"Does Perception of Gasoline Taxes Paid Influence Support for a State Gas Tax Increase for Highway Improvements? Evidence from California and Michigan"[1]

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Abstract

This research compares the actual magnitude of fuel taxes to the perceptions of these amounts. The issue is whether misperceptions about fuel taxes are contributing to voter perspectives about transportation finance and investment issues. A survey of likely California and Michigan voters shows that taxpayers often overestimate the amount they pay in fuel taxes. Considering a worst-case scenario of miles traveled in a year by a typical driver, about half of the California poll respondents overestimate the magnitude of monthly state gas taxes paid by a typical driver in the state; while about three-quarters of Michigan poll respondents overestimate the same magnitude for their state. Logistic regression analysis shows that voter (mis)perceptions regarding the magnitude of state fuel taxes do affect their views regarding highway revenue and investment proposals. Therefore, a reasonable policy implication from this research it that proposals to generate additional revenue for highway investment are likely to have more success if accompanied by a public education campaign concerning the gasoline taxes actually paid in a state and the reality of the magnitude paid by the state's typical driver.

[1] Please do not cite or quote without the authors' permission. The Michigan Infrastructure and Transportation Association provided the financial support necessary to conduct the Michigan poll that is the basis of this state's portion of the research. The Field Poll award of survey questions for a California State University faculty provided the opportunity to place similar questions on their California-wide poll that is the basis for this state's portion of this research. The Association or Field took no role in designing or selecting the issues covered in these polls or the specific questions asked. The results or opinions expressed here do not necessarily represent the views of the Association or Field. We presented this paper at the 15th Annual APSA Conference on State Politics and Policy Conference at California State University, Sacramento in May 2015 and at the IIPF congress in Dublin, Ireland in August 2015. We are grateful to the helpful comments offered by Nicholas Pyeatt, John Anderson, Bill Fox, and other participants at these sessions.

I. Introduction

Three aspects of state and local government transportation policy are recently apparent: (1) changes in vehicle technology are making fuel taxes less attractive as a means of financing highway investment and use, (2) measures of road/bridge age and quality suggests substantial interest in increasing maintenance or replacement, and (3) transportation congestion continues to worsen. Such features have induced state and local governments in the United States to consider raising additional revenue for transportation purposes, and using alternatives to traditional fuel excise taxes for transportation funding. Surveys of public opinion suggest that the majority of the public favor increased transportation investment. Yet, at the same time, both the public and the officials representing them, very often oppose increases in fuel tax rates. There exists, furthermore, widespread skepticism regarding the desirability of pursuing an increased reliance on alternative revenue sources for desired highway repair; including forms of mileage-based fees

Previous examinations support these fundamental facts of the state of transportation funding and infrastructure. In its 2011 report, the Minnesota Mileage-Based User Fee Policy Task Force noted that vehicles are increasingly using less gasoline or diesel fuel, and in addition, the number of non-petroleum-powered vehicles is rising and expected to continue. Consequently, the task force notes, "… fuel consumption – and associated fuel tax collections – has lagged the growth in vehicle miles traveled" (p. 4). In its report on transportation conditions for 2010, the Federal Highway Administration estimated that achieving all cost-beneficial investments in highways would require annual expenditure of $170 billion through 2028, 86.6 percent more than actual spending in 2008 (p. 9). In its infrastructure report card for 2013, the American Society of Civil Engineers reported, "Forty-two percent of America's major urban highways are congested … costing the U.S. economy $101 billion in wasted fuel…." The issue, of course, is how to deal with these trends.

Michigan's Governor Rick Snyder (a Republican) recently proposed increasing annual state-local capital expenditure for highways by $1 billion, essentially doubling annual highway capital investment that would cost an additional $10 per month for each Michigan driver. In May 2015, voters in Michigan soundly rejected (71% opposed) a legislative proposal to increase the state's sales tax from 6 to 7 percent that would have implemented the governor's suggested increase. Subsequently, the issue of generating funds for increased transportation capital investment in Michigan has continued to receive consideration by the governor and legislature, although at the time of this writing there has been no resolution.

The 2013 version of the American Society of Civil Engineers report card for America's infrastructure identified the need for at least $10 billion per year in additional spending for ongoing maintenance of existing transportation facilities (broader than just roads) in California. The Fix Our Road Coalition of California business and local government officials pegs $6 billion as the annual funding needed for road and highway fixes (SFGate, 2015). This implies, like Michigan, California requires additional transportation capital expenditures of anywhere between $5 and $10 billion annually, approximately $10 to $20 per driver, per month. Given this context, in September 2015, California Governor Jerry Brown (a Democrat) proposed adding an annual charge of $65 for every driver, and raising the state's gasoline excise tax by $0.06 for gas and $0.11 for diesel. Respectively, the enhanced revenue expected from these is an additional $2 billion and $1 billion for California road repair and maintenance. In addition, Governor Brown suggests using an additional $500 million in cap and trade funds, and $100 million of existing transportation funds for this. This increase of $3.6 billion being in response to a bipartisan realization of the need for this repair and maintenance; though it appears that the state's Republicans will balk at the idea of a new fee and gas tax to this, and thus, the necessary two-thirds majority to achieve passage in California's Legislature is not likely to happen.

Casual observation also indicates that beliefs regarding the magnitude of federal and state fuel taxes affect opinions regarding the desirability of paying for additional road investment through an increase in taxes or other sources. Thus, the issue for this research is whether misperceptions about fuel taxes contribute to one's willingness to fund increased transportation investment. To do this, we first describe the reality of the magnitude (per month, per year, per mile) of fuel taxes and alternative mileage fees. A survey of California and Michigan voters then allows us to examine the perceptions of these same amounts. The influence of gas tax perceptions on opinions expressed regarding support for further transportation investment are then analyzed using variations of the regression analyses of Fisher (1985) and Slemrod (2006). We conclude with policy implications drawn from these findings.

II. Previous Opinion Polls

A number of previous opinion polls examine individual attitudes toward transportation funding and fuel taxes. The national Reason-Rupe Poll, in 2011, found that only 6 percent identified the quality of the area of residence's transportation system as "excellent," and 49 percent believed that congestion has "gotten worse." Accordingly, 62 percent wanted government to "prioritize funding for roads and highways." The poll, however, also reported that 77 percent opposed increasing the federal gasoline tax, although a majority favored targeting road and highway projects. For new highway construction, 58 percent favored funding by tolls and only 28 percent by tax increases.

An April 2013 Gallup Poll for the United States found that 66 percent opposed increases in state gasoline taxes even if the funds were to improve roads, bridges, and public transportation. In analyzing those results, the Gallup researcher suggested a likely relationship between a responder's opposition to a gas tax and concern over the magnitude of gasoline prices in general (suggested by responses to other questions). This suggests that individuals may be

confusing gasoline prices overall with the component due to fuel taxes. Furthermore, several polls in New Jersey in 2014 similarly found that 65 percent of respondents were opposed to increasing the state gasoline tax. Even after being informed that the state's tax rate was the third lowest among all the states (although not identifying the amount), 60 percent remained opposed. Duncan and colleagues (2014) report the results of a 2013 nationally representative survey concerning individual attitudes about the use of a mileage-based user fee as an alternative to gasoline excise taxes. They find that only between 21 and 13 percent of the poll's participants support a mileage-based fee for transportation funding. Greater support occurs if odometer readings form the basis of the fee, while more technological-based measurements resulted in less support. However, in any of these previous surveys, respondents received no information on the magnitude of the gas tax they currently face (rates or amounts), nor were they surveyed about what respondents thought those amounts were.

Boyer (2010) notes an exception to not informing poll respondents of the magnitude of existing gas taxes that occurred in a 2008 survey of Michigan residents. A willingness-to-pay question indicated that the state's excise tax was $0.19 per gallon. Still, a majority of respondents indicated a willingness to pay of zero in additional excise tax to improve roads in Michigan, even though respondents from the populated urban area of southeast Michigan overwhelming identified road quality as "fair" or "poor."

Duncan and colleagues (2014) use survey data to examine public attitudes about mileage user fees. In this survey, 79 percent oppose adoption. Extending the work of Agrawal and Nixon (2013), they report that perceived invasion of privacy and out-of-pocket adoption costs reduce support for mileage fees. If costs are misperceived, support for this financing option is reduced.

III. Tax Perceptions and Behavior

Previous research on other tax issues has shown that inaccurate perceptions about the amount and/or distribution of taxes may influence voters to support positions that are not in their self-interest. Long ago, Schmoelders (1959) argued that perceptions were important for public finance issues, what he called "fiscal psychology." For instance, Fisher (1985) found that political positions, rather than individual economic circumstances, explained responses to survey questions about simultaneous increases in taxes and public expenditures. Responses to this question were generally inconsistent with what would be expected based on net fiscal residuals as calculated by economists. Instead, measures of the respondent's political party, region, and race explained much of the variation in support for various expansions of government activity.

