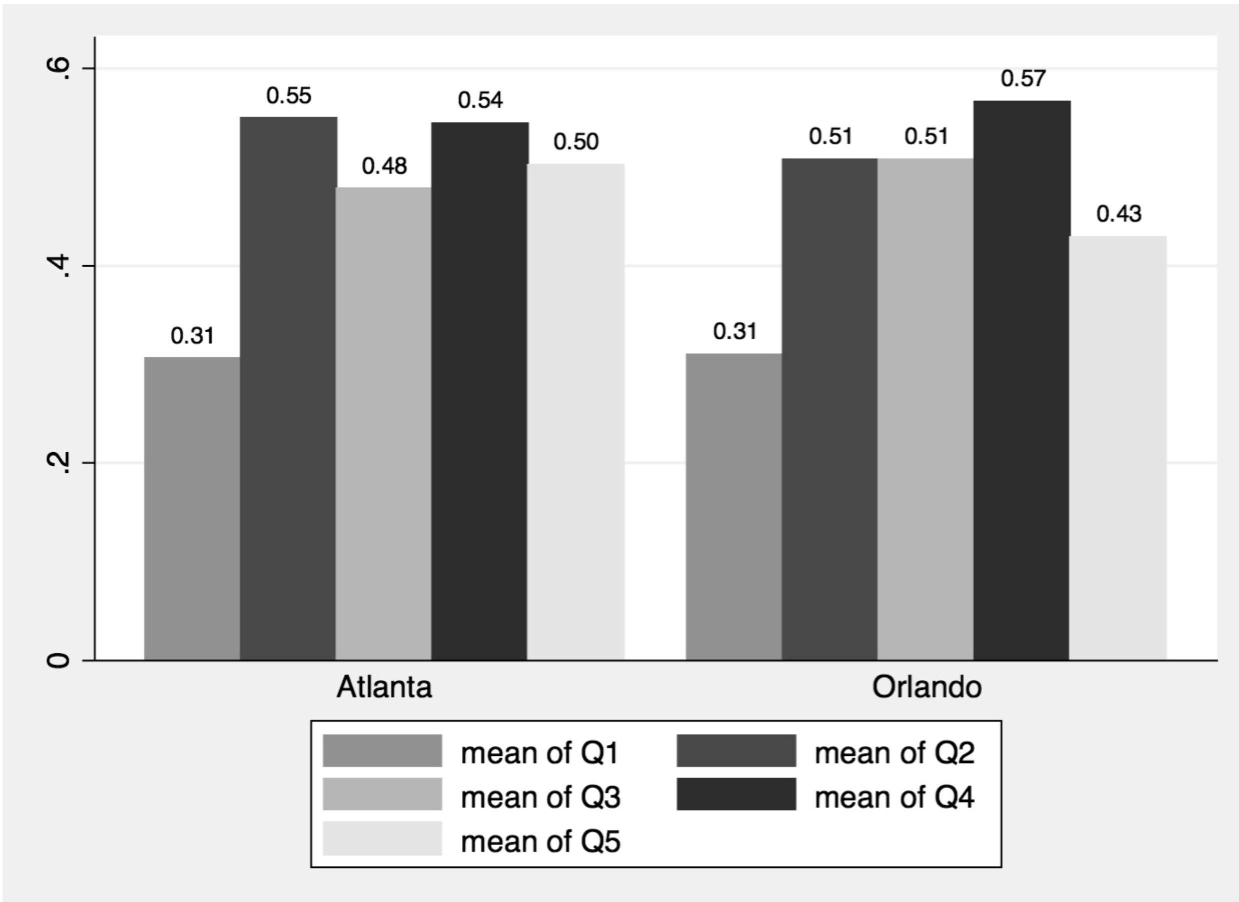
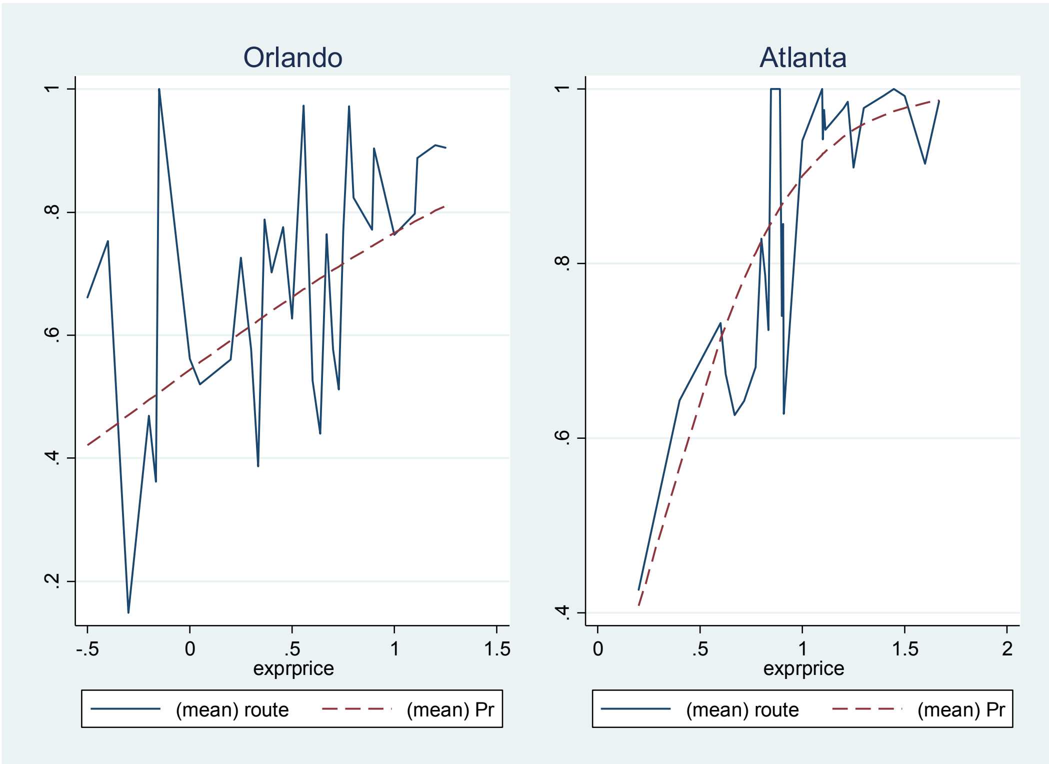


