ECOLOGICAL ECONOMICS 68 (2009) 1701–1710

available at www.sciencedirect.com

ScienceDirect

www.elsevier.com/locate/ecolecon

SURVEY

Preferences for change: Do individuals prefer voluntary actions, soft regulations, or hard regulations to decrease fossil fuel consumption?

Shahzeen Z. Attari[a,b,*], *Mary Schoen*[a], *Cliff I. Davidson*[a,b], *Michael L. DeKay*[c], *Wändi Bruine de Bruin*[d], *Robyn Dawes*[d], *Mitchell J. Small*[a,b]

[a]*Department of Engineering and Public Policy, Carnegie Mellon University, 5000 Forbes Avenue, Baker Hall 129, Pittsburgh, PA 15213, United States*
[b]*Department of Civil and Environmental Engineering, Carnegie Mellon University, United States*
[c]*Department of Psychology, The Ohio State University, United States*
[d]*Department of Social and Decision Sciences, Carnegie Mellon University, United States*

ARTICLE DATA

Article history:
Received 14 July 2008
Received in revised form
13 October 2008
Accepted 13 October 2008
Available online 14 February 2009

Keywords:
Preferences for change
Energy conservation
Environmental behavior
Regulations
Personal freedom

ABSTRACT

Pittsburgh residents (n=209) reported their preferences for voluntary actions, soft regulations, and hard regulations to (a) limit the number of SUVs and trucks and (b) increase green energy use for household energy consumption. These two goals were presented in one of two motivating frames, as addressing either environmental or national security issues. For the goal of limiting SUVs and trucks, results indicated that participants favored voluntary actions over hard regulations, and soft regulations over voluntary actions. For the goal of increasing green energy, results indicated that participants preferred both voluntary actions and soft regulations over hard regulations, but had no significant preference between voluntary actions and soft regulations. How the problems were framed did not significantly affect participants' willingness to accept voluntary actions or regulations. Participants' environmental attitudes (as assessed using the New Ecological Paradigm scale) had a strong positive relationship with support for regulatory strategies intended to change the behaviors in question. Women were more likely to support voluntary actions than men. The loss of personal freedom was frequently mentioned as a reason for saying no to hard regulations.

1. Introduction

Increasing carbon dioxide levels in the atmosphere (Hansen et al., 1981) are leading to anthropogenic climate change (IPCC, 2007). Changing consumption habits in the domains of transportation, home energy use, and other resource-intensive activities provides one approach to sustainable development (World Commission on Environment and Development, 1987). The effectiveness of alternative policies to promote changing these behaviors is thus of great interest.

Although federal regulation on climate change in the United States is still lacking, a select number of states have been trying to implement policies. In 2007, the United States Supreme Court ruled in favor of the plaintiffs in the landmark

* *Corresponding author*. Department of Engineering and Public Policy, Carnegie Mellon University, 5000 Forbes Avenue, Baker Hall 129, Pittsburgh, PA 15213, United States.
E-mail address: shahzeen.attari@gmail.com (S.Z. Attari).

0921-8009/$ – see front matter © 2008 Elsevier B.V. All rights reserved.
doi:10.1016/j.ecolecon.2008.10.007

case of Massachusetts vs. the United States Environmental Protection Agency (EPA), in which twelve states sued the EPA to force the agency to regulate carbon dioxide and other greenhouse gases (GHGs) as air pollutants under the Clean Air Act. Section 202 of that Act states that "the administrator shall by regulation prescribe [...] standards applicable to the emission of any air pollutant from any class or classes of new motor vehicles [...] which may reasonably be anticipated to endanger public health and welfare"("Clean Air Act", 1970). The court ruling now requires that the EPA articulate why it should not regulate GHGs. This ruling applies only to mobile sources of GHGs, not to stationary sources such as power plants.

In addition, many states have unilaterally adopted California's emissions standards which require larger emissions reductions and fuel-efficiency improvements than the targets set by the current Corporate Average Fuel Economy (CAFE) standards. However, the EPA has denied California the right to set stronger standards on grounds that national energy legislation should be used instead of statewide initiatives. California has retaliated by suing the EPA (California State, 2007). Although the current state of the law imposes very little restriction on individual consumer behavior, stronger regulations may eventually be adopted.

