How Negative Framing Impacts the Valence of Attitudes to Increase Support of Vehicle Miles Traveled Taxation

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Abstract

This paper examines the effect of framing of Vehicle Miles Traveled (VMT) information messages. Using *loss aversion*, part of *prospect theory*, defined as an individual’s tendency to prefer avoiding losses more than acquiring gains, and *negativity bias*, derived from an information processing perspective that claims that negative information receives greater weight and requires more processing than positive information, this paper examines the effect of negative goal framing of VMT messages with attitudes of self-interest versus prosocial or altruistic behavior. Analysis on data collected on subjects shows that prosocial behavior in terms of transportation attitudes can be developed through targeted message and communication strategies which are developed for very specific markets.

Introduction

The National Surface Transportation Infrastructure Financing Commission (NSTIFC) recently recommended a Vehicle Miles Traveled (VMT) program as a viable solution to meet infrastructure needs (NSTIFC 2009). Although critically needed, current public reactions appear to suggest a reluctance to support fuel tax rates and fees (NSTIFC 2009). Generally, feelings towards taxes of any type are mostly negative (Kirchler 2007). However, since people tend to understand that taxes are used for the common good, paying taxes creates a social dilemma between one’s own interest and the collective interests of society (Holler, Hoelzl, Kirchler, Leder, and Mannetti, 2008). For effective policy implementation, government must not only understand public attitudes towards tax policy, but must also weigh the effects of how tax policy information messages are framed (McCaffery and Baron 2004).
The goal of our study is to examine the effect of framing of VMT information messages which carry the specific objective of funding ongoing transportation infrastructure. The paper begins with a literature review of the two key areas we focus on: (1) prosocial and altruistic behavior as it relates to taxation attitudes and public transit support; and (2) the theoretical foundations of negative framing effects. Following this background, we develop our hypotheses regarding negative framing effects on four key dependent measures, which include: (1) \( \text{Attitude}_\text{towards VMT} (A_{\text{vmt}}) \); (2) \( \text{VMT environmental benefit} (B_{\text{environment}}) \); (3) \( \text{VMT societal benefit} (B_{\text{societal}}) \); and (4) \( \text{VMT distributive justice} (D_{\text{vmt}}) \). Next we detail our experimental test of the framing effects and the corresponding statistical analysis to support our hypotheses. Finally, we include a short discussion and present future research ideas.

The Key Issue: Prosocial and Altruistic Behavior

Creating a sustainable environment is the focus of not only hoards of academic research, but also of popular magazines, movies, and culture, throughout the world, and more so in highly developed countries. The communication of the climate change has been identified as one of the most pressing issues of the current political economy in the United States (Nisbet 2009). In addition to this important communication, Nisbet (2009) identifies framing effects as an important means of structuring relevant information for the public with the purpose of gathering support. Recent experimental research in New Zealand (Kolandai-Matchett 2009) suggests that buzzwords such as “sustainable development” are often misunderstood by the public, and must be explained in carefully framed information-based campaigns to increase public awareness and consequently, prosocial behavior. Since a few of the key environmental issues include reduction
of both natural resource utilization and pollution/emissions, increasing the use of public transportation can be identified as an important prosocial behavior. Chatterjee and Ma (2009) model the adoption of a new public transport option using duration modeling, and conclude that such models can provide valuable information which can be used to create tiered targeted marketing campaigns which vary with reference to public interest and response. Other researchers discuss a “mobility management” program, designed to promote public transport use through marketing communication strategies (Taniguchi and Fujii 2007). Using an experimental intervention methodology, they show that even by implementing a one-shot TFP (travel feedback program), individuals exhibit increased use of public transportation over time.

Prosocial behavior, derived from prosocial motivation, is defined as a high level of other-orientation and other-concern (versus self-orientation and self-concern) (De Dreu and Nauta, 2009). We might thus consider that a high willingness to take public transportation even when personal transportation is available, is a display of prosocial behavior. The experimental research of Lindenmeier (2008) indicates that such behavior, for example, the willingness to volunteer, can be positively impacted through the use of targeted communications, such as print advertisements.

