Tax rate design and support for mileage user-fees

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Abstract

Road mileage user-fees (MUFs) remain an unpopular financing option to replace fuel taxes at the state level despite being viewed favorably by some policy experts and policymakers. We investigate the extent to which tax-rate design can be used to boost support to the point where policymakers might feel comfortable moving ahead with replacing their fuel taxes with MUFs. Using data from four experimental surveys, we show that while tax-rate design can be used to increase public support for MUFs, the effect is likely too small to convince policymakers to adopt MUFs.

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1 Introduction

Long-run revenue projections have shown that the excise tax on fuel currently used to finance road construction, repair and maintenance in the US is losing its ability to generate adequate amounts of revenue (Dumortier et al. 2017). The reduction in revenue generating capacity is driven by two factors. First and arguably most important is the increase in fuel efficiency driven by state and federal fuel economy standards (e.g., the Federal corporate average fuel economy (CAFE) and California's Zero Emission Vehicle (ZEV)). These policies not only increase the fuel efficiency of internal combustion engine vehicles, they also incentivize the adoption of alternative-fuel technologies that are not taxed as heavily as diesel and gasoline (Jenn et al. 2015; Tscharaktschiew 2015). Second, fuel tax rates rarely change and are generally not indexed to inflation within the construction industry. Together, these lead to a downward trend in the inflation-adjusted revenue generated by a given tax rate *all else equal* (see Duncan et al. (2017) for a more detailed discussion of these reasons).

Because fuel taxes account for a significant share of revenues used to finance roads (Bishop-Hencman and Scarboro 2017; Sorensen 2013), most state governments have been investigating alternative means of generating the required revenues (Duncan et al. 2017). One revenue source that has received a lot of attention from both academics and policymakers is the road mileage user-fee (MUF) (Wachs 2009; Sorensen 2013). Instead of paying a tax on each gallon of fuel bought, drivers would pay a tax on each mile they drive. Despite its many advantages and the significant attention received at the state level, the MUF remains strongly opposed by the public (Duncan et al. 2017; Agrawal and Nixon 2017).[1] Consequently, there hasn't been much action in the way of implementing MUFs. There have been many pilot programs and feasibility studies. However, only Oregon has implemented the MUF as a replacement for its fuel taxes. Even here, the adoption is on a small scale relative to the fuel tax.

Policymakers interested in adopting the MUF must identify the reasons for low support and then devise strategies for swaying public opinion toward support for the MUF. Existing literature have identified a number of reasons for low support. For example, Duncan et al. (2017) find that technological costs, privacy, and security are factors that influence support for MUFs. They also find that people are concerned about fairness toward drivers who live in rural areas and drivers who must drive many miles for employment. Additionally, Sorensen et al. (2012) argue that opposition is likely tied to a general unfamiliarity with the MUF. This is supported by several pilot studies that find

[1] Road transportation generates a number of externalities; e.g. congestion, noise, accidents, and local and global pollution. In a first-best world, each of these externalities would be addressed by specific instrument. There is a very strong role for a MUF in the absence of these differentiated instruments (Parry and Small 2005).

that support for the MUF generally increases as pilot participants experience and thus become familiar with the MUF (e.g., Hanley and Kuhl (2011), Whitty (2007)).

Opponents of the MUF also cite fairness and environmental concerns for their opposition. First, some argue that switching from the fuel tax to the MUF might increase emissions and thus harm the environment because MUFs reduce the incentive for drivers to purchase fuel-efficient vehicles.[2] Second, it is sometimes argued that it is both unfair and inefficient for heavy vehicles and light vehicles to pay the same per-mile fee because heavier vehicles do greater damage to the roads per mile driven. An important feature of these two concerns is that they can be addressed by designing the MUF to account for fuel efficiency and vehicle weight. Still, there is little empirical evidence that these factors are important determinants of public support for MUFs. We contribute empirical evidence on the importance of these two arguments by estimating the effect of tax-rate design on support for MUFs. In particular, we compare the support for a MUF that uses a flat rate per mile with one where rate per mile varies with fuel economy and one where rate per mile varies with vehicle weight.

Data for our analysis are collected from four experimental-surveys that were implemented over four years. The first survey was implemented on a representative sample of Indiana driving-age residents in 2014. We randomly assigned $1,000$ subjects to one of three groups; flat-rate, fuel-adjusted-rate and weight-adjusted-rate. Each subject was asked to state her support or opposition to the MUF on a four-point likert scale. Consistent with previous studies, we find that support for the MUF is low; ranging from 24% to 30%. Importantly, we find no consistent evidence that rate-design matters. Furthermore, while we find fairly large effect size for fuel efficiency in some specifications, the sign is always negative, which is inconsistent with the arguments outlined above.

We extend the analysis by replicating our Indiana survey on mTurk in three separate surveys; mTurk I, mTurk II, and mTurk III.[3] The primary difference between mTurk I and mTurk II is that mTurk I uses a between-subjects design as in the Indiana survey, while mTurk II uses a within-subjects design.[4] We find mixed evidence on the effect of

[2]For example, Duncan et al. (2017) find that support for a MUF is lower among people who believe a MUF is unfair to owners of fuel-efficient vehicles.

[3]mTurk is one of the largest online labor markets where job offers are posted and workers choose jobs for payment. According to Amazon, there are over 500,000 workers from 190 countries in the mTurk labor market: `https://requester.mturk.com/tour`. It is widely used for academic research: Kuziemko et al. (2015), DellaVigna and Pope (2018), and Anania et al. (2018) are recent examples of papers using Amazon's Mechanical Turk.

[4]A within-subjects design exposes each subject to each treatment sequentially. For example, 400 subjects are recruited and all of them respond to the flat rate MUF and then the Fuel-adjusted MUF. A between-subjects design exposes each subject to only one treatment. For example, 400 subjects are recruited and 200 of them respond to the flat rate MUF and 200 of them respond to the Fuel-adjusted MUF. See Charness, Gneezy, and Kuhn (2012) for more details on similarities and differences between the two types of experimental designs. See Charness et al. (2012) for more details on similarities and differences between the two types of experimental designs.

tax-rate design on public support. On the one hand, we find no statistical evidence that rate design matters when we use the between-subjects design of mTurk I. Furthermore, the effect sizes are smaller than in the Indiana study. On the other hand, we find positive treatment effects that are fairly large for both weight and fuel economy in the within-subjects design of the mTurk II sample. Support increases by 10% and 20% for weight and fuel economy, respectively, from a base of 30%.

The goal of the 'fuel-adjustment' design is to account for the possibility that the public has a preference for policies that are beneficial for the environment. However, it is possible that subjects fail to make the connection between fuel efficiency and pollution. We check for this possibility in mTurk III by replacing the phrase 'fuel-efficiency' with 'pollution level'. mTurk III also tests whether support varies with the tax rate by comparing support for a MUF with a tax rate of 1-cent rate per mile with that of MUF with a tax rate of 2-cents per mile. We find no difference in support between a fuel-adjusted and pollution-adjusted tax rate design. Additionally, we find very strong evidence that support is decreasing in the tax rate; support for a 1-cent MUF is about 11 percentage points higher than support for a 2-cent MUF.