Sheffrin (1994) summarized studies showing that taxpayers often underestimate both average and marginal income tax rates. Slemrod (2006) found that misconceptions about tax incidence were important in explaining public support for a flat-rate income tax and the general sales tax. Specifically, many individuals believed that high-income individuals would pay more with a sales tax or a flat-rate income tax than they do with the current progressive federal income tax. Such misperceptions stem from a less than full comprehension of the degree of tax avoidance and tax evasion, among other factors.

Most recently, Chetty and coauthors have explored the implications of behavioral economics for public finance. Individuals may not respond to some types of incentives, including those through taxation or public programs, partly because they may not be aware of the incentive effects. Pursuing their own self-interest, they do not take the time and effort to consider the possibility of these effects to their own behavior. For instance, Chetty, Looney, and Kroft (2009) find that the method of sales tax collection (whether the tax is included in the price or applied at the register) has important implications for how consumers respond. Similarly, Goldin and Homonoff (2013) find that only low-income consumers change behavior in response

to cigarette taxes levied at sale, whereas all consumers respond to taxes included in the price. These results have direct application to transportation finance, particularly the difference between gasoline excise taxes imbedded in retail gasoline prices as opposed to direct user fees.

IV. The California and Michigan Polls

We contracted with Epic-MRA, a private professional polling firm located in Lansing, Michigan, to add our questions about highway use and perceptions of highway finance to one of the firm's regular statewide opinion polls. Thus, our questions were a subset of the full set of questions asked in this general poll, which also included a number of questions about political races in the state. Conducted in August 2014, the poll was a telephone survey of 600 likely voters, using a random-dial technique to produce a poll sample representative of the state. We received survey weights that align the sample of respondents to the distribution of Michigan voters by race/ethnicity, geography, party registration, and other demographic characteristics.

We also entered into a competition open to California State University faculty to place questions on an upcoming California-wide poll regularly conducted by the Field Research Corporation. Field has conducted independent and non-partisan surveys of Californians since 1947. We received this award, and placed the same questions as used in Michigan on a February 2015 Field Poll of 1,241 randomly selected registered voters in California. Similar to the Michigan poll, survey weights exist for this poll.

Two results from both the California and Michigan polls standout. First, the contrast between favoring additional highway investment and opposing additional financing seen in numerous previous surveys also exists in these polls. Table 1 offers the results for three questions concerning highway expenditure preferences. In California and Michigan there is strong support for improving highway quality and some support for greater quantity through additional investment: 71 percent of California respondents favor more spending on road

maintenance and 89 percent in Michigan. Fifty percent favor more spending on construction of new roads in California and 41 percent in Michigan. On the other hand, 42 percent of California survey participants and 43 percent in Michigan responded "nothing" when asked how much they were willing to pay for additional road investment. However, a majority (54 percent in California and 53 percent in Michigan) was willing at least to pay some additional amount to fund road investment, although the median amounts for both states were less than $5 per month. Although not reported in Table 1, the majority of California respondents opposed (55 percent oppose, 38 percent support, and 7 percent no opinion) the use of toll roads as a method to fund road improvements, as did a near majority of Michigan respondents (49 percent oppose, 45 percent support, and 6 percent no opinion). Similar opinions exist for the use of an electronic device to measure miles for a mileage-based fee. In California, 66 percent oppose this technology, with only 30 percent supporting and 4 percent offering no opinion, whereas the corresponding results for the Michigan survey were 68 percent opposing, 24 percent supporting, and 8 percent no opinion. Voters in these two states overwhelmingly support additional spending, but not additional or new funding to the same degree.

Second, taxpayers greatly overestimate the amount they pay in fuel taxes. The Michigan fuel excise tax is $0.19 per gallon of gasoline. If a typical driver travels 12,000 to 13,000 miles per year at 21.5 miles per gallon, the excise tax cost is about $9 to $10 per month (or equivalently $108 to $120 per year). Adding the $0.184 federal excise tax, the amount essentially doubles (less than $20 per month). Figure 1 illustrates the monthly state excise tax cost in Michigan for various combinations of miles traveled and vehicle fuel efficiency. For the "worst case" possibility—someone traveling 20,000 miles per year in a vehicle that gets only 15 miles per gallon—the monthly tax cost is about $21. The California fuel excise tax is $0.425 per gallon of gasoline, including the embedded sales tax. As shown in Figure 2, the "worst case"

possibility for California—someone traveling 20,000 miles per year in a vehicle that gets only 15 miles per gallon—is a monthly tax cost of about $47.

The surveys asked respondents to "Consider the average or typical driver in California/Michigan, who might be different than you. How much would you estimate that the average driver in California/Michigan pays in state gasoline tax each month?" As shown in Table 2, 46 percent of California respondents and 50 percent of Michigan respondents thought the tax was $50 per month or more. Thus, at least half respondents (voters) overestimate the magnitude of their state's gas tax. Several aspects might explain why voters overestimate the typical excise tax amount, including (1) an overestimate of the excise tax rate, (2) an overestimate of miles driven (or underestimate of mpg), (3) a misinterpretation of the question to include the federal excise tax and the state sales tax, and/or (4) a confusion of the degree of fuel tax with the price of gasoline.[2]

Our survey results suggest that a primary reason for the misperception regarding the excise tax amount is that voters overestimate the excise tax rate. When asked "What would you estimate the amount of the combined state and federal government gasoline excise tax per gallon in Michigan?" only 19 percent of respondents selected the correct answer (between $0.25 and $0.50 that includes the correct amount of $0.374). In California, only 18 percent of respondents selected the correct answer (between $0.50 and $0.75 that includes the correct amount of $0.544). Furthermore, 48 percent of Michigan respondents thought the combined state and federal gas tax rate was $0.50 or greater; 38 percent of California respondents thought the combined state and federal gas tax was $0.75 or greater. On the other hand, survey respondents do not overestimate miles driven. When asked to estimate the number of miles driven per year,

[2] The Center for Economic Analysis (2014) offers a brief report examining the relative magnitude of Michigan gas taxes based upon only the excise tax on gasoline, or if a state taxes gasoline under its general sales tax, or if other taxes on gasoline are included.

the median response in both California and Michigan was "between 10,000 and 15,000 miles," which is consistent with observed behavior.

Even if respondents misinterpreted the question and included other taxes in addition to the state excise tax, these two state survey results indicate that voters' perception of the amount of motor fuel excise tax is seriously flawed. Combining the state and federal excise taxes in California implies a monthly cost of about $49 and $21 in Michigan. However, 23 percent in California and 75 percent in Michigan responded that the cost was more than these amounts. Misunderstanding the question does not seem to explain the overestimate of the amount of the tax.

The California and Michigan surveys provided insight about two other public finance perception issues. Poll respondents overestimated the amount of potential road-use fees, even when told the level of the fee. Participants in the Michigan poll were asked, "If Michigan adopted a new transportation fee equal to 1 cent ($0.01) per mile driven, what is your estimate of how much more you would end up owing each month?" Only 29 percent of respondents responded with the correct response of "about $10," whereas another 29 percent thought the fee amount per month would be $30 or more, a serious overestimate.

Respondents also believe overwhelmingly that gasoline excise taxes are (at least) fully passed on to consumers. Participants were asked "Suppose the state of Michigan/California raised the tax it charges on a gallon of gasoline by ten cents ($0.10) per gallon. Which of the following do you think would be the likely result of this tax increase?" In response to this question, 58 percent in California and 61 percent of respondents in Michigan selected the option "Consumers of gasoline paying about $0.10 more per gallon." Less than a quarter of

respondents (23 percent in California and 17 percent in Michigan) believe that the incidence of the tax increase would be shared by consumers and producers (the option was $.05 each).[3]

It is striking how similar are the responses of California and Michigan residents to these survey questions, despite very different gasoline tax amounts and structures, different gasoline prices, and different transportation infrastructure. California levies a $.36 per gallon excise tax on gasoline, with a prepaid 2.25 percent sales tax embedded in addition, so the Federation of Tax Administrators identifies the aggregate California motor fuel tax rate as $.425 as of January 1, 2015. In contrast, Michigan levies an excise tax rate of $.19 per gallon, with the state 6 percent sales tax collected separately. Moreover, between the times when the two polls were taken (August 2014 vs. February 2015), gasoline prices decreased nationally. AAA reports that the national average price for regular unleaded gasoline fell from $3.43 in August 2014 to $2.30 in February 2105.