Theoretical Foundations: Negative Framing Effects

There are two fundamental theoretical frameworks which underlie the present research. The first, loss aversion, discussed as part of prospect theory, is defined as an individual’s tendency to prefer avoiding losses more than acquiring gains (Kahneman and Tversky, 1982). For example, research shows that consumers will have a larger decrease in satisfaction from a $50 loss than the increase in satisfaction they will achieve from a $50 win.
The second, *negativity bias*, derives from an information processing perspective, and claims that negative information receives greater weight and requires more processing than positive information (Baumeister, Bratslavsky, Finkenauer, and Vohs, 2001). Through the use of event-related brain potentials, Ito, Larsen, Smith and Cacioppo, (1998) confirm the negativity bias hypothesis by demonstrating that the negative motivational system responds with greater intensity than the positive motivational system, when activation remains constant across both systems.

As it relates to the message, a frame can define or limit the meaning of the message by shaping an individual’s inferences about the message (Hallahan 1999). Thus, a frame is selected for the purpose of making the message more salient to the particular target of interest. Goal framing is a particular method of positioning information as choice options which represent gains or losses. Frames that represent gains are positive frames whereas those that represent losses are negative frames (Wheatley and Oshikawa 1970). Both positive and negative goal framing are intended to persuade in the same (intended) direction. Therefore the question becomes, which type of framing is more persuasive: positive or negative? As discussed earlier, because of loss aversion theory, where losses are processed more carefully than gains, negative framing that focuses on avoiding a loss is more likely to be effective than positive framing that focuses on obtaining a gain (Levin 1998). In line with this notion, Ganzach and Karsahi (1995) use a field experiment to show that a negatively framed message produces a greater behavioral change (credit card use in this case) than does a positively framed message. Likewise, consumers report an increased willingness to buy private brands when presented with loss (negative) oriented messages than with gain (positive) ones (Gamliel and Herstein, 2007).
However, goal framing is subject to a variety of characteristics of a situation that may enhance, eliminate, or possibly reverse the effects of framing. For example, endowment or ownership has a strong effect on goal framing, whereas lack of involvement and personal relevance in a decision task reduce the effects of negative framing (Kahneman, Knetsch, and Thaler, 1990; Maheswaran and Meyers-Levy, 1990; Krishnamurthy, Carter, and Blair, 2001).

**Hypotheses Development**

Because of the possible interactive effects of goal framing with other factors, our study specifically examines the effect of negative goal framing of VMT messages with attitudes of self-interest versus prosocial or altruistic behavior. VMT is a tax that is used to help the government maintain the transportation infrastructure, which makes it a public good and a system that supports a sustainable environment. However, individual’s who drive are the only contributors to a VMT tax while those who do not drive or take public transportation do not pay a tax. This creates a conflict for drivers because they are paying a tax used to maintain transportation infrastructure for the benefit of all.

Classic economics theory assumes that individuals should act in their own best interest. This suggests that drivers may have a negative attitude towards paying a VMT tax. However, individuals sometimes do not act in their own interest, but instead act in the collective interest of others (Brewer and Kraemer 1986) and exhibit prosocial behavior. Brewer (1979) argues that the salience of the collective identity may place more weight on collective gains than individual gains. Similarly, we argue that more weight may be placed on collective losses than individual losses when attitudes are most salient to collective outcomes. This suggests that more weight may be placed on collective losses for those that identify with altruistic or prosocial attitudes than those who predominantly have an attitude of self interest.
A positive attitude towards public transit support is associated with the characteristic of *helpfulness to others* and considered more altruistic and prosocial than an attitude of self-interest (Harmatuck 1976). In terms of personal performance, public transit is considered to have social benefits as opposed to individual benefits (TCRP 2008, p.50). Cools, Moons, Janssens, and Wets (2009) discuss attitudes toward public transportation and use survey research followed by cluster analysis to study four dimensions of support, including motivation, stability, control, and repetition. Their findings validate the notion that if public transit support policy and communication are targeted towards differing levels of individual states in these dimensions, it will be most effective. We therefore hypothesize that greater weight will be placed on the collective losses when attitudes are most salient to collective outcomes. Because of our theoretical framework of loss aversion and negativity bias, we focus our hypotheses on the effects of negative framing rather than positive framing. Thus, we hypothesize the following:

H$_1$: Negative goal-framing will be most effective for those that support public transit (most salient to collective good) than those who do not regarding attitudes towards VMT.