Our paper makes important contributions to both the academic literature and ongoing policy discussions about road financing. Existing empirical evidence show that design and administration features impact public support for MUFs. For example, support can be improved if the MUF is designed to minimize privacy concerns (Duncan et al. 2014) and technological costs are minimal or borne by the government (Duncan et al. 2014; Duncan et al. 2017). There is also evidence that acceptability depends on how collected revenues are allocated (Harrington et al. 2001; Schuitema and Steg 2008), belief about expected consequences of pricing policies on own car use (Zhan et al. 2011; Whitty 2013), financial costs (Kallbekken et al. 2013), and perceptions of equity and fairness (Jakobsson et al. 2000; Fujii et al. 2004; Hiramatsu 2010).[5] Finally, Hanley and Kuhl (2011) find that support increases after having experienced the MUF during a pilot program. Additional administrative/design features that can be used to improve public acceptance are discussed in Sorensen et al. (2012). We contribute to the literature by showing that rate design matters in some contexts.

The qualitative findings are somewhat consistent with the body of work described in Agrawal and Nixon (2017). They find that public support for a MUF adjusted for a vehicle's pollution level is higher than a MUF based on a flat fee in a nationally representative sample. Our paper differs from theirs in important ways. First, we explore the effect of vehicle weight-adjustments whereas Agrawal and Nixon (2017) only look at adjustments for pollution level. Second, our experiment allows us to estimate the relationship be-

[5]See Zmud (2008) and Anas and Lindsey (2011) for a more detailed summary of this branch of the literature.

tween support and tax rate. Third, our experiment includes administrative details that are more likely to be adopted in MUFs. For example, Agrawal and Nixon (2017) assume the fee would be collected at the gas pump as the driver pays for fuel. However, the only active MUF in the country - Orego in Oregon -, administers the tax via privately operated account managers who collect mileage data and use this data to determine driver's tax bill. Relatedly, we provide subjects with information about the annual tax bill for an average driver, projected annual tax revenues, and explicitly state that revenues will be dedicated toward roads. Finally, we present results using both within-subjects and between-subjects designs and show that this design feature matters. We also account for order effects in the design of our within-subjects experiments and provide suggestive evidence that order matters when comparing support for flat-rate MUF to support for a fuel-adjusted MUF.[6]

Our findings are also relevant for the current policy discussions about MUFs. To the extent that within-subjects design is the most appropriate way to model the behavior of citizens in real-world policy debates, our findings suggest that policymakers can influence public support for MUFs using the rate design. In particular, MUFs that are adjusted for vehicle weight and fuel economy are likely to receive greater public support. Our results also suggest that policymakers must pay careful attention to the tradeoff between support and revenue adequacy associated with lower tax rates. Lower tax rates can be used to increase support, but could compromise the revenue collections.

However, our results also imply that support for the MUF remains very low even accounting for the favorable boost provided by rate design. Support for the MUF remains lower than 50% across all four samples. So, while fuel economy and weight appear to increase support for MUF, their impacts might not be large enough to influence policymakers to adopt MUFs.

The remainder of the paper proceeds as follows. We discuss the experimental design and results of the Indiana study in sections 2 and 3, respectively. The mTurk extensions and results are presented in sections 4 and 5. We discuss conclusions in section 6.

2 Design and Implementation

The experiment is designed to compare three alternative tax-rate structures: flat rate, fuel-economy-adjusted rate, and weight-adjusted rate. Below we describe the structure of each tax-rate design along with the implementation strategy.

[6]Order effects refers to idea that subjects' responses to the treatment information in a within-subject design might depend on the sequence in which the information is presented. For example, a subject's opinion about the flat-rate MUF might depend on whether she saw flat-rate and then fuel-adjusted or fuel-adjusted and then flat rate. Randomizing the order in which treatment is presented when conducting within-subjects design experiments allows the experimenter to address this concern.

2.1 Design

Treatment We design an experiment with three treatment groups that allows us to identify the effect of tax-rate structure on support for mileage user-fees. In particular, we compare flat-rate, fuel-efficiency-adjusted and vehicle-weight-adjusted mileage user-fees. The design details presented to subjects are identical across the three treatments except for the way in which the rate varies across vehicles. Subjects in the *flat-rate treatment* are told that vehicle mileage will be taxed at a rate that remains constant across vehicle types. Subjects in the *fuel-efficiency-adjusted* treatment are told that vehicle mileage will be taxed at a rate that declines with fuel efficiency. Finally, subjects in the *vehicle-weight-adjusted* treatment are told that vehicle mileage will be taxed at a rate that increases with vehicle weight. Additionally, subjects are given a revenue target and are asked whether they would support replacing the fuel tax with the mileage user fee as a means of achieving that revenue target. Therefore, subjects know they would **not** be paying both a fuel tax and a mileage tax. The remaining design details discussed below are identical across treatment.

Tax Rate and Use of Funds Subjects are told that the average per-mile rate is 2 cents and that the average driver who drives 12,500 miles per year will pay an annual total fee of $250. They are informed that the total revenues generated by the tax will be ear-marked to road construction, maintenance and repair.

Mileage Collection Technology Subjects are presented with three alternative mileage collection technologies: self-reporting, a basic electronic device that **does not** have any GPS capabilities, and a GPS-capable electronic device. We randomize the order in which the collection technologies are presented to each subject within each tax-rate-design treatment. They are told that they do not have to pay for the mileage collection device; that both the basic electronic device and the GPS device will transmit their mileage data wirelessly to a central database; and that only the GPS device is capable of restricting their tax liability to miles driven on public roads within the taxing jurisdiction.[7]

Remittance Policy Subjects are instructed that mileage-information will be collected by a private company. The company is responsible for assessing, collecting and remitting the tax liability to the government. We also inform the subjects that the government will check 1 in 20 vehicles to verify that mileage information is correct.

[7] Subjects have to pay for all of their vehicle miles under the self-reported and basic electronic device collection technologies. Subjects can report their mileage in-person or online once per year under the self-reporting technology.

2.2 Implementation

The experiment was implemented using an experimental-survey as part of a larger road-financing project aimed at understanding public opinion of several alternative ways of financing roads in Indiana. The road-financing project was mandated by the Indiana state legislature and commissioned by Indiana's department of transportation. Therefore, the decision to focus on Indiana in this section of the paper is driven primarily by the availability of the data generated by the road-financing project.

The MUF was one of eight financing options explored in the road-financing project and several dimensions of the MUF were studied: mileage-collection technology, rate design, administration responsibility (public versus private), and taxing only tractor-trailers.[8] This paper focuses on the rate-design component of the road-financing project. Subjects were randomly assigned to one of the three rate-design treatments and were asked to state whether they would support a mileage user-fee on a four-point likert scale. Because the survey covered eight financing options, and every subject responded to each financing option, we also randomized the order in which subjects saw each financing option.

The questionnaire was programmed and distributed online by GFK Knowledge Networks using their panel of respondents in 2014.[9] GFK Knowledge Networks sampled 19,827 potential respondents for screening to determine eligibility (Indiana resident who is $\geq$18 years old). Of this total, 1,093 completed the screening process and 1,061 of those who completed the screening process completed the questionnaire. This implies a completion rate of 5 percent. Although the completion rate is low, the results in Table 1 show that the sample of respondents is representative of the state's adult population. Because the study was commissioned by a state agency, the sample was restricted to non-institutionalized adult ($>$ 18 years old) residents of Indiana.