The California and Michigan survey results show clearly that taxpayers/voters do not have an accurate understanding of the magnitude of state and federal fuel taxes.[4] We turn now to regression analyses of the influence of this misperception of taxes toward willingness to pay additional dollars toward road improvement.

V. Regression Analysis of Willingness to Pay for Road Improvement

In this section, we expand our analysis of data on the opinion of California and Michigan residents regarding their willingness to pay to improve the condition of roads using two forms of

[3] Standard microeconomics analysis implies that the tax would be fully paid by consumers only if the demand was perfectly price inelastic or supply perfectly elastic. Empirical evidence shows that demand is inelastic, but not perfectly. Similarly, supply would be perfectly price elastic only if gasoline prices were determined in a national market, but there is substantial evidence that the market for gasoline is regional.

[4] Some might be concerned over the potential inaccuracy of the responses if participants respond strategically or untruthfully. We think this is unlikely because (1) the telephone surveys included questions about other issues, (2) the surveys were not connected to any specific policy proposal, (3) the survey responses were fairly consistent across states, and (4) the Michigan responses generally were confirmed in subsequent ballot votes.

regression analysis. Specifically we concentrate on the question asked in both the Michigan and California polls:

> *How much more would you be willing to pay per month in any form (gas taxes, other taxes, toll charges, etc.) than you are currently paying to improve California (Michigan) roads?*

The allowed responses to this question, and the percentage of the respective 1,241 California-based and 600 Michigan-based responses that answered in each category, are reported in Table 1. To put these responses in perspective, the Census Bureau data for 2012 show that state and local governments in California spent about $7.6 billion or $17 per person per month on capital expenditures for highways. State and local governments in Michigan spent about $1.2 billion or $10 per person per month on capital expenditures for highways in 2012.

From the poll responses to the above question, we created two dummy variables used as the dependent variables in logistic regression analyses conducted separately with California and Michigan poll data. The first logistic dependent variable is equal to one if the poll respondent responded "nothing," and equal to zero if the respondent offered any other response besides "undecided/refused." The second logistic dependent variable is equal to one if "more than $20" is the response and equal to zero if any other response besides "undecided/refused" is selected. These logistic regression analyses account for the two extreme responses to this particular question.

We also use Multinomial Logistic regression analysis to account for a second set of California and Michigan dependent variables that describe the five possible categorical answers given to the italicized question above that include: (1) nothing, (2) up to $5, (3) between $5 and $10, (4) between $10 and $20, and (5) more than $20. The chosen "base" category is nothing, so the multinomial logistic regression coefficient represents the influence of a particular

explanatory variable on the likelihood of an individual moving from the base to the respective category.

We specifically wish to test whether a poll respondent's *Knowledge of the Magnitude of Gas Tax*, and *Opinion on Who Would Pay for a Gas Tax Increase* exert a separate and distinctive influence on both the two extreme representations of *Willingness to Pay for Road Improvements*, and the four possible categorical values besides "nothing". We accomplish this through Logistic and Multinomial Logistic regression analysis where we control for other factors expected to influence a poll respondent's opinion on the question asked given the available data collected in the poll. The following represents our basic regression model:

Willingness to Pay for Road Improvements =
f (*Knowledge of Gas Tax, Who Pays for a Gas Tax Increase, Personal Characteristics, Own Demand for Auto Use, Economy's Transport Need, Government's Role*).

We account for the six broad categories expected to influence willingness to pay for road improvements with the following explanatory variables drawn separately from the California and Michigan polls:

Knowledge of Gas Tax =
f (GasTaxHigher, GasTaxMore100),

Who Pays for a Gas Tax Increase =
f (ConsumerPaysAll),

Personal Characteristics =
f (Male, AgeOver65, Married [Children][5], Income80100K, IncomeOver100K, SomeCollege, CollegeGrad, GradSchool),

Own Demand for Auto Use =
f (Drive5-10KMiles, Drive10-15KMiles, Drive15-20KMiles, DriveMore20KMiles),

[5] Due to a restriction on the number of questions allowed to place on the California-based Field Poll, we were unable to ask the question of whether the respondent had children. The Field Poll does normally ask whether married or not and thus that was deemed a reasonable substitute. The Michigan poll did not ask of marital status.

Economy's Transport Need =
f (CountyPopDen, CentralCity, Suburb, SmallTown),

Government's Role =
f (TeaPartySupport).

Table 3 includes descriptions and the mean values for the two dependent variables, and each of the explanatory variables chosen to represent a causal factor. Table 4 includes the results of the two logistic regression results, for each state, using dependent variables set equal to one for no support for paying for road improvement and equal to one for the greatest support (more than $20 per month) offered in the poll for paying for road improvement. The Multinomial Logistic regression results distinguished by the use of California and Michigan data are reported in Table 5. Both regressions results are from STATA and integrate the weights provided by each survey for all estimations.

To derive an interpretable meaning of the statistically significant odds ratios reported in Table 4, and the relative risk ratios recorded in Table 5, subtract one from their values and multiply by 100. For the odds ratios reported in the Logistic regressions in Table 4, this represents the expected increase in the probability that the dependent variable equals one instead of zero, when the explanatory variable changes by one unit. In the case of dummy explanatory variables, this means the individual takes on the characteristic represented by the dummy. For the relative risk ratios reported in the Multinomial Logistic regressions, this represents the expected increase in the probability that the survey respondent chose the respective category over the base category of "nothing," when the explanatory variable changes by one unit. In the case of dummy explanatory variables, this means the individual takes on the characteristic represented by the dummy.

For example, consider the statistically significant Odds Ratio of 2.27 recorded in the PayZeroRoadImprove regression for the explanatory variable GasTaxMore100 in the Michigan

poll. This explanatory variable equals one if the respondent believes that the total per gallon gas tax in Michigan is greater than $1.00. Subtracting one from this odds ratio, and multiplying by 100, yields 127, which represents an approximate 127 percent increase in the probability that a respondent would state they are willing to pay nothing for road improvements (over any of the other responses) if they believe the combined state and federal gas tax in Michigan is this high.

The key question in this research is whether a survey respondent's *Knowledge of Gas Tax* exerted an influence on their willingness to pay for road improvements. In the regression results recorded in Tables 4 and 5, we find ample evidence to support this claim. For instance, a California respondent's willingness to PayZeroRoadImprove was 68.9 percent greater if they thought the per-gallon gas tax in their state was more than a dollar. Similarly, in Michigan, if the respondent thought the per-gallon gas tax was greater than a dollar, they were 127.1 percent more likely to say they would pay nothing to improve the state's roads compared to the alternatives.

The effect of gas tax expectations being greater than what gas taxes actually are also exerted the inverse expected negative influence on PayMore20RoadImprove. From Table 4, a California respondent thinking that their state's gas tax was greater than $1.00 per gallon was 73.5 percent less likely to want to pay this upper-end amount for road improvement. In Michigan, a respondent who thought the per-gallon gas tax was greater than in other states was 70.6 percent less likely to support this than if they thought the tax was lower than in other states.

The multinomial logistic regression results in Table 5 also confirm that a poll respondent's belief that their state's gas tax is higher than it is in reality reduces the likelihood of being in the offered categories of wanting to spend more than nothing per month to improve roads. For instance, in Michigan, if someone believes the state's gas tax is higher than in other states, they are 74.1 percent less likely to support spending $10 to $20 more per month on road

improvements.[6] Similar results apply in California, as shown in Table 5. A belief by a Californian that the state's gas tax is more than a $1.00 per gallon reduces the chances of recommending the state should be spending $10 to $20 and more than $20 more per month on road improvements by 93.7, and 79.5 percent respectively. The same belief by a Michigander that the state's per gallon gas tax is greater than $1.00 per gallon reduces the chance of being in the respective categories of spending $5 to $10 more per month or $10 to $20 more per month by 63.3 and 72.8 percent.

The logistic and multinomial regression findings reported in Tables 4 and 5 include several other consistent results of note. Consistent across the regression findings from both states, although slightly larger in magnitude for those derived from Michigan poll respondents, is the strong positive relationship between those expressing an affinity for the views of the Tea Party movement and being less likely to support greater spending on road improvements. The effect of this political affiliation or belief exists even after holding constant income and education levels. Respondents who have a high education level (graduate school) exhibit less likelihood of a willingness to pay zero for road improvements and a positive probability of supporting additional monthly payments of $5 or more. Especially relevant to tax incidence analysis, there is some consistent evidence that those who believe that consumers bear the full burden of a gasoline excise tax are less likely to support the larger increases in additional spending for road investment. It is also interesting that self-reported miles driven generally does not have a statistically significant effect on willingness to pay for additional road investment, at least given the other characteristics in the regressions (the exception being that those who report driving over 20,000 miles per year are more willing to support paying $20 or more additional).