Governmental bodies may propose *hard* or *soft* regulations (also called *hard-path* or *soft-path* regulations). Hard regulations impose economic costs of non-compliance (Wilms, 1982). Soft regulations make some options more appealing than others in order to change behavior without imposing such economic costs (Thaler and Sunstein, 2003). An example of a successful hard regulation is the mandatory seatbelt law (Viscusi, 1993). An example of a successful soft regulation was demonstrated by Choi et al. (in preparation), where changes in the default savings rates for 401 (*k*) plans stimulated significant boosts in retirement savings.

In a democracy, such policy changes usually need the support of the majority of citizens. There are a variety of reasons why people may be especially resistant to hard governmental regulations. First, people generally prefer the status quo over a change in their situation (Samuelson and Zeckhauser, 1988), suggesting that they may not support new regulations that require change. Although hard regulations may lead to both losses (in terms of restricting behaviors) and gains (in terms of increased safety, improved environmental quality, reduced costs, or other individual or social outcomes), losses may loom larger than gains in many decisions (Kahneman and Tversky, 1979, 1984). In addition, individuals may not appreciate how well they would adapt to the behavior changes required by hard regulations (as they have adapted to seat belt laws, for example) (Loewenstein et al., 2002).

Moreover, hard regulations may evoke psychological reactance, with individuals seeking ways to re-establish their lost freedom (Brehm et al., 1966; Kornberg et al., 1970). For example, Mazis et al. (1973) found that banning phosphate detergents in Miami, Florida led to negative attitudes towards the restrictive laws, with individuals bootlegging phosphate detergents from neighboring counties. However, a softer policy involving a simple educational campaign reduced the market share of high-phosphate detergent by only 12%. Thus, some people who support sustainability may prefer hard regulations because they view such regulations as more effective.

Despite imposing limits on personal freedom, hard regulations may be preferred because they avoid aversive social dilemmas. Without hard policies, an individual's optimal strategy may be to free ride, by continuing to engage in a personally advantageous behavior, such as polluting, at the expense of those who voluntarily limit their own behavior (Hardin, 1968). As a result, people who cooperate are likely to feel "suckered" and tempted to defect as well (Orbell and Dawes, 1993). Hard regulations may be seen as more fair, because they establish similar payoffs for all participants (Hardin, 1968). Moreover, hard regulations may induce social cooperation because "we're all in this together."

Research shows that normatively irrelevant changes in how a decision is framed may affect people's preferences (Kahneman and Tversky, 1984). For example, the same ground beef is evaluated more favorably when it is presented as "75% lean" than when it is presented as "25% fat" (Levin and Gaeth, 1988). Similarly, the framing of the broader context of the decision may also affect choices.Wade-Benzoni et al. (2007) showed that manipulating one's self-perception of being an environmentalist affects whether the participant donates money to environmental causes.

Our exploratory study investigates whether individuals would support voluntary actions, soft regulations, or hard regulations to decrease their fossil fuel consumption in two different ways. As possible mechanisms for behavior change, voluntary actions, soft regulations, and hard regulations can be viewed as different points along a continuum. In our study, *voluntary actions* are characterized by the lack of regulation, with the individual left to decide independently whether or not to engage in a particular behavior. *Soft regulations* are characterized as incentive-based mechanisms or changes in default options, and are intended to guide consumer behavior. *Hard regulations*, on the other hand, are characterized as governmental controls, like bans, and are designed to compel consumer behavior.

We compare individuals' pro-environmental attitudes and demographic information with their preferences for no action, voluntary action, soft governmental regulation, or hard government regulation. This approach is important in mapping which kinds of actions and regulations to curb carbon emissions will be favored by particular demographic groups. Note that participants' responses may be only weakly associated with actual reactions to the behavior-change strategies because self-reported preferences may be colored by social desirability (i.e., the inclination to present oneself in a manner that will be viewed favorably by others) (Stone et al., 2000). However, given that we collected no unique identifying information from the study participants, we anticipate that the elicited preferences are as close to actual attitudes as possible.

The guiding questions for this study are:

1) Do participants prefer voluntary actions, soft regulations, or hard regulations?
2) Does the specific goal of the action or regulation, or the way in which that goal is framed, affect participants' willingness to support the action or regulation?
3) Is participants' willingness to support each action or regulation related to participants' environmental attitudes and demographic characteristics?

4) What are participants' reasons for their support or lack of support for each action or regulation?

2. Method

2.1. Participants

The surveys were distributed in Pittsburgh, Pennsylvania, USA, at the main branch of the Carnegie library, at an outdoor plaza, at a shopping mall, in downtown Pittsburgh, and in residential areas within the city limits, reflecting a sample of convenience (n=209). The survey was conducted from May through December of 2006.