Figure 3: Opinion Responses by Question and Region



Numbers on top of the bars show the proportion of participants favoring the policy.

Figure 4: Expressway Choice and Relative Price



The vertical axis shows the proportion of drivers choosing Expressway. The horizontal axis shows the relative price we charged in the study, in dollars. The trend line is fitted using a Probit model.

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ONLINE APPENDIX (*NOT FOR PUBLICATION IN JOURNAL*)

Table A1: Bivariate Probit of Opinion Responses and Reactions to Road Pricing With Demographics and Session 4 Interactions

	ATLANTA	*ORLANDO*		*ATLANTA*	*ORLANDO*
N	78195	56978			
rho	0.0526	-.029			
	(0.558)	(-.634)			
ROUTE			*OPINIONS*		
cons	-2.088**	0.657	cons	-0.012	-0.528***
	(0.030)	(0.215)		(0.959)	(0.009)
P-Q1	0.154	0.278	Q1	-0.626***	-0.545***
	(0.513)	(0.150)		(0.000)	(0.000)
P-Q2	-0.038	0.041	Q3	-0.180**	-0.024
	(0.806)	(0.737)		(0.023)	(0.843)
P-Q3	-0.036	0.208	Q4	-0.018	0.127
	(0.822)	(0.108)		(0.872)	(0.350)
P-Q4	-0.053	0.032	Q5	-0.099	-0.211**
	(0.720)	(0.775)		(0.186)	(0.050)
P-Q5	-0.053	0.244*	Sess4	0.022	-0.049
	(0.718)	(0.055)		(0.531)	(0.161)
TTdiff	0.041	-0.024	OpinionOrder	0.115	0.206*
	(0.387)	(0.483)		(0.151)	(0.052)
Drivepay	0.052	-0.002	Nosurvey	-0.040	0.598***
	(0.409)	(0.976)		(0.833)	(0.000)
Exprprice	3.331***	-0.723	Q1-S4	-0.094*	0.071
	(0.024)	(0.241)		(0.069)	(0.204)
Dearnings	-0.004***	-0.001	Q3-S4	-0.020	0.057
	(0.035)	(0.381)		(0.690)	(0.191)
Driverecord	-0.0032	0.005	Q4-S4	-0.016	0.051
	(0.477)	(0.387)		(0.752)	(0.371)
tTE	-0.030	-0.439*	Q5-S4	-0.001	0.035
	(0.879)	(0.072)		(0.989)	(0.281)
tTL	0.023	0.358*			
	(0.880)	(0.087)			
P-Education	-0.332	0.054			
	(0.422)	(0.739)			
P-Female	-0.606*	-0.811***			
	(0.070)	(0.001)			