[6] Other regression formats we estimated suggested that a Michigan poll respondent who believes that the state's gas tax is lower than in other states is 587.4 percent more likely to support spending more than $20 per month than the base category of nothing.

It seems important to note that the regressions we estimate likely are best thought of as a type of reduced-form equation. The coefficients on income, education, miles driven, and political views show the effects of those characteristics given a level of tax knowledge (belief about the relative tax rate or overall tax amount). It is possible that those other characteristics also influence tax knowledge. Thus, it seems particularly interesting that more education or affiliation with the Tea Party affects willingness to pay for road investment *holding tax knowledge constant*.[7]

To put the results derived from the logistic regressions in perspective, Figures 3 through 8 represent the factors found to exert a statistically significant influence in each logistic regression based on the California and Michigan poll results. The influence of tax perceptions is especially clear. Figures 3 through 6 illustrate significant variables in the logistic regressions about willingness to pay "nothing" and "more than $20 per month." The effect of tax perceptions on willingness to pay stands out in these figures; belief that that the gas tax rate is more than $1.00 increases the probability of willingness to pay zero, and belief that the gas tax rate is more than $1.00 or higher than in other states reduces the probability of a willingness to pay $20 or more. Figures 7 and 8 illustrate significant variables in the multinomial regressions. In both California and Michigan, belief that the gas tax rate is more than $1.00 reduces willingness to pay over $5 more, and belief that the state gas tax is higher than in other states reduces willingness to pay $20 or more.

V. Conclusion

Taxpayers, at least those in California and Michigan, do not have a good understanding of the magnitude of state and federal fuel tax amounts. A major reason for the misperception regarding

[7] We explored various simultaneous estimation approaches in which tax knowledge is endogenous, but were unable to estimate reasonable results. It seems that our survey results do not provide an effective instrument for tax knowledge independent of an effect on willingness to pay. This is an area deserving additional work.

the gasoline excise tax amount is that voters overestimate the excise tax rate. Voters, at least on average, seem to have an accurate sense of miles driven, but overestimate the tax rate and thus also overestimate the amount of fuel excise tax that a typical driver pays. About half of respondents (likely voters) overestimate the magnitude of gasoline taxes in California, and about three-quarters overestimate the magnitude in Michigan.

These inaccurate perceptions seem to have important policy implications. Voters who substantially overestimate the magnitude of state gasoline taxes are willing to pay much smaller amounts (including zero) for additional highway investment and are less likely to support user fee alternatives to taxes. Using various specifications of both logistic and multinomial regression analysis, we find that voters who substantially overestimate the magnitude of state gasoline taxes are willing to pay much smaller amounts (including zero) for additional highway investment.

These results showing that taxpayers have inaccurate perceptions of tax rates and amounts are consistent with other studies (noted previously) and call into question the standard economics assumption that consumers have complete information. Behavioral economics research has shown that consumers sometimes do not find it economically efficient to invest the resources to acquire complete information, using "rules of thumb" instead. However, one also has to be concerned that agents may try to influence consumers' perceptions in an attempt to affect economic decision outcomes. For this reason, it seems important to explore further the source of tax misperceptions commonly held by consumers.

These results suggest that a misunderstanding of existing fuel taxes influences voter preferences regarding fuel tax increases or other ways of financing road investment. Therefore, a reasonable policy implication from this research it that proposals to generate additional revenue for highway investment are likely to have more success if accompanied by a public education campaign concerning the gasoline taxes actually paid in a state and the reality of the magnitude

paid by the state's typical driver. State policymakers and revenue officials seem to have a responsibility to provide accurate information to taxpayers about the magnitude of taxes and fees. It appears dangerous for officials to assume that taxpayers have accurate information.

The illustrations in Figures 1 and 2 provide a basis for such an education effort. Someone who drives 12,500 miles per year and gets about 23 miles per gallon (both good approximations of current averages) buys about 550 gallons of gasoline annually. This equates to about $55 per year or $4.50 per month for each $.10 of tax. A similar simple calculation applies for a mileage fee. A fee of a half cent ($.005) per mile also would cost about $5 per month. We expect on the basis of our surveys that many taxpayers would be surprised to learn how small such amounts are.

The continuing research agenda regarding this topic includes a further examination of a number of other issues. We are specifically interested in a further empirical examination of the individual characteristics (age, education, income, geographic location, etc.) related to misperceptions that people possess about transportation taxes, miles driven, support for road payments based on miles driven, and the greater use of toll roads. One possible topic for examination is whether individuals confuse the tax amount and the overall price of gasoline. As noted previously, there are similar misperceptions among the California and Michigan surveys even though gasoline prices declined between the times of the two surveys. It is also interesting to consider whether tax misperceptions held by individuals also extend to elected officials. Some fiscal policy decisions are made directly by voters in the form of ballot proposals or tax rate elections, but decisions through the representative system are more common in the United States. Although voter opinions can affect legislative outcomes, they may not be decisive, so it would be interesting to explore the tax knowledge of elected representatives, as well.

Figure 1

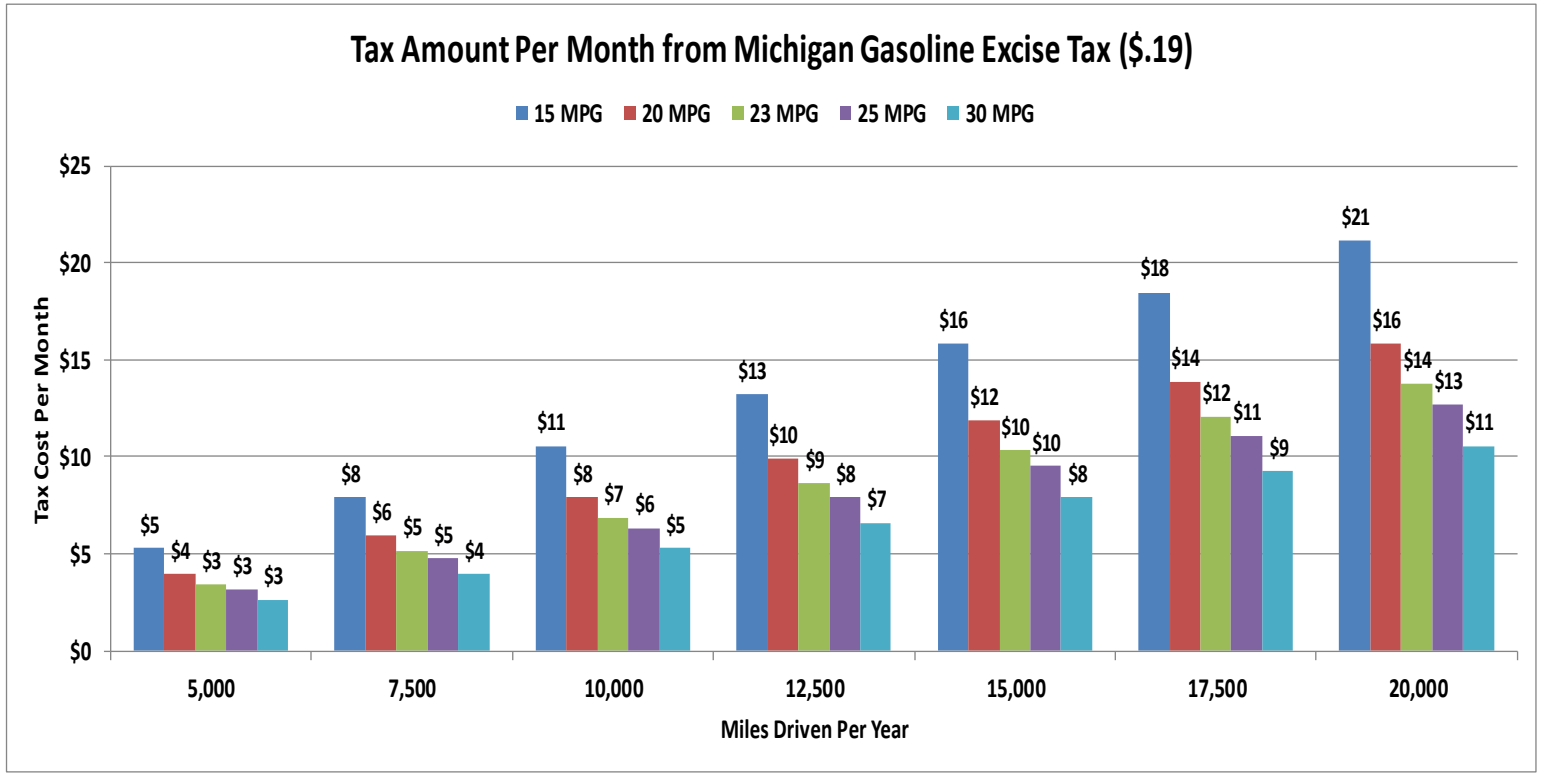

Tax Amount Per Month from Michigan Gasoline Excise Tax ($.19)
15 MPG
20 MPG
23 MPG
25 MPG
30 MPG
Tax Cost Per Month
$25
$20
$15
$10
$5
$0
$5 $4 $3 $3 $3
$8 $6 $5 $5 $4
$11 $8 $7 $6 $5
$13 $10 $9 $8 $7
$16 $12 $10 $10 $8
$18 $14 $12 $11 $9
$21 $16 $14 $13 $11
5,000
7,500
10,000
12,500
15,000
17,500
20,000
Miles Driven Per Year