2.2. Procedure

All participants were asked to state their preferences for hypothetical regulatory options intended to (a) limit SUVs and trucks and (b) increase green energy use, in that order. Each participant was randomly assigned to one of four experimental conditions, created by crossing two between-subject variables: they were asked to state preferences for the regulatory options of (a) voluntary actions and soft regulations or (b) voluntary actions and hard regulations, and whether the options were framed as addressing (a) environmental concerns or (b) national security concerns. In each condition, the voluntary action was presented before the (hard or soft) regulation, to provide a systematic reference point. Thus, we used a 2×2×(2) design, with regulatory options (voluntary and soft regulation vs. voluntary and hard regulation) and frame (environmental vs. national security) as between-subject factors, and goals (limiting SUVs and trucks vs. increasing the use of green energy) as a within-subject factor. Table 1 shows the number of participants in each of the four between-subject condition. The details of these conditions are described below.

2.3. Environmental vs. national security frame

Before making each choice, participants were presented with the environmental or the national security frame. In the environmental frame, the goal of limiting SUVs and trucks was presented as: "Many scientists agree that automobile emissions are changing the composition of the atmosphere. On average, automobile emissions increase the global temperature, which in turn damages ecosystems. Large vehicles like SUVs and trucks typically have low gas mileage, and as a result, release more harmful emissions than compact cars." Similarly, the environmental frame for the goal of increasing green energy use read: "Many scientists agree that electricity generated by coal pollutes the atmosphere with toxic substances and contributes to climate change. Living in Pennsylvania, you can select to have a portion of your energy generated by solar and wind power (green energy). Electricity generated from green energy does not pollute the atmosphere with toxic substances, but is more costly than electricity generated by coal. Selecting green energy, a typical homeowner's monthly bill is likely to increase by about $5.00." The surcharge cost was estimated from a Pennsylvania renewable energy provider (Community Energy, 2006). By contrast, the national security frame presented the goal of limiting SUVs and trucks as: "Many political scientists agree that the low gas mileage of SUVs and trucks is increasing our oil consumption and dependence on foreign oil. This heightened dependence on foreign oil decreases our national energy security — that is our ability to ensure and control our energy supply. The lack of control of our energy supply compromises our national security." Similarly, the national security frame presented the goal of increasing green energy use as: "Many political scientists agree that one way to decrease our nation's dependency on foreign energy supplies is to invest in domestic, renewable energy sources. Living in Pennsylvania, you can select to have a portion of your energy generated by renewable energy. Electricity generated from renewable sources is more costly than non-renewable sources. Selecting renewable energy, a typical homeowner's monthly bill is likely to increase by about $5.00."

Table 1 – Number of participants in each of the 2×2 between-subjects conditions

Frame	Regulatory options	
	Voluntary and soft regulation	Voluntary and hard regulation
Environmental	53	56
National security	50	50

Note: Each participant evaluated voluntary actions and regulations for the goals of (a) limiting SUVs and trucks and (b) increasing green energy use (within-subject condition).

2.4. Voluntary action and soft regulation vs. voluntary action and hard regulation

After being presented with the environmental or the national security frame, all participants were asked whether or not they were willing to engage in voluntary action to limit SUVs and trucks. For the environmental frame, the question read, "In order to reduce automobile emissions, I would be willing to pledge that the next car I purchase will not be a high emission vehicle such as a SUV or truck," with response options "yes" and "no." Subsequently, participants were asked whether they would be willing to accept a soft or hard regulation (depending on the survey version). For the environmental frame, the soft regulation option read, "In order to reduce automobile emissions, I would support the government providing tax breaks to individuals who purchase low emission vehicles like compact cars." The hard regulation option read, "In order to reduce automobile emissions, I would support the government restricting the purchase of SUVs and trucks, so that only individuals with approved certification and need can purchase and operate the vehicles." For the national security frame, the phrase "In order to reduce automobile emissions" was replaced by the phrase "In order to reduce dependency on foreign oil."