3 Results

This section describes our results. First, we present summary statistics of the data. Next we describe the non-parametric and parametric results. We present robustness checks in the next section.

[8] The full questionnaire is available from the authors upon request.

[9] The KnowledgePanel® is a probability-based online panel. Members are recruited using random-digit dialing and address-based sampling methods that include both households with and without internet access, thus providing nearly complete coverage of the US population. Probability-based internet panels have advantages compared to random-digit dialing telephone surveys and other methods, including the potential for reduced measurement error, lower cost, and increased timeliness (Chang and Krosnick 2009; Yeager et al. 2011).

3.1 Data Summary

We make two adjustments to the data before running our analysis. First, we remove 53 unqualified responses that were flagged by the survey administrators. Next, we restrict the sample to subjects for whom we have non-missing observations on all covariates (this drops 31 subjects). As a result, our empirical analysis is based on 977 subjects.

Table 1 shows the summary statistics for several demographic variables that we use to check for the representativeness of the sample and balancedness across the treatment groups. First, we compare our sample to CPS data on the Indiana population and find that our sample is highly representative of the Indiana population. In order to substantiate internal validity, we check whether the treatment groups are balanced on observables. Visual inspection of the results presented in the first three columns of Table 1 suggests that the groups are balanced. This observation is supported by the results of a ranksum non-parametric test; except for race, all variables are balanced across groups (see p-values in Table 10 of Section 9).

3.2 Non-Parametric Results

Table 2 shows the level of support for mileage user-fees in Indiana by collection technology and rate design. Support is a binary variable equal to one if the subject supports or strongly supports and zero otherwise. We find that support for the mileage user-fee ranges from 24% to 30% in the self-reporting and basic collection technology modes, respectively (see panel A). While support for the self-reporting mode is similar to the findings of Duncan et al. (2017), the level of support for the two electronic modes are substantially different from theirs. For example, Duncan et al. (2017) find that support is only 13% for GPS-based mileage fee among a sample of respondents who are representative of the US population. Similarly, Agrawal and Nixon (2017) find support of approximately 20% for a mileage user-fee based on a basic electronic device.

While the variation in support across modes is interesting, we are primarily interested in the variation across tax-rate design. Therefore, we calculate the mean level of support for each mileage collection mode by fee-design and present the results in Panel B of the Table 2. We then compare support for a flat-fee to that of weight-adjusted and fuel-economy-adjusted fees. Support for the self-reporting mode is 27% when the fee is flat, 25% when the fee is adjusted for vehicle weight and 20% when adjusted for fuel efficiency. These results suggest a treatment effect of -2 percentage points for weight adjustments and -7 percentage points for fuel efficiency adjustments. In other words, adjusting the mileage user-fee for vehicle weight or fuel efficiency reduces support relative to a flat fee. The negative treatment effect is observed for the other mileage collection technologies although the estimated effects are smaller.

The non-parametric ranksum test results in Panel C of Table 2 show mixed evidence on the importance of rate design. While there is strong evidence that rate design matters for the self-reporting mode, only weight adjustment matters for the GPS mode, and there is no evidence that rate design matters when the mileage collection technology is a simple electronic device.

3.3 Parametric Results

One of the shortcomings of the non-parametric test is that it does not allow us to control for weights. This is important since we hope to generate results that can be generalized to the Indiana population. The non-parametric test also does not allow us to control for demographic characteristics that differ between the treatment groups. We address these concerns using an ordinary least squares model to estimate the effect of rate design on support.[10]

The results in Panel A of Table 3 (estimated without weights and covariates) are similar to the non-parametric results.[11] In particular, we find that support for the weight and fuel adjusted fees is 7 and 6.7 percentage points lower than for a flat fee when vehicle mileage is collected via self-reporting. We also find that vehicle weight matters for the GPS mode, and that there is no statistically significant effect of rate design when mileage is collected by a basic electronic device. Panel B shows that weights are important for our results; although the estimates remain negative, they are smaller (especially for fuel efficiency) and are statistically indistinguishable from zero. These results are unaffected by the inclusion of covariates; see Tables 11 and 12 in the appendix for alternative specifications.

4 Robustness checks

The results described in the previous section are inconsistent with the general impression that support for a MUF can be improved by designing the MUF to account for a vehicle's fuel economy and weight characteristics. The results are also inconsistent with previous work by Agrawal and Nixon (2017) who find that support for road mileage fees increases substantially when respondents are told that the rate will be adjusted for a vehicle's level of pollution. Therefore, we conducted additional experimental-surveys in an attempt to test the robustness of our findings.

We explore the robustness of four dimensions of our survey in three additional

[10] We find similar results when we estimate the model using a logistic approach. However, we prefer the OLS model since it offers an easier interpretation of the causal effects that we are interested in.

[11] The weights are produced by GFK and designed to ensure that the selected sample is representative of the Indiana's adult population.

experiments that were implemented using subjects recruited from Amazon Mechanical Turk: sample size, experimental design (between-treatment vs within-treatment), tax rate (2-cents versus 1-cent), and terminology (fuel-efficiency adjustment versus pollution-level adjustment). Using mTurk for this type of robustness check is advantageous because it has a large subject pool, which allows us to test the robustness of our findings in a highly controlled environment at low cost. However, this increased flexibility and large sample size are based on convenience rather than representativeness. Therefore, care must be exercised when generalizing the findings of our study to the US population. We label the mTurk studies mTurk I, mTurk II and mTurk III, and describe them below (the questionnaires are available from the authors upon request).

4.1 mTurk I Design

The treatment design is identical to that of the Indiana study described above in that subjects are randomly assigned to one of three groups: flat, weight-adjusted or fuel-adjusted. However, there are some differences from the Indiana study that we highlight below.

Tax Rate and Use of Funds Subjects are given the same information as in the Indiana study, but are also told that the tax would generate $60 billion in revenue annually.

Mileage Collection Technology We limit the mileage-collection technology to the basic electronic device in all of our mTurk studies, which is similar to Agrawal and Nixon (2017). We tell subjects that the device counts the number of miles driven and wirelessly transmits that information to a private company. They are also told that they will not have to pay for the device, and that the device will not collect any data on location.

Remittance Policy This is identical to the Indiana study except that we do not provide any details on enforcement strategies.

Implementation mTurk I was implemented as part of a research project conducted by the authors; that study was implemented two times over the period November 2015 - January 2016 and the mileage experimental-survey was tacked on each time. Subjects were paid a flat fee of $0.50 for completing the mileage survey which took approximately 5 minutes of their time. We randomly assigned 1600 subjects to one of the three rate-design treatments and asked them to state whether they would support a mileage user-fee on a five-point likert scale.