Table A1 cont'd					
	ATLANTA	*ORLANDO*		*ATLANTA*	*ORLANDO*
ROUTE			*OPINIONS*		
P-Age	0.065	0.740***			
	(0.833)	(0.001)			
P-African-american	-0.581*	-0.861**			
	(0.056)	(0.020)			
P-TTdiff	-0.033	0.021			
	(0.558)	(0.635)			
Female	0.544*	0.564**	Female	0.037	0.044
	(0.083)	(0.015)		(0.633)	(0.634)
Age_2	-0.784**	-0.762***	Age_2	0.160	0.172
	(0.016)	(0.003)		(0.136)	(0.143)
Age_3	-0.929	-1.268***	Age_3	0.074	0.306
	(0.108)	(0.005)		(0.581)	(0.131)
African-american	0.226	0.152	African-american	-0.165*	-0.074
	(0.467)	(0.718)		(0.089)	(0.652)
Income_2	0.485	0.029	Income_2	-0.019	0.010
	(0.112)	(0.908)		(0.901)	(0.952)
Income_3	0.314	0.536**	Income_3	0.084	0.063
	(0.283)	(0.035)		(0.573)	(0.735)
Income_4	0.522*	1.002***	Income_4	-0.023	0.049
	(0.092)	(0.001)		(0.881)	(0.804)
Education_2	0.957*	0.111	Education_2	0.035	0.111
	(0.077)	(0.725)		(0.876)	(0.447)
Education_3	1.282	-0.553	Education_3	0.059	0.231*
	(0.112)	(0.107)		(0.756)	(0.078)
Cohort_2	0.086	0.289	Cohort_2	-0.044	0.083
	(0.645)	(0.259)		(0.659)	(0.483)
Cohort_3	-0.088	0.238	Cohort_3	-0.116	-0.086
	(0.689)	(0.423)		(0.343)	(0.577)
Cohort_4	0.125		Cohort_4	-0.261**	
	(0.554)			(0.018)	

*Significant at 10%, ** Significant at 5%, *** Significant at 1%, p-values in parentheses. P-Q1-Q5 are interaction variables between Exprprice and Q1-Q5, P-educ/female/age/black/TTdiff are interactions between Exprprice and demographics. Sess4 is a dummy variable for responses in the last meeting, OpinionOrder is a dummy variable for whether subject was in treatment with opinion questions presented in order Q1-Q5 rather than the inverse order Q5-Q1, Nosurvey is a dummy variable for subjects who did not receive opinion questions in the first meeting but only in the last.