Public transit support can also lead to externalities such as cleaner air, more job opportunities, less traffic congestion, and reduced street repairs (Sheskin and Stopher 1988). Thus, we hypothesize that a greater weight will be placed on the collective losses of public transit externalities when attitudes are most salient. We therefore hypothesize

H$_2$: Negative goal-framing will be most effective for those that support public transit than those who do not regarding VMT attitudes towards environmental benefit.
H₃: Negative goal-framing will be most effective for those that support public transit than those who do not regarding VMT attitudes towards societal (American) benefits.

Distributive justice is defined as an obligation of a community to its members (Fagothey 1953). Evaluating tax policy from the perspective of distributive justice is appropriate and can be approached either economically or socially (Porcano 1984). From an economic perspective, the emphasis is on the contribution aspect whereas with a social approach, emphasis is placed on the deservingness aspect. Leventhal (1976) identified three justice rules to determine a person’s deserved outcomes: contributions rule, needs rule, and equality rule. The contributions rule examines fairness based on one’s overall contribution whereas the needs rule assesses that an individual’s needs are met, regardless of their contribution. The equality rule requires similarity in outcomes for everyone. An example of the equality rule would be an argument for a flat income tax rate.

Although no one principle may be perceived fair to everyone, Klein (2008) suggests that self-interested individuals or groups are more likely to select the outcome that best satisfies their individual needs. Accordingly, those who support public transportation are more likely to select the outcome that supports this need. In this particular case, VMT tax is used to benefit transportation infrastructure. Therefore, the potential threat of losses to this benefit is more likely to positively influence attitudes towards distributive justice as it relates to VMT for those that identify with those needs than for those who do not. Therefore, the following is hypothesized:

H₄: Negative goal-framing is most effective for those that support public transit than those that do not on attitudes of distributive justice regarding VMT tax.
EXPERIMENT

Experimental Design and Participants

A 2 x 2 between-subjects experimental design was used to test all hypotheses. The independent variables (treatment conditions) were *VMT Goal Framing* (positive vs. negative) and *Public Transit Support* (high vs. low). The dependent variables of interest include: (1) *Attitude_towards_VMT* (*A*<sub>vmt</sub>); (2) *VMT environmental benefit* (*B*<sub>environment</sub>); (3) *VMT societal (American) benefit* (*B*<sub>societal</sub>); and (4) *VMT distributive justice* (*D*<sub>vmt</sub>). Figure 1 shows the conceptual framework and relationship between the variables for the experiment. Each participant was randomly assigned to view only one of the four VMT messages and then complete a survey instrument. The VMT framing messages (as shown in Appendix 1) were adapted from Holler, Hoelzl, Kirchler, Leder, and Mannetti (2008).

Seventy-nine (40 female, 39 male; mean age = 27.32 years) undergraduate students from a university in the western part of the United States participated in this study. All participant identification information and responses were kept confidential throughout the study to protect the anonymity of the subjects.

Manipulation check

To determine whether the VMT goal-framing independent variable was effective, one of the survey items asked about the scenario. The results of an independent samples t-test showed that subjects in the positive versus negative framing conditions were aware of the wording in the messages. Specifically, the magnitudes of the means were significantly different (*M*<sub>negative</sub>=4.78; *M*<sub>positive</sub>= 6.33; *t*(77) = 3.22, *p* < .002.)
Material and procedure

Each participant received a paper survey with an explanatory cover page, asking them for informed consent to complete the study. The procedure is detailed as follows:

1. On the cover page, they were instructed to turn the page and read a short scenario regarding Vehicle Mile Taxation. They were unaware of the specific treatment condition they were assigned to (i.e. negative vs. positive VMT goal-framing). All of the dependent variables were measured with 9 point scales in this survey, along with the manipulation check item. The Attitude_towards_VMT ($A_{vmt}$) variable was measured with three attitude items: $A_{vmt}$ (negative/positive, unfavorable/favorable, dislike/like; $\alpha=0.98$). VMT environmental benefit ($B_{environment}$) and VMT societal (American) benefit ($B_{societal}$) were both measured with single-items as follow: “Is good for the environment” and “Is good for all Americans” (endpoints: not at all descriptive of the tax/describes the tax very well). VMT distributive justice ($DJ_{vmt}$) was measured with the single-item “Generally, I believe that the manner in which the vehicle mile taxation burden is distributed across taxpayers is” (endpoints: very unfair/very fair). The survey also ascertained whether subjects read and understood the scenario, via the following manipulation check item: “The scenario you read claims that by using a vehicle mile taxation plan, which one is more likely to occur?” (endpoints: The threat of restrictions in our infrastructure can be avoided/The ability to have improvements in our infrastructure can be maintained.)

2. The second independent variable, Public Transit Support, was ascertained with the following single-item: “If I could use public transportation to get to work, I would
definitely use it” (endpoints: not at all true of me/very true of me). A median split of this variable was used to create high and low groups.

3. Finally, the subjects answered several demographic questions which include: (1) age; (2) gender; (3) car ownership; and (4) car purpose (work vs. leisure vs. both). Of the 79 subjects who completed the survey, 77 claimed to own a car (46.8% reported using it for work; 7.8% reported using it for leisure; 45.5% reported using it for both).

RESULTS

A between-subjects Analysis of Variance (ANOVA) was used to analyze the data for all hypotheses. Following the establishment of significant between subject effects, we further substantiate other hypotheses using simple effects or planned contrasts.

Test of Hypotheses

H1 Test. H1 proposed that for the negative VMT goal-framing condition, \( A_{vmt} \) would be higher for high public transit supporters. A univariate ANOVA revealed a main effect for Public Transit Support \( (F(1, 75) = 10.76, p = 0.002) \). To test \( H_1 \), simple effects analysis revealed that \( A_{vmt} \) was significantly higher for the negative VMT goal-framing condition, \( (M = 5.30) \) than for the positive VMT goal-framing condition \( (M = 3.66) \), \( (F(1, 75) = 4.50, p = 0.04) \). As shown in Figure 2, we thus confirm hypothesis \( H_1 \).

H2 Test. H2 proposed that for the negative VMT goal-framing condition, \( B_{environment} \) would be higher for high public transit supporters. A univariate ANOVA revealed a main effect for Public Transit Support \( (F(1, 75) = 11.81, p = 0.001) \). To test \( H_2 \), simple effects analysis revealed that \( B_{environment} \) was significantly higher for the negative VMT goal-framing condition, \( (M = 6.82) \) than
for the positive VMT goal-framing condition ($M = 3.69$), ($F (1, 75) = 12.13$, $p = 0.001$). We thus confirm this hypothesis, as shown in Figure 3.

**$H_3$ Test.** $H_3$ proposed that for the negative VMT goal-framing condition, $B_{societal}$ would be higher for high public transit supporters. A univariate ANOVA revealed a main effect for Public Transit Support ($F (1, 75) = 7.41$, $p = 0.008$). To test $H_3$, simple effects analysis revealed that $B_{environment}$ was significantly higher for the negative VMT goal-framing condition ($M = 5.09$) than for the positive VMT goal-framing condition ($M = 2.59$), ($F (1, 75) = 11.33$, $p = 0.001$). We thus confirm this hypothesis, as shown in Figure 4.

**$H_4$ Test.** $H_4$ proposed that for the negative VMT goal-framing condition, $DJ_{vmt}$ would be higher for high public transit supporters. A univariate ANOVA revealed a main effect for Public Transit Support ($F (1, 75) = 16.94$, $p = 0$). To test $H_4$, simple effects analysis revealed that $DJ_{vmt}$ was significantly higher for the negative VMT goal-framing condition ($M = 6.00$) than for the positive VMT goal-framing condition ($M = 3.55$), ($F (1, 75) = 13.50$, $p = 0$). We thus confirm this hypothesis, as shown in Figure 5.