4.2 mTurk II Design

Every element of mTurk II is identical to mTurk I except that mTurk I uses a between-subject design (similar to the Indiana study) while mTurk II uses a within-subject design (similar to Agrawal and Nixon (2017)). mTurk II was implemented as part of a separate research project conducted by the authors between December 2017 and January 2018. Subjects were paid a flat fee of $0.65 for completing the mileage survey which took approximately 5 minutes of their time. We asked 2755 subjects to state whether they would support a mileage user-fee on a five-point likert scale. Because mTurk II uses a within-subject design, we randomize the order in which subjects see a particular treatment in order to control for possible order effects.[12]

4.3 mTurk III Design

mTurk III is identical to mTurk II except for the following design elements. mTurk III is a *2 x 2* design that crosses tax rate level (1-cent vs 2-cents) with tax-rate design (flat-rate vs pollution-adjusted rate). Each subject is randomly assigned to one of two treatment groups: 1-cent tax rate or 2-cent tax rate. Subjects in each treatment group are then asked to state their support for a flat-rate mileage user-fee and a pollution-level adjusted mileage user fee. mTurk III was implemented in July 2019. Subjects were paid a flat fee of $0.65 for completing the mileage survey which took approximately 5 minutes of their time. We asked 1200 subjects to state whether they would support a mileage user-fee on a five-point likert scale. Because the tax-rate design element of mTurk III uses a within-subject design, we randomize the order in which subjects see flat-rate and pollution adjustment in order to control for possible order effects.

5 mTurk Robustness Results

This section describes the mTurk results. We begin with mTurk I, which replicates the Indiana study, before discussing mTurk II and mTurk III, which tests for experimental design, tax rate, and framing.

5.1 mTurk I

Data Summary We restrict the sample in two ways. First, we create a variable that measures the time each subject takes to complete the experimental-survey and drop subjects that are in the bottom and top 5 percent of the duration distribution; (n=174). Second, we restrict the sample to subjects for whom we have non-missing observations

[12] Randomization covers the six possible orders of flat, fuel, weight.

for all covariates (this drops 25 subjects). These restrictions leave us with 1434 subjects evenly distributed across the three treatment groups.[13]

Table 4 presents descriptive results for the mTurk I sample. First, we compare the mTurk I sample to the US population based on data from the American Community Survey. As to be expected, the mTurk sample is different from the US population on a number of observables. The mTurk I sample is younger, more educated and has fewer females than the US population. Additionally, about 43% of the mTurk sample drive fewer than 50 miles per week while 33% drive more than 100 miles per week. More importantly though, we cannot reject that the three treatment groups are balanced on observables.

Results. The left panel of Table 5 reports the level of support for mileage userfees across treatment groups in mTurk I. Support is a binary variable equal to one if subjects support or strongly support and zero otherwise.[14] Approximately 35 percent of the mTurk subjects reported that they would support the adoption of a road mileage userfee where mileage is collected by a private company using a basic electronic device. This is 5 percentage points higher than the support for MUF with the same collection technology in the Indiana sample. Breaking out support by treatment groups shows that fuel-adjustments do not appear to have any effect on support. The estimated treatment effect relative to a flat rate is 1 percentage point, which is both economically and statistically indistinguishable from zero (ranksum test p-value = 0.67). Adjusting the tax rate for vehicle weight increases support, relative to the flat fee, by 4 percentage points. This represents an 11% increase in support from a base of 35% for the flat fee. However, the treatment effect is imprecisely estimated with ranksum p-value = 0.19. Panel A of Table 6 shows that these results continue to hold in a parametric framework, and are largely unaffected by the inclusion of several covariates.

The results obtained in the mTurk I sample are consistent with the Indiana results in that we find no statistical evidence that rate design matters for support. However, the sign and magnitude of the estimates are different. The estimated effects go from −5 in the Indiana sample to +4 and +1 in the mTurk I sample for vehicle-weight and fuel-economy adjustments, respectively.

5.2 mTurk II

We test the robustness of our findings to the experimental-design by switching from a between-subjects design in mTurk I to a within-subjects design in mTurk II. mTurk I and

[13]None of the results presented below are impacted by these data restrictions.

[14]Subjects respond on a five-point scale. Therefore, the opposite of support in this case is oppose, strongly oppose or neutral. We find that about 13% of subjects report being neutral toward the MUF.

mTurk II are identical except for this change. The results from this switch are presented below.

Data Summary We begin by cleaning the mTurk II data in the following ways. First, we drop subjects in the top and bottom 5% of duration (n=284). Second, we drop subjects who said the US president is Michael Jordon (n=71). Third, we drop subjects with duplicated ipaddress (n=69). Finally, we keep subjects for whom we have non-missing observations on all covariates (drops n=27). This leaves us with 2304 subjects.

The mTurk II column of Table 4 again confirms that our sample is younger and more educated that than the US population. We also find that the mTurk sample has the same car ownership rate as the US population. With the exception of education, the two mTurk samples are very similar.

Results. The results presented in the right panel of Table 5 show that approximately 33 percent of subjects in the mTurk II sample support the mileage user-fee.[15] More importantly, we find that rate design matters; especially for fuel-adjusted rates. The estimated treatment effects are 4 and 5 percentage points for weight and fuel, respectively, and both are statistically different from zero (ranksum test p-value < 0.01). It is worth noting that the estimated treatment effect for vehicle-weight adjustment is very similar to the effect obtained in the mTurk I sample.

We find similar results in our parametric framework. The results in Panel B of Table 6 show that the treatment effect remains large, positive and statistically different from zero regardless of estimation model. Column 1 shows results from a linear probability model with no covariates. Next we include race, age, and gender in column 2, followed by education, self-reported weekly mileage, and use of public transportation in column 3. Because every subject responds to every rate design, each subject shows up in the data set three times. This allows us to absorb all non-varying individual characteristics including the ones that we observe in the data set. The results from this fixed-effect model are presented in column 4. None of these adjustments affect our estimated treatment effects.

Order effects. We find some suggestive evidence that order matters. For comparison reasons we restrict the mTurk II sample to two groups of subjects: 1) subjects who responded to the flat-rate treatment directly followed by the fuel-adjusted rate treatment and 2) those who responded to the fuel-adjusted rate treatment directly followed by the flat-rate treatment. Support is 30% and 37% for the flat-rate and fuel-adjusted MUF, respectively, when the fuel-adjusted treatment is presented before the flat-rate

[15] Support is a binary variable equal to one if subjects support or strongly support and zero otherwise. Subjects respond on a five-point scale. Therefore, the opposite of support in this case is oppose, strongly oppose or neutral. We find that about 18% of subjects report being neutral toward the MUF.

treatment. The estimated treatment effect in a linear probability model is 6.3 percentage points ($p - value < 0.01$). The estimated treatment effect is only 1.8 percentage points ($p - value = 0.46$) when the fuel-adjusted treatment is presented after the flat-rate treatment. We find a similar disparity for weight-adjusted treatment; treatment effect is larger when weight-adjusted is presented before the flat-rate treatment.

5.3 mTurk III

Data Summary We first clean the data by removing 34 cases of duplicated IP addresses and 13 subjects who took fewer than 60 seconds to complete the experiment. As a result, our empirical analysis is based on 1163 subjects evenly split between the 1-cent and 2-cents treatments. We then identified subjects for whom the tax rate treatment was salient; i.e., subjects who correctly identified the tax rate specified in the treatment they were randomly assigned to.[16] Approximately 88% of subjects correctly identified their assigned treatment tax rate; 93% in the 2-cent treatment and 84% in the 1-cent treatment.

Summary statistics presented in Table 4 shows that the treatment groups in mTurk III are balanced with respect to observables. The only exception is sex where the 2-cents treatment has about 5 percentage points more female subjects compared to the 1-cent treatment. Importantly, the treatments remain balanced when we restrict the sample to the subjects for whom treatment was salient. We also find that the mTurk II and mTurk III samples are very similar in age, sex, race, education, urban, car ownership and weekly mileage.