For the goal of increasing green energy use, the voluntary option under the environmental frame read, "In order to decrease the pollution released into the atmosphere, I would be willing to pledge to buy green energy from my energy supplier," with response options "yes" and "no." Depending on

the survey version, participants were then asked whether they would be willing to accept a soft or hard regulation. For the environmental frame, the soft regulation option read: "In order to reduce dependency on foreign oil, I would be in favor of changing the current system — so that customers automatically purchase a percentage of renewable energy, unless they explicitly decide not to. This would require a consumer who desires an electricity service plan without green energy to make a telephone call to change their plan." The hard regulation option read, "In order to decrease the pollution released into the atmosphere, I would support a government regulation requiring that home-owners purchase a fraction of their electricity from green energy suppliers." For the national security frame, the phrase "In order to decrease the pollution released into the atmosphere" was replaced by "In order to reduce dependency on foreign oil."

After indicating whether or not they would support a particular voluntary action or regulation, participants were asked to explain their response in writing, by briefly listing the reasons for their preference. Next, they completed the New Ecological Paradigm (NEP) scale, which assesses pro-environmental attitudes (Dunlap et al., 2000). The NEP scale is a well-tested set of 15 statements that assess an individual's beliefs about his or her ability to change the balance of nature, the limits to growth of human societies, and the right of humans to rule over the rest of nature. Each of the 15 statements on the NEP (e.g., "The so-called 'ecological crisis' facing humankind has been greatly exaggerated") was followed by a seven-point scale ranging from 0 (completely disagree) to 6 (completely agree). For each participant, we computed an overall NEP score by the averaging his or her responses to the 15 items.

Finally, participants were asked whether or not they currently owned or leased an SUV, used alternative energy, and purchased green energy. Participants also reported their political party affiliation (Democrat, Republican, Independent, or Not sure) and their political views (with response options on a seven-point scale ranging from extremely liberal to extremely conservative). The survey ended with demographic questions regarding their gender, age, family income before tax, and highest level of education completed.

3. Results

Data from the U.S. Census Bureau indicate that our sample was reasonably representative of the Pittsburgh population (U.S. Census Bureau, 2007). The Census shows that 82% of Pittsburgh residents who are of age 25 or older have high school diplomas (90% in our sample) and 31% have a bachelor's degree (27% in our sample). Of participants who reported their highest level of education, 4% had completed no high school, 6% had obtained a high school diploma or GED, 31% had completed some college, 27% had finished college, 5% had some graduate training, and 16% had earned a graduate degree.

As reported by the U.S. Census Bureau, Pittsburgh's median family income is $44,027 (our sample median was in the $20,001–$50,000 range), and 47.2% of Pittsburgh's population is male (47% in our sample). The median age in Pittsburgh (38 years) is somewhat greater than that in our sample (28 years, SD = 14.5 years). Pittsburgh also has about twice as many registered Democrats than Republicans (Commonwealth of Pennsylvania, 2007), whereas our sample consisted of 52% Democrats, 16% Republicans, and 13% Independents (19% of participants were not sure). Self-reported political views included 46% liberals (scale score = 0–2), 30% moderates (score = 3), and 24% conservatives (score = 4–6). At the time of the survey, 21% of our participants owned or leased an SUV, 5% used alternative energy, and 9.3% bought green energy from their electricity provider.

The average NEP score of 3.6 shows that our sample was slightly pro-environmental relative to the scale mid-point (3), which resembles the results found by Scott and Willits (1994) in their statewide survey of Pennsylvania (n = 3632), using an earlier 12-item version of the NEP scale. To investigate the correlates of participants' environmental attitudes, we regressed participants' NEP scores (environmental attitudes) onto the following demographic variables: political party (coded using three dummy variables for Democrat, Republican, and Independent; Not Sure was the excluded category), political views, gender, age, income, and education. The results, which appear in Table 2, indicate that NEP scores were higher for more liberal participants and older participants, but lower for male participants. Similar to our findings, women have been found to be more pro-environmental than men (Bord and O'Connor, 1997; Davidson and Freudenburg, 1996). Buttel and Flinn (1978) found that liberal political values also imply stronger pro-environmental attitudes and that political party affiliation did not determine environmental concern. The observed relationship between age and pro-environmentalism was somewhat unusual. Many studies have found age to be negatively correlated with environmentalism (Van Liere and Dunlap, 1980), although some have reported a positive relationship. Dietz et al. (1998) found that depending on the indicator used, younger participants in a sample may either be the most pro-environmental or the least. Specifically, their study found that younger participants tend to engage in less pro-environmental consumer behavior compared with older participants, and are less likely to sign pro-environmental petitions.