Table A2: Including Income Interactions for Orlando

	Model 1	Model 2		Model 1	Model 2
N	56978	56978			
rho	-0.0770	-0.0764			
	(0.247)	(0.252)			
ROUTE			*OPINIONS*		
cons	0.384	0.386	cons	-0.129	-0.129
	(0.395)	(0.392)		(0.224)	(0.224)
P-Q1	0.362	0.385	Q1	-0.518***	-0.518***
	(0.071)	(0.433)		(0.000)	(0.000)
P-Q2	0.102	0.075	Q3	-0.008	-0.008
	(0.457)	(0.804)		(0.944)	(0.944)
P-Q3	0.277**	0.126	Q4	0.143	0.143
	(0.046)	(0.703)		(0.291)	(0.291)
P-Q4	0.103	0.032	Q5	-0.197*	-0.197*
	(0.393)	(0.902)		(0.068)	(0.068)
P-Q5	0.325**	0.383	Sess4	-0.004	-0.004
	(0.026)	(0.307)		(0.819)	(0.818)
TTdiff	0.031	0.031	OpinionOrder	0.183*	0.183*
	(0.486)	(0.487)		(0.064)	(0.064)
Drivepay	0.005	0.005	Nosurvey	0.477***	0.476***
	(0.944)	(0.949)		(0.000)	(0.000)
Exprprice	0.252	0.270			
	(0.659)	(0.637)			
Dearnings	-0.003	-0.003			
	(0.132)	(0.132)			
Driverecord	0.003	0.003			
	(0.580)	(0.580)			
tTE	-0.430*	-0.431*			
	(0.060)	(0.059)			
tTL	0.332*	0.331*			
	(0.086)	(0.086)			
P-Education	-0.297**	-0.297**			
	(0.038)	(0.038)			
P-Female	-0.204	-0.203			
	(0.330)	(0.331)			
P-Age	-0.057	-0.056			
	(0.762)	(0.763)			
P-African american	-0.775***	-0.776***			

	(0.001)	(0.001)			
Table A2 cont'd					
	Model 1	Model 2		Model 1	Model 2
ROUTE			*OPINIONS*		
P-TTdiff	-0.003	-0.003			
	(0.951)	(0.949)			
P-Income	0.408***	0.401***			
	(0.000)	(0.000)			
P-Q1-Income		-0.009			
		(0.954)			
P-Q2-Income		0.011			
		(0.918)			
P-Q3-Income		0.061			
		(0.578)			
P-Q4-Income		0.029			
		(0.751)			
P-Q5-Income		-0.023			
		(0.859)			

*Significant at 10%, ** Significant at 5%, *** Significant at 1%, p-values in parentheses. P-Q1-Q5 are interaction variables between Exprprice and Q1-Q5, P-educ/female/age/black/TTdiff are interactions between Exprprice and demographics. Sess4 is a dummy variable for responses in the last meeting, OpinionOrder is a dummy variable for whether subject was in treatment with opinion questions presented in order Q1-Q5 rather than the inverse order Q5-Q1, Nosurvey is a dummy variable for subjects who did not receive opinion questions in the first meeting but only in the last. P-income is a twoway interaction between Exprprice and Income (treated here as a continuous variable), and P-Q_income1/2/3/4/5 are threeway interactions between Exprprice, Income and the five opinion responses.

Sample instructions for route choice experiment using GPS recorders.

These instructions where used in the Atlanta East region.

Now we will tell you what you will do during the next couple of weeks, until your next session. During this period you will have a GPS unit in your vehicle. It will be plugged into your cigarette lighter the entire time. As long as it stays plugged into the cigarette lighter there is nothing else you need to do. Just leave it there until you return.

The GPS unit will record all the roads you drive on and at what times you drive. This unit is not connected to any other devices in your vehicle. It does not transmit any signals so nobody can see where you are going while you drive. It is only recording, not sending any information.

When you return we will download this data to our computer. However, we are only interested in your driving on select routes. Thus as we download the data we will destroy any other driving information, except those routes. Therefore we will not save any information about the location of your home, your work place, or other places you visited.

The routes we are interested in are Roswell Road (SR9), between I-285 and Northridge Road, and SR400, also between I-285 and Northridge Road. We will save your driving records from some distance beyond these points. Just far enough so that we can identify in our records which way you came from when you entered these route. But not so far that we can identify your home, work or school locations.

How will you get paid for your driving during this time?