Results: pollution vs flat fee. Table 7 reports level of support for the treatment groups as well as p-values from a ranksum test that the treatments had no effect. Approximately 40% of subjects in mTurk III sample support the mileage user-fee. This level of support is 3 and 8 percentage points higher than the support in mTurk I and mTurk II, respectively. However, we find no evidence that support for a MUF depends on the tax-rate design; support for the pollution-adjusted fee is approximately 2 percentage points higher than the flat fee with a p-value of 0.5. We find mixed results when we split the sample by tax rate treatment. On the one hand, subjects in the 2-cent tax rate treatment express the same level of support for both flat-rate and pollution-adjusted mileage user-fees. On the other hand, subjects in the 1-cent treatment are about 4 percentage points more likely to support the pollution-adjusted fee relative to the flat fee. Although we cannot reject the null that the estimate is zero ($p - value = 0.17$), it is

[16] We asked subjects a post-experiment question about the tax rate they saw in the description of the mileage tax. Subjects who got this question correct are labeled attentive and are included in the 'salient' sample.

economically meaningful. These results are robust to restricting the sample to subjects for whom treatment was salient.

We estimate the effect of tax-rate design on support for the MUF using six samples and report the results in Panel A of Table 8. First, using data for the full sample of subjects, we estimate the effect separately for the 1-cent and 2-cent treatments as well as for the pooled-sample of subjects from both treatments. We then repeat this analysis using only subjects for whom treatment was salient. All estimates are from a linear probability model. These results confirm the nonparametric results; support for the pollution-adjusted rate is similar to the flat fee in the mTurk III sample.

Results: pollution vs fuel economy. The results presented above compare pollution-adj. to flat fee using data from mTurk III. However, we are particularly interested in support for fuel-adj. relative to support for pollution-adj. To do this, we append the data from the 2-cents treatment of mTurk III to the data from mTurk II.[17] Next we compare support for the flat-fee with support for pollution-adjustments and fuel-economy adjustments. The results presented in Table 9 show that the treatment effect is the same for both types of adjustments. Support for the MUF in the combined data is 31%, 35% and 37% for flat, fuel-adj. and pollution-adj. rates, respectively. The estimated treatment effects, relative to the flat-rate design, are statistically different from zero at the 1% level. Additionally, we find no statistical difference in support for pollution and fuel-economy adjustments; $p-value = 0.3$. It is not surprising that subjects are equally likely to support fuel and pollution adjustments considering that approximately 63% of subjects in mTurk III correctly associated higher fuel-economy with lower vehicle emissions.[18]

Results: 2-cents vs 1-cent. The results reported in Table 7 and Panel B of Table 8 show that tax rate matters and that it matters more in the pollution-adjusted MUF. When we look at the unconditional means in Table 7 we find that support for the 1-cent MUF is about 8 percentage points higher than for the 2-cent MUF; $p-value < 0.001$. This result continues to hold separately for the flat-rate and pollution-adjusted MUFs; 5

[17] The only difference between these two data sets is that mTurk II uses fuel-economy adjustments while mTurk III uses pollution adjustments. The summary statistics presented in Table 4 show that, except for sex, the two samples are very similar on observables; i.e., the mTurk II sample and the 2-cent treatment of the mTurk III sample.

[18] We included a question at the end of the survey that ask subjects which of two identical cars had the higher emission. The specific question is the following: "John is on the car market for a low polluting vehicle. He has narrowed his options down to two cars. The two cars are identical except one car gets 40 miles per gallon of gasoline while the other car gets 20 miles per gallon of gasoline. Which car should John buy if he wants the car that emits the lower level of pollution?" Approximately 63% of subjects selected the 40 MPG car and 30% responded that John should select either car since they emit the same amount of pollution. Technically, those who selected "either car" are also correct if they interpreted the question to mean emission per gallon of gasoline consumed. Therefore, the share of subjects who correctly link fuel economy to pollution level is likely to be much higher than 63%.

percentage points ($p - value = 0.08$) and 10 percentage points ($p - value < 0.001$) for flat-fee and pollution adjustments, respectively.

The parametric results presented in Panel B of Table 8 support the non-parametric results. Subjects in the full sample are about 11 percentage-points more likely to support a 1-cent MUF relative to a 2-cents MUF. The estimated effect falls to approximately 9 percentage points for a flat-rate MUF and increases to about 13 percentage points for a pollution-adjusted MUF. The pattern of the results remains unchanged when we restrict the sample to subjects for whom treatment was salient although the estimates are modestly smaller.

6 Discussion and Conclusions

The results described in sections 2, 5.1, 5.2, and 5.3, show that support for mileage userfees can be influenced by the design of the tax rates. While Indiana residents appear to dislike mileage userfees that account for vehicle weight and fuel efficiency, our results suggest that this finding is not robust. In particular, we find strong evidence that design matters when we replicate the analysis using a within-subjects design with a larger sample of subjects recruited from mTurk. Additionally, we find that support for a pollution-adjusted fee is similar to support for a fuel-economy-adjusted fee, which suggest that subjects view both types of adjustments equally. Finally, our results confirm the expectation that support is decreasing in the tax rate.

We argue in this section that the most policy relevant results are those from the mTurk samples. The one-shot between-subjects design of mTurk I allows us to capture subjects' true opinion of each type of the rate designs. The within-subjects design of mTurk II and III allows us to identify the effect of rate design conditional on exposure to alternative rate designs. The mTurk II and III samples also most closely resemble the likely flow of information to voters in the real world debate about mileage user-fees. In particular, we suspect that voters will be exposed to all of the design options in a real-world debate. If true, then the results from the mTurk II and III samples suggest that policymakers can influence public support for mileage user-fees through careful consideration of the choice of tax rate level and design.

However, our findings do not support the idea that rate structure alone can speed up the adoption of mileage user-fees. This is because public support for the mileage user-fee remains low even after accounting for the extra boost in support induced by the choice of rate design. Support for the MUF is less than 50% across the four experimental surveys. This is an important finding considering that the administrative details presented to subjects arguably represent the best case for the MUF: revenues dedicated to roads, privately administered, no information about when or where miles are driven, free electronic mileage-collection device, and low tax rate.

One avenue worth exploring in the effort to improve support for MUFs is information about actual fuel tax liability and projected mileage tax liability. Existing evidence shows that many drivers do not know what the federal and state fuel tax rates are (Fisher and Wassmer 2017). As a result, people generally do not know their fuel tax liability and often overestimate how much fuel taxes they pay (Fisher and Wassmer 2017). These misperceptions have been shown to reduce voters' willingness to pay more for transportation infrastructure spending. Therefore, an information campaign that includes the actual costs to taxpayers might be a fruitful strategy for improving support.

Another avenue for future exploration is to provide information about the pros and cons of a MUF. For example, the increased saliency of a mileage user-fee relative to a fuel tax is expected to reduce vehicle miles traveled, which could reduce both congestion and carbon emissions. We would expect this positive effect of a MUF to increase the level of support across all types of MUFs. Therefore, the level of support is likely affected by the amount of information that people have about the pros and cons of the MUF. We believe that future work should consider exploring the impact of these information treatments on support for MUFs.