Figure 2

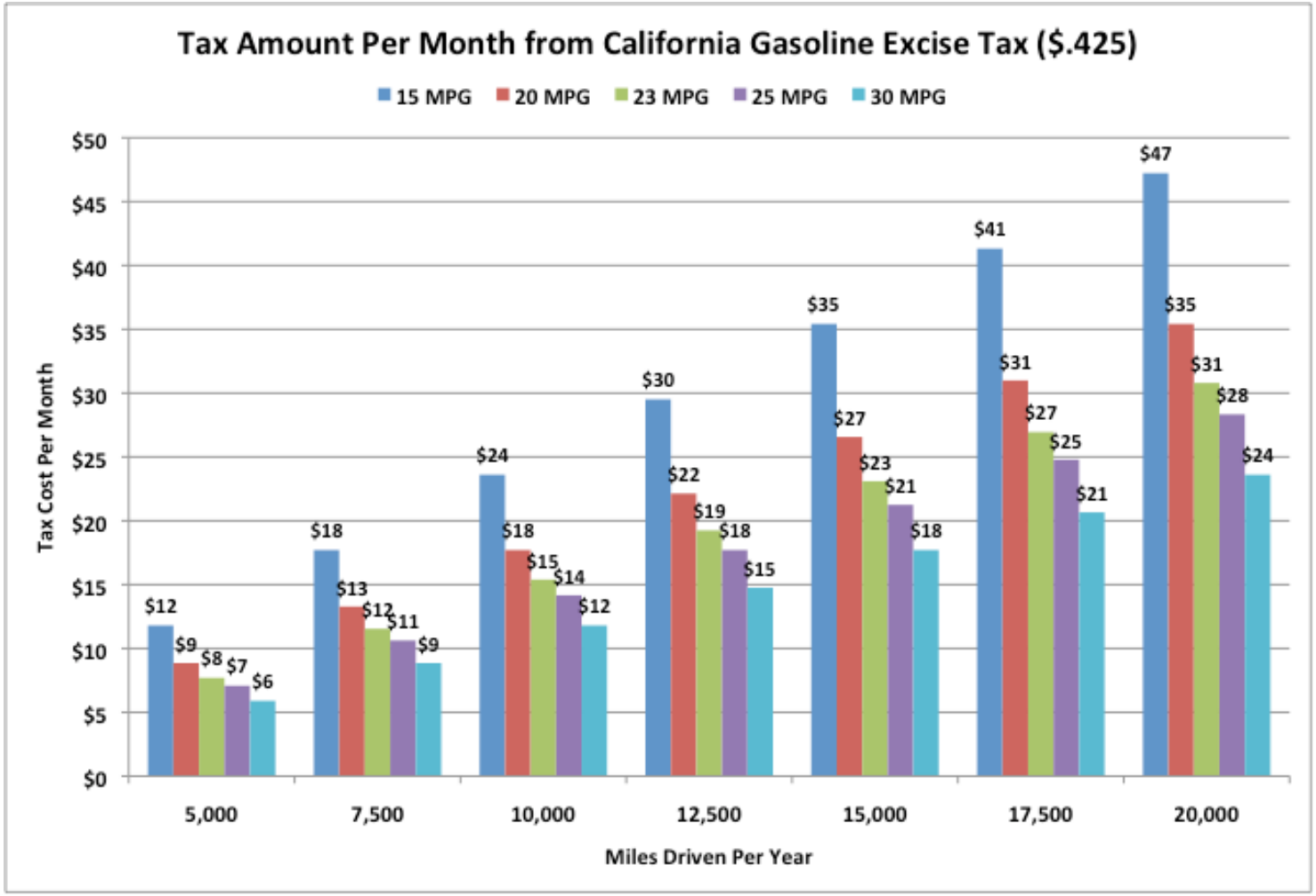

Tax Amount Per Month from California Gasoline Excise Tax ($.425)
15 MPG
20 MPG
23 MPG
25 MPG
30 MPG
Tax Cost Per Month
$50
$45
$40
$35
$30
$25
$20
$15
$10
$5
$0
$12 $9 $8 $7 $6
$18 $13 $12 $11 $9
$24 $18 $15 $14 $12
$30 $22 $19 $18 $15
$35 $27 $23 $21 $18
$41 $31 $27 $25 $21
$47 $35 $31 $28 $24
5,000
7,500
10,000
12,500
15,000
17,500
20,000
Miles Driven Per Year

Table 1: Road Expenditure Preferences
Michigan Epic-MRA Poll, August 2014
California Field Poll, February 2015

	Responses	Michigan	California
Given the amount of roads that exist in Michigan/California and their condition, should the state and local governments be spending more or less on maintenance of existing roads than they do currently?	More	89%	71%
	Less	2%	14%
	About the same	7%	9%
	Undecided/Refused	2%	7%
Given the amount of roads that exist in Michigan/California and their condition, should the state and local governments be spending more or less on construction of new roads than they do currently?	More	41%	48%
	Less	38%	35%
	About the same	15%	8%
	Undecided/Refused	6%	8%
How much more would you be willing to pay per month in any form (gas taxes, other taxes, toll charges, etc.) than you are currently paying to improve Michigan's/California's roads?	Nothing	43%	43%
	Up to $5	16%	23%
	Between $5 and $10	17%	18%
	Between $10 and $20	17%	8%
	More than $20	8%	5%
	Undecided/Refused	4%	4%

Table 2: Gasoline Tax Perceptions
Michigan Epic-MRA Poll, August 2014
California Field Poll, February 2015

	Responses	Michigan	California
Consider the average or typical driver in Michigan/California, who might be different than you. How much would you estimate that the average driver in Michigan/California pays in state gasoline tax each month?	More than $50	29%	23%
	About $50	21%	24%
	About $30	24%	27%
	About $10	6%	7%
	About $5	1%	1%
	Undecided/Refused	19%	19%
What would you estimate the amount of the combined state and federal government gasoline excise tax per gallon in Michigan/California?	Between $.10 and $.25	11%	13%
	Between $.25 and $.50	19%	22%
	Between $.50 and $.75	16%	20%
	Between $.75 and $1.00	14%	11%
	More than $1.00	18%	18%
	Undecided/Refused	22%	20%
Estimate the number of miles you drove last year.	Less than 5,000 miles	16%	17%
	Between 5,000 and 10,000 miles	26%	29%
	Between 10,000 and 15,000 miles	26%	26%
	Between 15,000 and 20,000 miles	14%	13%
	More than 20,000 miles	17%	14%
	Undecided/Refused	1%	1%

Correct answer in red

Table 3: Variable Description and Descriptive Statistics
(1,241 CA Observations, 600 MI Observations)

Variable Category/Name	Description	Mean	
Dependent		CA	MI
PayZeroRoadImprove	Equals 1 if willing to pay nothing in any form for road improvements	0.38	0.45
PayMore20RoadImprove	Equals 1 if willing to pay more than $20 per month in any form for road improvements	0.04	0.12
PayRoadImprove	Categorical variable equals (1) nothing, (2) up to $5 more, (3) $5 to $10 more, (4) $10 to $20 more, and (5) more than $20 more	2.1	2.2
Knowledge of Gas Tax			
GasTaxHigher	Equals 1 if believes total per-gallon gas tax in MI is higher than in other states	0.86	0.71
GasTaxMore100	Equals 1 if believes total per gallon gas tax in MI is greater than $1.00	0.21	0.23
Pay for a Gas Tax Increase			
ConsumerPaysAll	Equals 1 if believes that after state imposes a $0.10 per-gallon tax, price per-gallon of gasoline rises by $0.10[8]	0.63	0.75
Personal Characteristics			
Male	Equals 1 if identified as male by interviewer	0.50	0.47
AgeOver65	Equals 1 if over age 65 based upon date of birth given	0.21	0.26
Married [Children]	Equals 1 if answered yes to whether married [children less than age 18 residing in household]	0.48	0.28
Income80[75]100K	Equals 1 if told interviewer to stop at the $75 to $100K when asked what yearly income is of all in household	0.08	0.16
IncomeOver100K	Equals 1 if told interviewer to stop at over $150K when asked what yearly income is of all in household	0.21	0.18
SomeCollege	Equals 1 if reported some college attendance but not a bachelor's degree	0.29	0.25
CollegeGrad	Equals 1 if reported having earned a bachelor's degree	0.26	0.32
GradSchool	Equals 1 if reported some post-bachelorette college attendance or degree	0.15	0.17

[8] The recent work of Marion and Muehlegger (2011) indicates that in most cases the economic incidence of a gas tax does entirely fall upon the consumer with the exception being in states that allow greater heterogeneity in gasoline content requirements.