First, you will only get paid when you drive during weekdays 7 am – 9:30 am in a southbound direction, or 4 pm – 8 pm in a northbound direction, plus Saturdays between 2 pm and 8 pm in either direction. Each week we will select your first 10 drives on these routes during these times and pay you for those. For example, if you drive every day during a standard Monday through Friday work week driving to downtown Atlanta in the morning and back in the evening you will be paid for your drives Monday – Friday morning and evening. You will then not be paid for any Saturday driving since you already completed the 10 paid drives that week. If you only drive during four of the week days, but travel the route on Saturday as well, you will be paid for the Saturday drive because you only fulfilled 8 of the 10 paid drives during the week. However, if you are a commercial driver and you drive multiple times on the route each day. You may fill your quota of 10 drives much quicker. If so, we will not pay you for any more drives that week, but you will be paid again the following week for an additional 10 drives.

You will have to drive the entire distance from I-285 to Northridge Road Parkway without stopping for any other reasons than traffic congestion. If you stop for other reasons it will not count as a drive we will pay for. For example, if you start on SR400 at I-285 driving away from Atlanta but you get off at Abernathy Road, the drive does not count as one of your 10 drives. Similarly, if you were to pull over to a shopping area to do some shopping the drive would not count as one we pay for.

You will be paid $______ for each of these drives. The maximum number of drives you can get paid for is 20, so the most you can earn is $______.

In the weeks following your next session with us we will change how you get paid. We will explain to you at that session exactly how the new payments will be determined. For now, however, you get $_____ for each of the 20 drives.

When you return we will download your GPS data. We will remove all the driving records that are beyond our routes. Then we will calculate how many drives you did that we pay for. You will be paid that money at the second session.

At the end of the session we will go with you to your vehicle and help you find a good way to keep the GPS unit plugged in. If at any time you have questions about how you are getting paid or problems with your GPS unit just email us at traffic@gsu.edu and we will get back with you as soon as possible.

If there are problems with your GPS unit, either because you had to unplug it or for other reasons, and it does not record your drives we cannot pay you for those drives. We will show you how you can see that it is getting power and operating properly.

Although the GPS unit is state of the art, the GPS technology has limitations that will affect the recording of your drives. Under some circumstances you will find that your drives may not be recorded. These circumstances include, but are not limited to, the type of garages you park in, the weather conditions while driving or the GPS signal strength at the location where you park. Under such circumstances the GPS unit will not find a satellite signal. In such cases your drives will not be recorded and you cannot be paid for those drives. If this were to happen so frequently that there are no valid records for you at all then you may choose not to continue in the study. In our experience it is almost impossible to predict for which participants this will happen.

The memory capacity of the unit also depends on a number of circumstances, not just the miles you drive. If the unit fills up with records then it erases everything and starts from scratch and all the drive records from your drives before then would be erased.

It is therefore important that you let us know of any problems you are having as soon as possible so that we can help you correct them.

For your own safety, and for the safety of other drivers around you, you should not attempt to plug the GPS unit in or out while driving, and you should also refrain from looking at it to verify if it is working while driving. You can easily verify that it operates properly while parked.

Station T1: Short Questionnaire About Your Opinions on Reducing Congestion

We are interested in how you think you would vote in a referendum to reduce traffic congestion. We want to know if you would be *more likely* to vote for the referendum, *less likely* to vote for it, or *would not care*.

Please circle the option that best matches your opinion. What would be the effect on your voting if congestion was to be reduced by

Financing enhanced road capacity through increased gas and property taxes?

MORE LIKELY TO VOTE LESS LIKELY TO VOTE DON'T CARE

Financing enhanced road capacity through toll lanes with a fixed toll charge?

MORE LIKELY TO VOTE LESS LIKELY TO VOTE DON'T CARE

Financing enhanced road capacity through toll lanes with toll charges that vary by the time of day or by the traffic volume?

MORE LIKELY TO VOTE LESS LIKELY TO VOTE DON'T CARE

Converting more lanes into carpool lanes with no additional taxes or tolls?

MORE LIKELY TO VOTE LESS LIKELY TO VOTE DON'T CARE

Converting more lanes into toll lanes with no additional taxes?

MORE LIKELY TO VOTE LESS LIKELY TO VOTE DON'T CARE