Fig. 1 shows the percentage of all participants who reported that they would support voluntary action, soft regulations, or hard regulations, for the goal of limiting trucks and SUVs and

Table 2 – Results of regressing NEP score onto demographic variables

Variable	Estimate	t value
Intercept	4.2	15***
Democrat	0.07	0.46
Republican	−0.14	−0.69
Independent	−0.16	−0.79
Political views	−0.18	−3.4***
Gender (male = 1)	−0.28	−2.4*
Age	0.016	3.7***
Income	−0.066	−1.8
Education	−0.039	−0.86
R^2 = 0.20		

Note: Asterisks denote significance level: *p < 0.05; **p < 0.01; ***p < 0.001.

for the goal of increasing green energy use. For each goal, the percentage of participants agreeing to support voluntary action was always greater than 50%. There was a significant difference between the percentages of participants supporting voluntary actions and soft regulations for limiting SUVs and trucks (67% vs. 80% respectively, exact p for McNemar's test = 0.029), although there was no significant difference between support for voluntary actions and soft regulations for increasing green energy use (76% vs. 69%, respectively, exact $p = 0.21$). Voluntary actions were significantly preferred to hard regulations for limiting SUVs and trucks (65% vs. 30%, exact $p < 0.0001$) and for increasing green energy use (81% vs. 39%, exact $p < 0.0001$).

4. Support for voluntary actions

To assess the support for voluntary actions to achieve each goal, we conducted two logistic regressions in which support for such actions was modeled as a function of frame, regulatory option (which was always presented *after* the voluntary action question), NEP score, SUV ownership (whether the participant currently owns or leases an SUV), alternative energy (whether the participant currently uses alternative energy, e.g., solar panels on his or her roof), green energy (whether the participant currently buys green energy from his or her provider), political party (using three dummy