Own Demand for Auto Use			
Drive5-10KMiles	Equals 1 if estimated auto miles drove last year between 5 and 10K miles	0.31	0.29
Drive10-15KMiles	Equals 1 if estimated auto miles drove last year between 10 and 15K miles	0.25	0.26
Drive15-20KMiles	Equals 1 if estimated auto miles drove last year between 15 and 20K miles	0.12	0.12
DriveOver20KMiles	Equals 1 if estimated auto miles drove last year greater than 20K miles	0.13	0.19
Economy's Transport Need			
CountyPopDen	Population density in 2013 of the county that respondent reported as residing in	1,961	1,009
CentralCity	Equals 1 if respondent chose central city as place of residence (rural area is base)	0.35	0.13
Suburb	Equals 1 if respondent chose suburb in urban area as place of residence (rural area is base)	0.36	0.39
SmallTown	Equals 1 if respondent chose small town outside of urban area as place of residence (rural area is base)	0.13	0.21
Government's Role			
TeaPartySupport	Equals 1 if chose strongly or somewhat supports the Tea Party Movement (strongly or somewhat opposes is base)	0.30	0.37

Table 4: Logistic Regression Results with Odds Ratio Reported
Sample Weights Used
708 California Observations, [261 Michigan Observations]

Variable Category/ Explanatory Variable	Dependent Variable PayZeroRoadImprove	PayMore20RoadImprove
Knowledge of Gas Tax		
GasTaxHigher	2.187** [1.230]	0.410* [0.294**]
GasTaxMore100	1.690** [2.271**]	0.265** [1.052]
Pay for a Gas Tax Increase		
ConsumerPaysAll	1.236 [1.473]	0.477* [0.328**]
Personal Characteristics		
Male	0.780 [0.875]	1.768 [1.167]
AgeOver65	1.320 [2.017*]	0.931 [0.884]
Married [Children]	1.253 [2.458**]	0.930 [0.580]
Income80[75]100K	0.880 [0.797]	2.233 [3.907*]
IncomeOver100K	1.081 [0.738]	1.411 [12.335***]
SomeCollege	0.826 [0.887]	0.587 [0.143*]
CollegeGrad	0.974 [0.579]	0.731 [0.391]
GradSchool	0.511* [0.340**]	0.552 [0.274]
Own Demand for Auto Use		
Drive5-10KMiles	0.841 [1.876]	1.028 [3.277]
Drive10-15KMiles	1.009 [1.384]	2.685 [4.286]
Drive15-20KMiles	0.691 [1.256]	2.570 [7.043]
DriveOver20KMiles	0.829 [2.049]	4.339* [10.722*]
Economy's Transport Need		
CountyPopDen	0.999 [0.9996**]	1.000074 [1.00073***]
CentralCity	1.104 [1.547]	0.985 [0.784]
Suburb	1.092 [0.727]	1.087 [1.562]
SmallTown	1.795 [0.528]	1.423 [6.091**]
Government's Role		
TeaPartySupport	2.486*** [2.974***]	0.526 [1.096]
Pseudo R-Squared	0.087 [0.183]	0.127 [0.312]

Statistical significance, in a two-tailed test, at *** greater than 99% confidence, at ** 95 to 99% confidence, and * at 90 to 95% confidence.

Table 5: Multinomial Logistic Regression Results with Relative Risk Ratio Reported
Dependent Variable PayRoadImprove, Base Category "Nothing"
Sample Weights Used
701 CA Observations, [260 MI Observations]

Variable Category/ Explanatory Variable	Category Up to $5 More	$5 to $10 More
Knowledge of Gas Tax		
GasTaxHigher	0.411** [1.328]	0.648 [0.950]
GasTaxMore100	0.831 [0.678]	0.764 [0.367*]
Who Pays for a Gas Tax Increase		
ConsumerPaysAll	0.709 [0.482]	0.946 [1.804]
Personal Characteristics		
Male	0.977 [1.291]	1.537 [0.744]
AgeOver65	0.759 [0.561]	0.922 [0.398*]
Married [Children]	1.177 [0.481]	0.633 [0.538]
Income80[75]100K	1.255 [0.848]	0.879 [1.549]
IncomeOver100K	0.815 [0.396]	0.983 [1.175]
SomeCollege	1.257 [1.229]	1.053 [1.559]
CollegeGrad	0.771 [2.640]	1.693 [0.981]
GradSchool	1.344 [2.669]	3.549** [2.880]
Own Demand for Auto Use		
Drive5-10KMiles	1.149 [0.389]	1.221 [0.488]
Drive10-15KMiles	0.749 [0.408]	1.251 [0.786]
Drive15-20KMiles	1.532 [0.617]	1.506 [0.680]
DriveOver20KMiles	1.111 [0.157]	0.996 [0.412]
Economy's Transport Need		
CountyPopDen	1.00005 [1.0003]	1.00001 [1.0001]
CentralCity	1.010 [0.724]	0.5554 [0.586]
Suburb	0.949 [0.787]	0.869 [2.067]
SmallTown	0.540 [1.011]	0.449 [1.916]
Government's Role		
TeaPartySupport	0.501*** [0.262***]	0.323*** [0.405**]

Variable Category/ Explanatory Variable	Category $10 to $20 More	More than $20 More
Knowledge of Gas Tax		
GasTaxHigher	0.458 [0.687]	0.257** [0.259**]
GasTaxMore100	0.063*** [0.272*]	0.205** [0.629]
Who Pays for a Gas Tax Increase		
ConsumerPaysAll	1.409 [0.779]	0.448* [0.295*]
Personal Characteristics		
Male	1.611 [1.492]	1.996 [1.312]
AgeOver65	0.436 [0.499]	0.802 [0.518]
Married [Children]	0.491* [0.245**]	0.794 [0.292*]
Income80[75]100K	0.739 [0.874]	2.341 [4.170*]
IncomeOver100K	0.814 [1.354]	1.308 [11.779***]
SomeCollege	2.210 [1.062]	0.667 [0.161**]
CollegeGrad	1.327 [2.600]	0.747 [0.623]
GradSchool	4.092** [4.650**]	0.885 [0.676]
Own Demand for Auto Use		
Drive5-10KMiles	1.621 [0.913]	1.206 [2.144]
Drive10-15KMiles	1.178 [1.226]	2.677 [3.366]
Drive15-20KMiles	1.009 [0.994]	3.258 [5.397]
DriveOver20KMiles	1.241 [0.873]	4.637** [6.327]
Economy's Transport Need		
CountyPopDen	1.00004 [1.0006**]	1.00010 [1.001***]
CentralCity	0.899 [0.304]	0.945 [0.512]
Suburb	0.544 [1.361]	1.024 [1.956]
SmallTown	0.505 [2.205]	1.033 [7.918**]
Government's Role		
TeaPartySupport	0.353** [0.271]***	0.343** [0.521]
Pseudo R-Squared		0.107 [0.238]

Statistical significance, in a two-tailed test, at *** greater than 99% confidence, at ** 95 to 99% confidence, and * at 90 to 95% confidence.