7 Disclosures

The authors have no financial arrangements that might give rise to conflicts of interest with respect to the research reported in this paper

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8 Tables and Figures

Table 1: Summary Statistics for Indiana Sample

Variable	Treatment			Total	**CPS**
	Flat	Weight	Fuel		
Male	44.35	47.18	48.31	46.7	47.19
Age					
Age 18-29	16.65	17.17	20.98	18.31	20.12
Age 30-44	26.19	25.09	27.08	26.11	25.47
Age 45-59	29.52	23.88	28.84	27.31	27.3
Age 60+	27.64	33.86	23.11	28.27	27.12
Race					
White	87.23	86.26	79.19	84.13	84.38
Black or Hispanic	10.95	11.87	18.1	13.72	13.51
Other or 2+ Races	1.818	1.873	2.71	2.143	2.11
Metro	76.11	71.38	77.29	74.86	74.82
Education					
Less than HS or HS	46.3	48.16	45.18	46.57	47.98
Some College	30.56	27.54	31.09	29.68	29.15
Bachelor or higher	23.14	24.3	23.73	23.75	22.87
Income					
Under $25,000	15.06	16.42	20.08	17.26	17.4
$25,000-$49,999	23.93	23.44	25.34	24.24	23.68
$50,000-$74,999	17.93	20.33	17.64	18.67	18.74
$75,000 and above	43.08	39.81	36.94	39.83	40.18
Marital Status					
Married	62.36	61.41	57.31	60.3	
Prev_mar	8.181	14.52	14.01	12.4	
Single	29.46	24.07	28.68	27.3	
HH Size					
1	10.47	15.52	18.14	14.87	
2	41.67	44.23	36.4	40.76	
3	23.77	13.71	16.91	17.9	
4	15.33	16.31	14.7	15.46	
5	8.756	10.23	13.84	11.01	
Working	53.39	55.95	55.15	54.89	
Annual Mileage					
<5k	25.13	26.65	22.74	24.84	
5k-9k	22.5	22.88	31.6	25.75	
9k-13k	27.41	26.61	23.64	25.83	
>13k	24.97	23.87	22.02	23.57	

Notes: CPS is the March 2014 Current Population Survey supplement data for Indiana.

Table 2: Support for mileage userfee by rate design in Indiana

Feedesign	Self-Reporting	Basic	GPS	N. Obs.
	Panel A: Share of supporters			
Total	0.24	0.30	0.27	977
	(0.02)	(0.02)	(0.02)	
	Panel B: Support by Fee-design			
Flat Fee	0.27	0.32	0.29	300
	(0.04)	(0.04)	(0.04)	
Weight Adj.	0.25	0.30	0.27	345
	(0.03)	(0.04)	(0.04)	
Fuel Adj.	0.20	0.29	0.25	332
	(0.03)	(0.03)	(0.03)	
	Panel C: Ranksum test (p-values)			
Flat vs Weight	0.05	0.18	0.02	
Flat vs Fuel	0.06	0.18	0.23	

Notes: Panel A reports the mean level of support for mileage user-fees by mileage-collection mode. *Self-Reporting* indicates that vehicle miles traveled (VMT) are collected via self-reported odometer readings; *Basic* indicates the VMT is collected via an electronic device; and *GPS* indicates that VMT are collected via a device that is capable of tracking location and time of travel. Panel B reports the mean level of support for each mileage collection mode by fee-design. *Flat Fee* indicates that VMT are taxed at 2 cents per mile with no adjustment for vehicle types. *Weight Adj.* indicates that VMT are taxed at an average rate of 2 cents per mile with adjustments for vehicle weight; heavier vehicle pay more than lighter vehicles. *Fuel Adj.* indicates that vehicle mileage are taxed at an average rate of 2 cents per mile with adjustments for vehicle fuel efficiency; more fuel efficient vehicles pay a lower rate than less fuel efficient vehicles. Panel C reports the p-values from a ranksum test that compares support for each of the adjusted rates to support for flat rates. Standard deviations are in parentheses.

Table 3: Treatment effect of rate design in Indiana sample

	Self-Reporting	Basic	GPS
	Panel A: Unweighted		
Constant	0.320***	0.367***	0.330***
	(0.027)	(0.028)	(0.027)
Weight	-0.071**	-0.051	-0.081**
	(0.036)	(0.037)	(0.036)
Fuel	-0.067*	-0.050	-0.044
	(0.036)	(0.038)	(0.037)
F	2.365	1.166	2.543
R2	0.005	0.002	0.005
	Panel B: Weighted		
Constant	0.273***	0.322***	0.287***
	(0.036)	(0.038)	(0.037)
Weight Adj.	-0.027	-0.018	-0.015
	(0.050)	(0.053)	(0.051)
Fuel Adj.	-0.068	-0.036	-0.037
	(0.047)	(0.051)	(0.049)
F	1.123	0.249	0.298
R2	0.004	0.001	0.001

Notes: Reported is the treatment effect of fee design on support for mileage userfee by mileage-collection mode using OLS; Panel B includes sample weights. The dependent variable is a binary variable equal to 1 if support mileage user fee and zero otherwise. *Weight Adj.* indicates that VMT are taxed at an average rate of 2 cents per mile with adjustments for vehicle weight; heavier vehicle pay more than lighter vehicles. *Fuel Adj.* indicates that vehicle mileage are taxed at an average rate of 2 cents per mile with adjustments for vehicle fuel efficiency; more fuel efficient vehicles pay a lower rate than less fuel efficient vehicles. *Self-Reporting* indicates that vehicle miles traveled (VMT) are collected via self-reported odometer readings; *Basic* indicates the VMT is collected via an electronic device; and *GPS* indicates that VMT are collected via a device that is capable of tracking location and time of travel. Number of observations is 977 in all specifications. Standard errors are in parentheses; * Significant at the 10 percent level. ** Significant at the 5 percent level. *** Significant at the 1 percent level.

Table 4: Summary Statistics for mTurk Samples

Variable	mTurk I				mTurk II	mTurk III			**ACS**
	Flat	Weight	Fuel	Total	Total	1-Cent	2-Cent	Total	
Female	43.13	46.82	45.47	45.14	47.83	52.20	56.45	54.33	49.2
Age: 18-24	11.63	15.89	14.44	13.98	9.90	11.32	9.49	10.41	12.5
Age: 25-44	70.82	65.47	67.89	68.06	66.58	60.45	64.67	62.55	34.1
Age: 45-59	13.53	15.25	13.15	13.98	17.23	20.38	19.16	19.77	25.8
Age: 60+	4.02	3.39	4.53	3.97	6.29	7.84	6.68	7.26	27.6
White	80.55	81.36	79.53	80.48	78.13	74.69	75.96	75.33	72.6
Education: upto HS	15.22	14.19	14.22	14.55	9.90	12.30	10.28	11.29	39.8
Education: Some College	35.31	36.23	35.99	35.84	34.94	27.07	30.49	28.78	20.6
Education: B.Sc. or higher	49.47	49.58	49.78	49.61	55.16	60.63	59.23	59.93	39.6
Weekly miles: <50	45.03	42.37	40.09	42.51	42.71	44.82	43.90	44.36	
Weekly miles: 50-100	24.95	23.31	25.43	24.56	26.30	27.07	27.35	27.21	
Weekly miles: >100	30.02	34.32	34.48	32.93	30.99	28.12	28.75	28.43	
Transport									
Frequent	12.47	12.92	10.13	11.85					
Not so frequent	11.63	10.81	14.22	12.21					
Not Frequent	75.90	76.27	75.65	75.94					
Public Transportation					63.00	64.32	62.02	63.17	
Urban					52.00	50.26	47.91	49.08	
Own car					92.00	91.92	92.33	92.13	91.3