**General Discussion and Future Research** We found support for all four of our hypotheses, which confirm both loss aversion and negativity bias theories. In essence, individuals with a high likelihood for utilizing public transportation (even when personal transportation is available) are more likely to support taxation policy changes. They have better attitudes towards them and recognize their benefits both in the form of society and distributive justice. This paper then contributes to the idea that prosocial behavior in terms of transportation attitudes can be developed through targeted message and communication strategies which are developed for very specific markets.
Taxation policy as it relates to the sustainability of both the environment and the infrastructure is a critical and fundamental issue. Of utmost importance is individual acceptance and compliance with such regulations, and research shows that, when properly communicated, policies can empower consumers to willfully engage in sustainable lifestyles (Thøgersen, 2005). As with other situations, goal framing interacts with prosocial behavior, i.e. altruistic attitudes, when the outcomes are most salient with the attitude. We found support for this notion in our experiment.

Future research in the area of framing of VMT messages can also explore the relationship of moderator variables, such as involvement (Tsai and Tsai, 2006) or perceived risk (Chang, 2007), which may influence the persuasive effect of negatively (or positively) framed messages on attitudes to VMT. Future research is also needed to identify individual and collective key values as they relate to VMT. Once understood, future research should also examine under what circumstances framing effects are most relevant. For example, is framing most effective when there is a fit between individual (collective) needs and individual (collective) outcomes? Because VMT is a tax focused on those that will use the roads, future research should aim to develop a more in-depth understanding of the importance of road use and its relationship to individual tax compliance and attitudes.
REFERENCES


Program, T. C. R. *Understanding How to Motivate Communities to Support and Ride Public Transportation*. Transportation Research Board, 2008.


FIGURE 1
Conceptual Model

Independent variable (personal preference):
- Public Transit Support (high/low)

Independent variable (manipulation):
- VMT Goal Framing (positive/negative)

Dependent variables:
- Attitude toward VMT ($A_{vmt}$);
- VMT environmental benefit ($B_{environment}$);
- VMT societal (American) benefit ($B_{societal}$);
- VMT distributive justice ($DJ_{vmt}$).
FIGURE 2

H₁ Attitude Towards VMT

Public Transit Support
- Low Public Transit Support
- High Public Transit Support

Estimated Marginal Means

VMT Goal-Framing

Positive 

Negative
FIGURE 3

$H_2$ VMT environmental benefit
FIGURE 4

$H_3$ VMT societal benefit
FIGURE 5

H₄ VMT distributive justice
## APPENDIX 1

<table>
<thead>
<tr>
<th>VMT Goal Framing</th>
<th>Scenario</th>
</tr>
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<tbody>
<tr>
<td>Beginning Paragraph (same for both conditions)</td>
<td>The Director of the Nevada Department of Transportation recently told members of the Senate Finance and Assembly Way and Means committees that her department is considering the idea of basing gas prices on each individual vehicle use. Known as a Vehicle Mile Taxation (VMT) plan, it entails charging drivers a fee on the number of miles they drive instead of the amount of gasoline they buy. The goal is to create an equitable way of taxing drivers while providing NDOT with the appropriate funds for Nevada's road system.</td>
</tr>
<tr>
<td>1. Positive (Beginning paragraph plus this part)</td>
<td>Sufficient tax revenues would allow the state to <em>further expand and improve infrastructure</em> (e.g., roads and railways). If we base gas prices on each individual vehicle use, the ability to have improvements in the infrastructure <em>can be maintained.</em></td>
</tr>
<tr>
<td>2. Negative (Beginning paragraph plus this part)</td>
<td>A lack of tax revenues may lead to a cutback on the transportation system. As a further consequence of lacking tax revenues, the state may be <em>unable to expand and improve infrastructure</em> (e.g., roads and railways). If we base gas prices on each individual vehicle use, the threat of restrictions in our infrastructure <em>can be avoided.</em></td>
</tr>
</tbody>
</table>