Figure 3: Relative Influence of Explanatory Variables on California Poll Respondents Choice of Paying Nothing for Road Improvement (Relative to all Other Options)

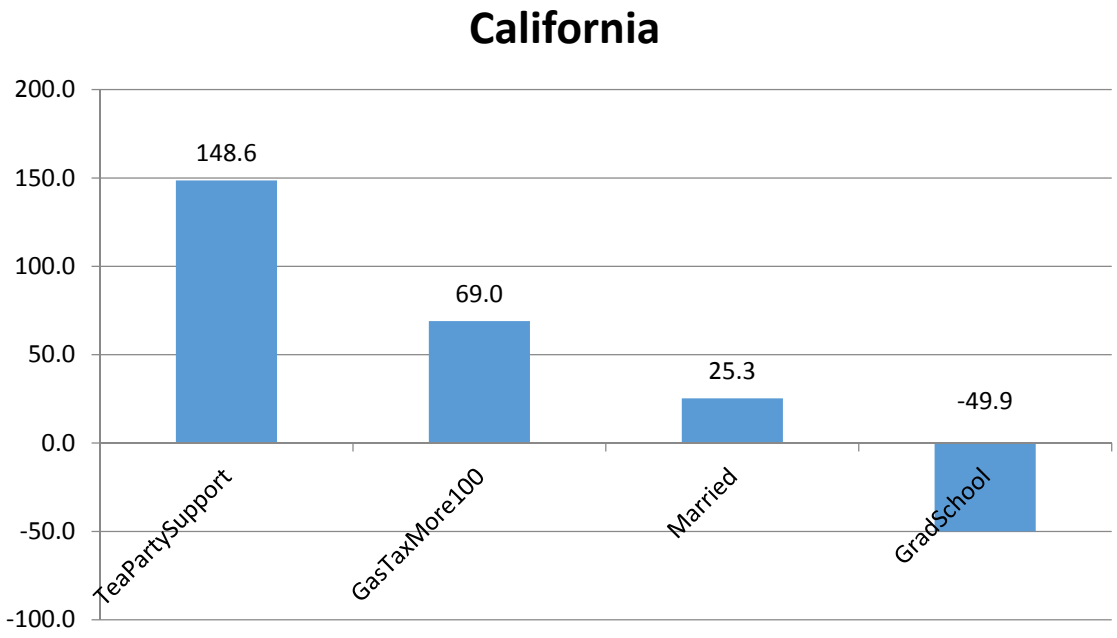


Figure 4: Relative Influence of Explanatory Variables on Michigan Poll Respondents Choice of Paying Nothing for Road Improvement (Relative to all Other Options)

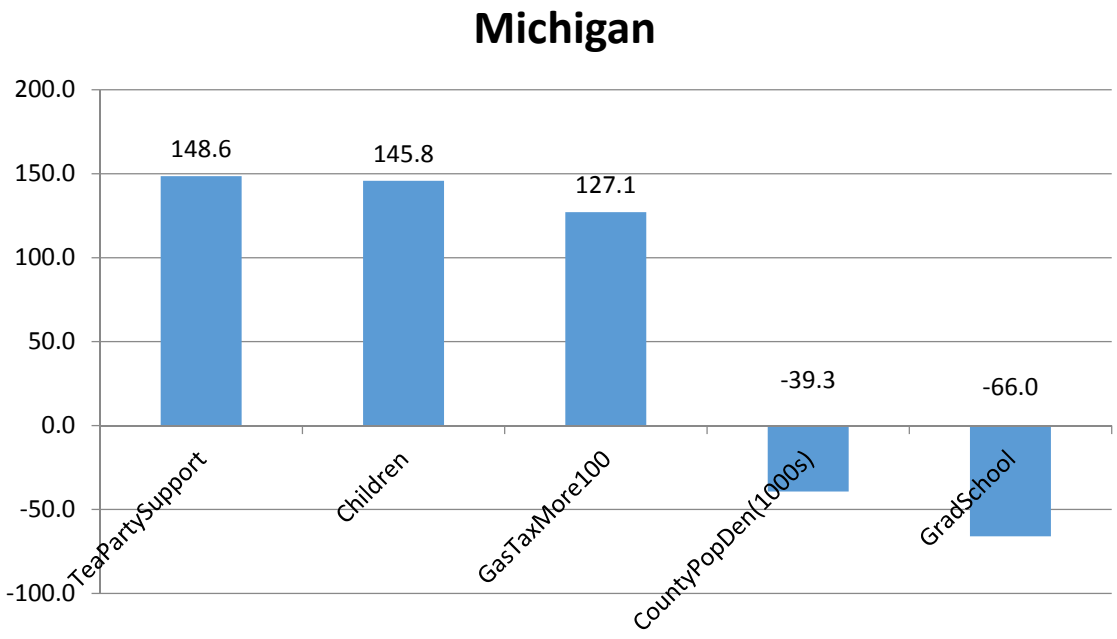


Figure 5: Relative Influence of Explanatory Variables on California Poll Respondents Choice of Paying More than $20 More per Month for Road Improvement (Relative to all Other Options)

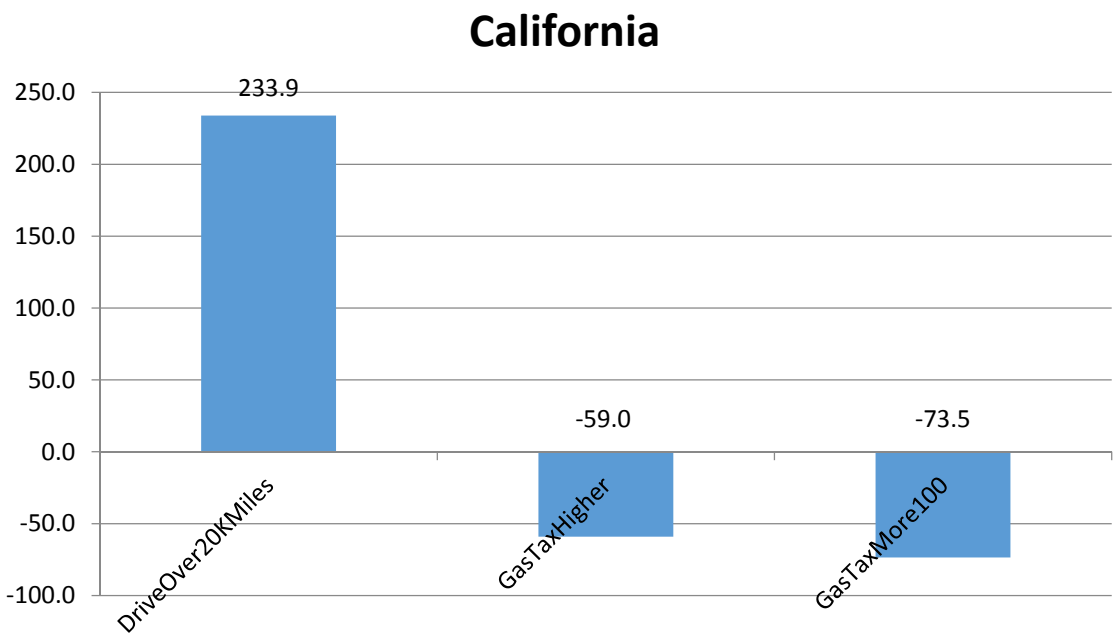


Figure 6: Relative Influence of Explanatory Variables on Michigan Poll Respondents Choice of Paying More than $20 More per Month for Road Improvement (Relative to all Other Options)

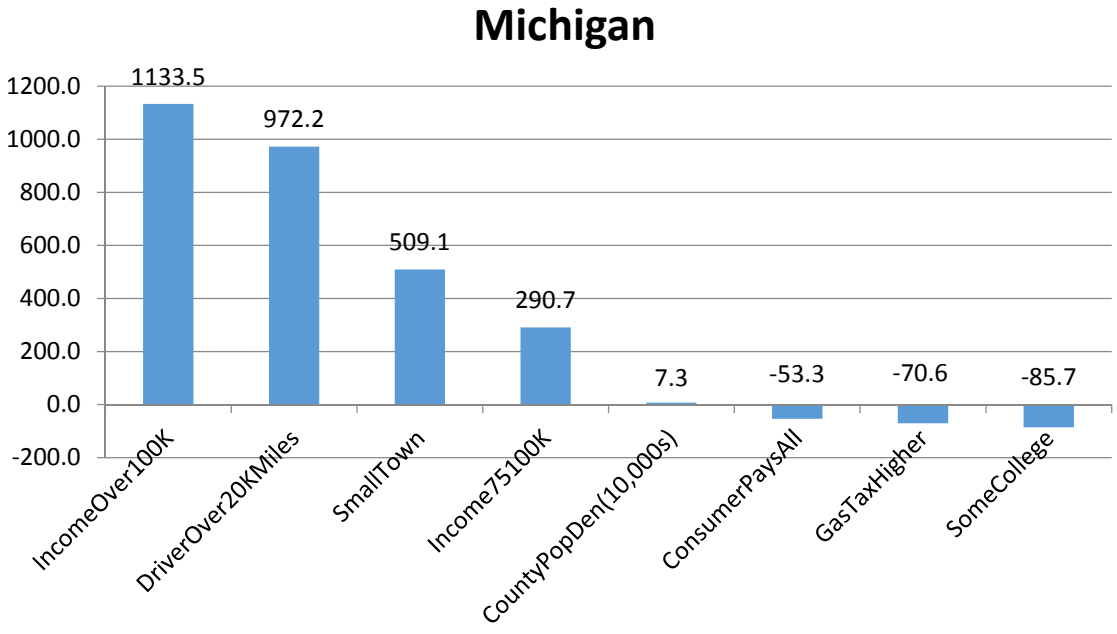


Figure 7: Relative Influence of Relevant Explanatory Variables on California Poll Respondents Choice of Paying the Given Category of Dollars per Month for Road Improvement (Relative to "Nothing" Option)