Notes: Reported is the mean (in percent) of each variable by sample and treatment group. ACS is the 2016 American Community Survey data. mTurk I uses a between-subject design. *Flat* indicates that VMT are taxed at 2 cents per mile with no adjustment for vehicle types. *Weight* indicates that VMT are taxed at an average rate of 2 cents per mile with adjustments for vehicle weight; heavier vehicle pay more than lighter vehicles. *Fuel* indicates that vehicle mileage are taxed at an average rate of 2 cents per mile with adjustments for vehicle fuel efficiency; more fuel efficient vehicles pay a lower rate than less fuel efficient vehicles. Summary statistics are shown for the full sample in mTurk II because mTurk uses a within subject design. mTurk III uses a between design to check for the effect of tax rate. *1-cent* indicates subjects are exposed to a MUF with a tax rate of 1-cent per mile. *2-cent* indicates subjects are exposed to a MUF with a tax rate of 2-cent per mile.

Table 5: Support for mileage userfee by rate design in mTurk samples

	mTurk I			mTurk II		
	Support	p-value (vs Flat)	N. Obs	Support	p-value (vs Flat)	N. Obs
Total	0.37	–	1409	0.33	–	2,304
	(0.48)			(0.47)		
Flat Fee	0.35	–	473	0.30	–	2,304
	(0.48)			(0.46)		
Weight Adj.	0.39	0.19	472	0.34	0.00	2,304
	(0.49)			(0.47)		
Fuel Adj.	0.36	0.67	464	0.35	0.00	2,304
	(0.48)			(0.47)		

Notes: Reported is the share of subjects who support mileage user fees by fee design and mTurk Sample. The two mTurk designs are identical except that mTurk I adopts a between-subject design while mTurk II adopts a within-subject design. *Flat Fee* indicates that VMT are taxed at 2 cents per mile with no adjustment for vehicle types. *Weight Adj.* indicates that VMT are taxed at an average rate of 2 cents per mile with adjustments for vehicle weight; heavier vehicle pay more than lighter vehicles. *Fuel Adj.* indicates that vehicle mileage are taxed at an average rate of 2 cents per mile with adjustments for vehicle fuel efficiency; more fuel efficient vehicles pay a lower rate than less fuel efficient vehicles. Reported p-values are from a ranksum test that compares support for each of the adjusted rates to support for flat rates. Standard deviations are in parentheses.

Table 6: Treatment effect of rate design in mTurk samples

	Panel A: mTurk I			
	Model 1	Model 2	Model 3	
Constant	0.351***	0.370***	0.461***	
	(0.022)	(0.052)	(0.081)	
Weight	0.041	0.041	0.041	
	(0.031)	(0.031)	(0.031)	
Fuel	0.013	0.013	0.018	
	(0.031)	(0.031)	(0.031)	
F	0.881	0.578	2.986	
R2	0.001	0.002	0.026	
N. Obs.	1,409	1,409	1,409	
	Panel B: mTurk II			
	Model 1	Model 2	Model 3	Model 4
Constant	0.304***	0.356***	0.289***	0.299***
	(0.021)	(0.034)	(0.046)	(0.007)
Weight	0.045***	0.045***	0.045***	0.045***
	(0.010)	(0.010)	(0.010)	(0.012)
Fuel	0.053***	0.053***	0.053***	0.053***
	(0.010)	(0.010)	(0.010)	(0.013)
F	4.857	5.090	5.435	10.595
R2	0.003	0.008	0.019	0.661
N. Obs.	6,912	6,912	6,912	6,912
N. Subjects	2304	2304	2304	2304
Controls	No	Yes	Yes	No
Fixed effects	No	No	No	Yes

Notes: Reported is the treatment effect of fee design on support for mileage userfee by mTurk sample using OLS. The dependent variable is a binary variable equal to 1 if support mileage user fee and zero otherwise. The two mTurk designs are identical except that mTurk I adopts a between-subject design while mTurk II adopts a within-subject design. *Weight Adj.* indicates that VMT are taxed at an average rate of 2 cents per mile with adjustments for vehicle weight; heavier vehicle pay more than lighter vehicles. *Fuel Adj.* indicates that vehicle mileage are taxed at an average rate of 2 cents per mile with adjustments for vehicle fuel efficiency; more fuel efficient vehicles pay a lower rate than less fuel efficient vehicles. Model 1 has no covariates. Model 2 controls for age, gender, and race. Model 3 additionally controls for education, self-reported annual mileage, and use of public transport. Model 4 includes individual fixed effects. Robust standard errors (in parentheses) are reported in Panel A and standard errors are clustered at the individual level in Panel B; * Significant at the 10 percent level. ** Significant at the 5 percent level. *** Significant at the 1 percent level.

Table 7: Support for mileage userfee by rate design in mTurk III sample

	Support			P-Value:
	1-Cent	2-Cent	Total	1-Cent v. 2-Cents
Flat Fee	0.42	0.37	0.39	0.08
	(0.49)	(0.48)	(0.49)	
Pollution Adj.	0.46	0.36	0.41	0.00
	(0.50)	(0.48)	(0.49)	
Total	0.44	0.36	0.40	0.00
	(0.50)	(0.48)	(0.49)	
P-value: Pollution v. Flat	0.17	0.70	0.50	
N. Obs	482	533	1015	

Notes: Reported is the share of subjects who support mileage user fees by fee design and tax rate. The sample is restricted to subjects for whom the tax rate treatment was salient. The tax rate level is between-subjects while the tax rate design is within-subjects. *Flat Fee* indicates that VMT are taxed at a flat rate of 1-cent or 2-cents per mile with no adjustment for vehicle types. *Weight Adj.* indicates that VMT are taxed at an average rate of 1 or 2 cents per mile with adjustments for vehicle weight; heavier vehicle pay more than lighter vehicles. *Pollution Adj.* indicates that VMT are taxed at an average rate of 1 or 2 cents per mile with adjustments for vehicle emission; high pollution vehicles pay a higher rate than low polluting vehicles. Reported p-values are from a ranksum test that compares support for each of the adjusted rates to support for flat rates. Standard deviations are in parentheses.

Table 8: Treatment effect of rate design in mTurk III sample

	Full Sample			Rate Salience		
	Panel A: Effect of Pollution Adjustment					
	Pooled	2-Cents	1-Cent	Pooled	2-Cents	1-Cent
Constant	0.419***	0.391***	0.376***	0.339***	0.231***	0.414***
	(0.073)	(0.103)	(0.112)	(0.079)	(0.106)	(0.117)
Pollution Adj.	0.017	-0.005	0.039	0.015	-0.011	0.044
	(0.020)	(0.028)	(0.029)	(0.022)	(0.029)	(0.032)
F	5.661	3.715	3.708	2.987	3.575	1.336
R-Sqd	0.036	0.043	0.045		0.044	0.021
N. Obs.	2,286	1,148	1,138	2,030	1,066	964
	Panel B: Effect of Tax Rate					
	Pooled	Flat	Pollution	Pooled	Flat	Pollution
Constant	0.366***	0.311***	0.356***	0.294***	0.300***	0.312***
	(0.073)	(0.108)	(0.108)	(0.079)	(0.108)	(0.108)
1-cent	0.111***	0.088***	0.133***	0.082***	0.054***	0.110***
	(0.020)	(0.029)	(0.029)	(0.022)	(0.031)	(0.031)
F	7.933	3.747	4.654	4.008	2.103	2.518
R-Sqd	0.048	0.047	0.056	0.028	0.030	0.035
N. Obs.	2,286	1,143	1,143	2,030	1,015	1,015

Notes: Reported is the treatment effect of tax rate and fee design on support for mileage userfee by mTurk sample using linear probability model. The dependent variable is a binary variable equal to 1 if support mileage user fee and zero otherwise. *Rate Salience* is the sample of subjects for whom the tax-rate treatment was salient. Panel A reports the effect of tax-rate level (1-cent vs 2-cents) on support. Results are presented separately for flat-rate and pollution-adj. rate designs. *Flat* indicates that VMT are taxed at a flat rate of 1 or 2 cents per mile with no adjustment for vehicle types. *Pollution* indicates that VMT are taxed at an average rate of 1 or 2 cents per mile with adjustments for vehicle emission; high pollution vehicles pay a higher rate than low polluting vehicles. Panel B reports the effect of tax-design on support. Results are presented separately for the 1-cent and the 2-cents samples. All of the models include age, sex, education, race, urban, car ownership, access to public transport, and weekly mileage. Robust standard errors are in parentheses; * Significant at the 10 percent level. ** Significant at the 5 percent level. *** Significant at the 1 percent level.

Table 9: Support for Pollution v. Fuel economy adjustments

	Flat	Fuel	Pollution
Mean	0.31	0.35	0.37
Std. Dev.	0.46	0.48	0.48
N. Obs.	2878	2304	574
P-Value (vs. Flat)	.	0.01	0.01
P-Value: Pollution v Fuel		0.30	

9 Appendix I

Table 10: Ranksum P-Values

Variable	Flat vs Weight	Flat vs Fuel	Fuel vs Weight
Age	0.70	0.43	0.78
Male	0.33	0.95	0.34
White	0.08	0.06	0.89
Married	0.42	0.87	0.51
Urban	0.88	0.73	0.61
Working	0.78	0.56	0.37
Income	0.91	0.56	0.62
Household Size	0.82	0.58	0.75
Mileage	0.30	0.69	0.11
Education	0.66	0.55	0.86

Notes: Reported are the p-values of a ranksum test comparing the observable characteristics of the treatment groups in the Indiana sample. *Flat Fee* indicates that VMT are taxed at 2 cents per mile with no adjustment for vehicle types. *Weight Adj.* indicates that VMT are taxed at an average rate of 2 cents per mile with adjustments for vehicle weight; heavier vehicle pay more than lighter vehicles. *Fuel Adj.* indicates that vehicle mileage are taxed at an average rate of 2 cents per mile with adjustments for vehicle fuel efficiency; more fuel efficient vehicles pay a lower rate than less fuel efficient vehicles. Age is continuous; Male, White, Married, Urban, and Working are binary variables; the remaining variables are categorical variables.

Table 11: Impact of rate design on support for mileage userfee; weighted

Treatment	Model 1	Model 2	Model 3	Model 4
		Panel A: Odometer		
Weight	-0.027	-0.026	-0.027	-0.026
	(0.050)	(0.050)	(0.050)	(0.049)
Fuel	-0.068	-0.077	-0.077*	-0.071
	(0.047)	(0.047)	(0.047)	(0.048)
		Panel B: Basic		
Weight	-0.018	-0.016	-0.017	-0.022
	(0.053)	(0.052)	(0.053)	(0.052)
Fuel	-0.036	-0.047	-0.043	-0.044
	(0.051)	(0.051)	(0.051)	(0.051)
		Panel C: GPS		
Weight	-0.015	-0.015	-0.015	-0.013
	(0.051)	(0.051)	(0.052)	(0.052)
Fuel	-0.037	-0.050	-0.050	-0.052
	(0.049)	(0.049)	(0.049)	(0.049)

Notes: Reported is the treatment effect of fee design on support for mileage userfee by mileage-collection mode using OLS. The dependent variable is a binary variable equal to 1 if support mileage user fee and zero otherwise. *Weight Adj.* indicates that VMT are taxed at an average rate of 2 cents per mile with adjustments for vehicle weight; heavier vehicle pay more than lighter vehicles. *Fuel Adj.* indicates that vehicle mileage are taxed at an average rate of 2 cents per mile with adjustments for vehicle fuel efficiency; more fuel efficient vehicles pay a lower rate than less fuel efficient vehicles. *Odometer* indicates that vehicle miles traveled (VMT) are collected via odometer readings; *Basic* indicates the VMT is collected via an electronic device; and *GPS* indicates that VMT are collected via a device that is capable of tracking location and time of travel. Model 1 does not include any covariates. Model 2 includes age, gender, and race. Model 3 additionally includes education and self-reported annual mileage. Model 4 adds marital status, household size, income, and whether or not working. Number of observations is 977 in all specifications. Standard errors are in parentheses; * Significant at the 10 percent level. ** Significant at the 5 percent level. *** Significant at the 1 percent level.

Table 12: Impact of rate design on support for mileage userfee; unweighted

	Model 1	Model 2	Model 3	Model 4
	Odometer			
Weight	-0.071**	-0.073**	-0.068*	-0.071**
	(0.036)	(0.036)	(0.036)	(0.035)
Fuel	-0.067*	-0.071*	-0.070*	-0.074**
	(0.036)	(0.036)	(0.036)	(0.036)
	Basic			
Weight	-0.051	-0.053	-0.049	-0.051
	(0.037)	(0.037)	(0.037)	(0.037)
Fuel	-0.050	-0.056	-0.056	-0.057
	(0.038)	(0.038)	(0.038)	(0.038)
	GPS			
Weight	-0.081**	-0.085**	-0.081**	-0.082**
	(0.036)	(0.036)	(0.036)	(0.036)
Fuel	-0.044	-0.051	-0.051	-0.052
	(0.037)	(0.037)	(0.037)	(0.037)

Notes: Reported is the treatment effect of fee design on support for mileage userfee by mileage-collection mode using OLS. The dependent variable is a binary variable equal to 1 if support mileage user fee and zero otherwise. *Weight Adj.* indicates that VMT are taxed at an average rate of 2 cents per mile with adjustments for vehicle weight; heavier vehicle pay more than lighter vehicles. *Fuel Adj.* indicates that vehicle mileage are taxed at an average rate of 2 cents per mile with adjustments for vehicle fuel efficiency; more fuel efficient vehicles pay a lower rate than less fuel efficient vehicles. *Odometer* indicates that vehicle miles traveled (VMT) are collected via odometer readings; *Basic* indicates the VMT is collected via an electronic device; and *GPS* indicates that VMT are collected via a device that is capable of tracking location and time of travel. Model 1 does not include any covariates. Model 2 includes age, gender, and race. Model 3 additionally includes education and self-reported annual mileage. Model 4 adds marital status, household size, income, and whether or not working. Number of observations is 977 in all specifications. Standard errors are in parentheses; * Significant at the 10 percent level. ** Significant at the 5 percent level. *** Significant at the 1 percent level.