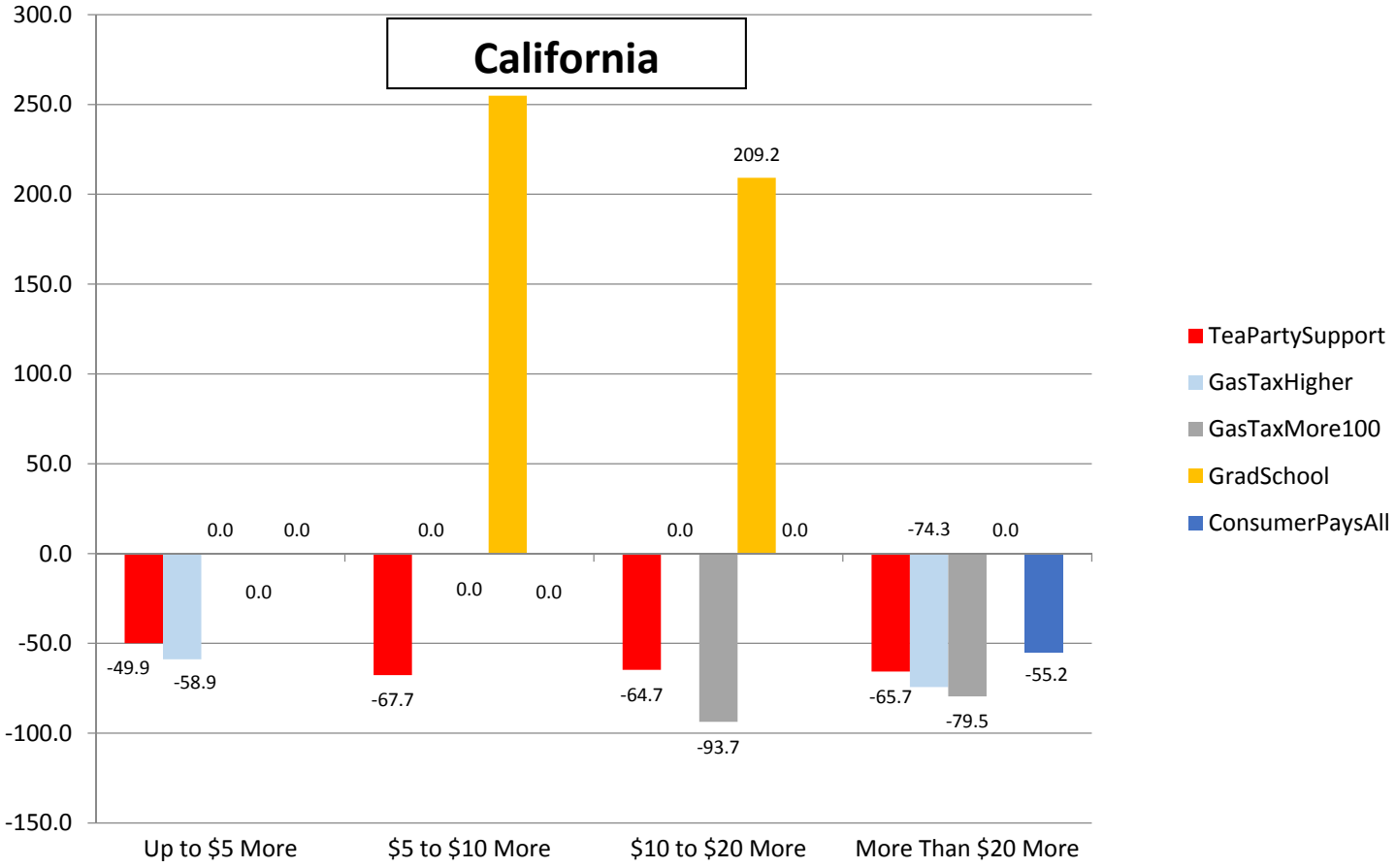
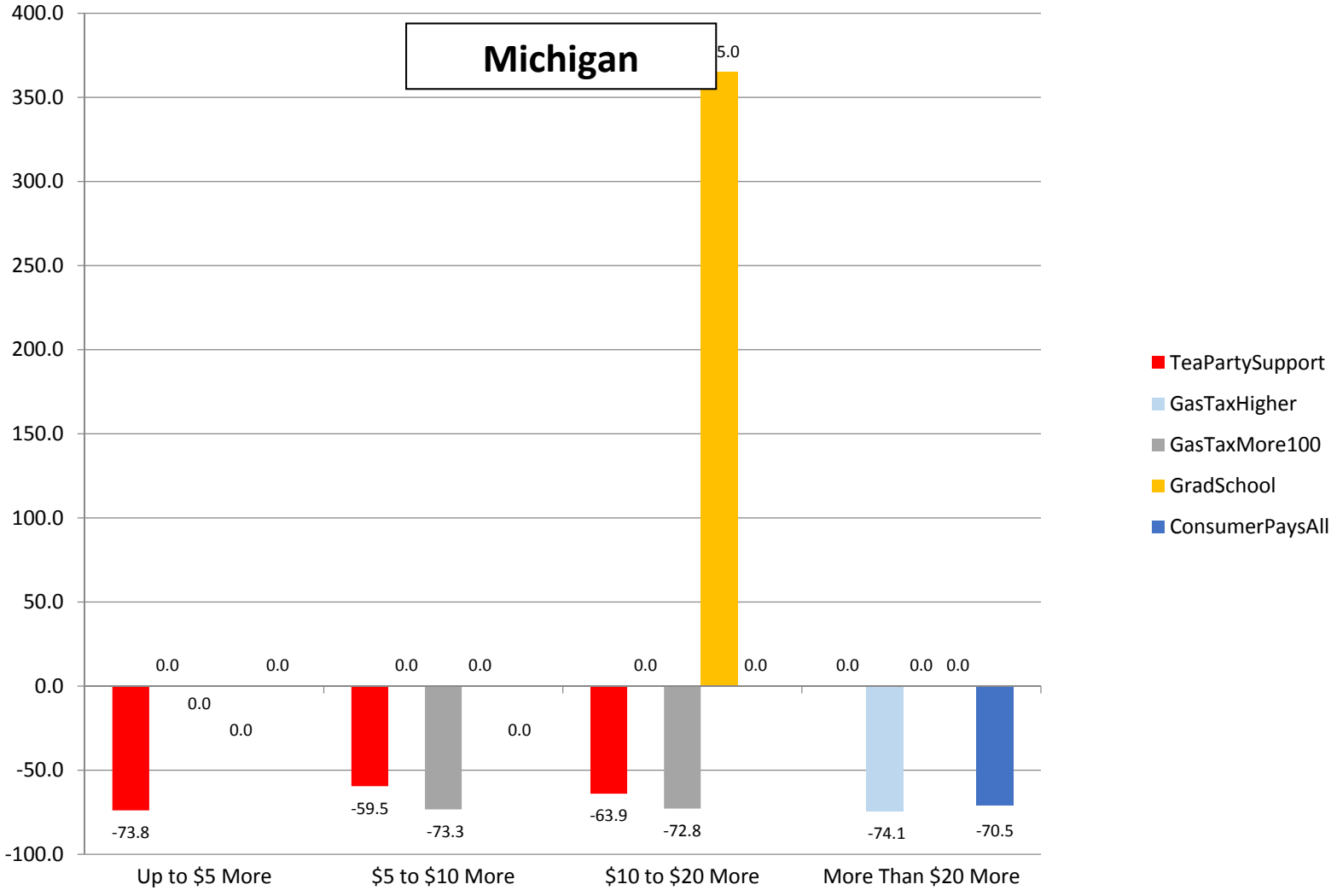


Figure 8: Relative Influence of Relevant Explanatory Variables on Michigan Poll Respondents Choice of Paying the Given Category of Dollars per Month for Road Improvement (Relative to "Nothing" Option)



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