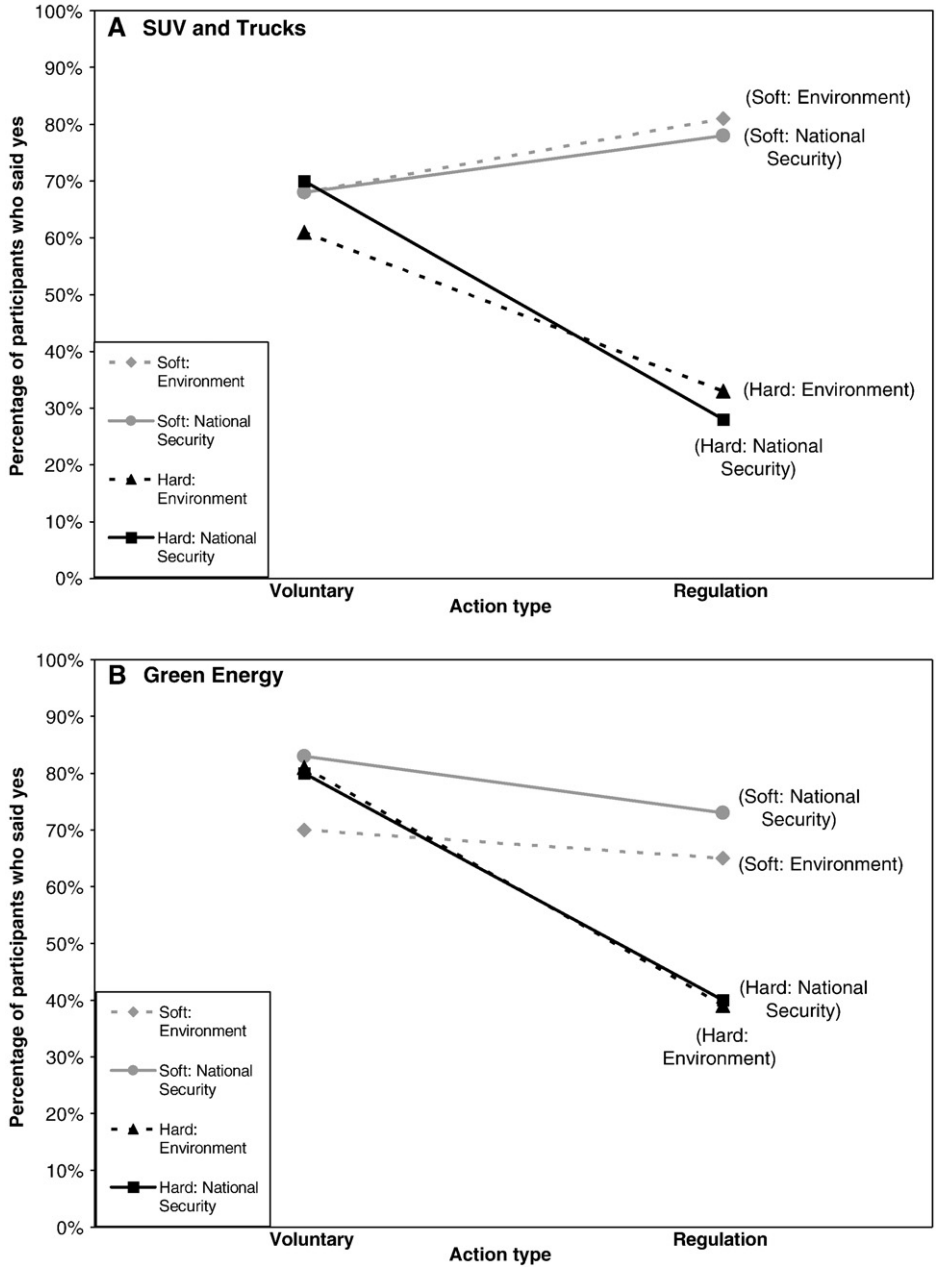

Fig. 1 – Percentage of participants who said yes to the voluntary action and regulation questions. Panel A shows the results for the goal of limiting SUVs and trucks and Panel B shows the results for the goal of increasing green energy. The labels indicate the regulation type and frame.

Table 3 – Results of logistic regressions for predicting whether or not participants support *voluntary action* to limit SUVs and trucks and to increase green energy use

Predictor	Limiting trucks and SUVs			Increasing green energy use		
	Estimate	Wald χ^2	Odds ratio estimate	Estimate	Wald χ^2	Odds ratio estimate
Intercept	−2.3	2.2		−1.2	0.45	
Frame (environmental=1)	−0.14	0.14	0.87	−0.19	0.17	0.83
Regulatory option (soft=1)	−0.090	0.059	0.91	−0.62	2.0	0.54
NEP score	0.69	6.0*	2.0	0.84	6.2*	2.3
SUV ownership	−1.5	11***	0.22	0.74	1.8	2.09
Alternative energy	0.090	0.0095	1.1	12	0.00080	>1000
Green energy	1.3	2.0	3.7	14	0.0024	>1000
Democrat	0.50	1.0	1.6	−0.32	0.31	0.73
Republican	−0.67	1.2	0.51	0.29	0.16	1.3
Independent	0.13	0.039	1.1	−0.051	0.0049	0.95
Political views	0.24	1.9	1.3	0.11	0.30	1.1
Gender (male=1)	−0.81	4.6*	0.45	−1.0	5.2*	0.37
Age	0.0030	0.044	1.0	0.0079	0.22	1.0
Income	−0.016	0.015	0.98	−0.27	3.2	0.76
Education	0.098	0.45	1.1	0.15	0.78	1.2
Max-rescaled R^2	0.31			0.29		

Note: Asterisks denote significance level: *$p<0.05$; **$p<0.01$; ***$p<0.001$.

variables for Democrat, Republican, and Independent), political views, gender, age, income, and education. One logistic regression predicted support for limiting SUVs and trucks and the other predicted support for increasing green energy use.

Results appear in Table 3. The left side of the table indicates that voluntary action to limit SUVs and trucks was not significantly related to whether the survey version also included questions regarding soft regulation or questions regarding hard regulation. This is as it should be, because the type of regulation was not mentioned until after support for voluntary action had been assessed. Whether the voluntary action was framed as addressing environmental concerns or national security concerns did not significantly affect participants' support. Participants' NEP scores significantly affected whether or not they would engage in voluntary actions, with pro-environmental participants being more likely to do so (the odds of supporting the action were 2 times higher for each one-unit increase in NEP score). In addition, SUV owners and men were less likely to pledge not to buy an SUV or truck as their next vehicle (the odds of supporting the action were 4.5 times lower for SUV owners than for non-owners and 2.2 times higher for women than for men).

The right side of Table 3 shows the results for voluntary action to increase green energy use. As was the case for the SUV goal, participants' support for voluntary action was not

Table 4 – Results of logistic regressions for predicting whether or not participants support *regulation* to limit SUVs and trucks and to increase green energy use

Predictor	Limiting trucks and SUVs			Increasing green energy use		
	Estimate	Wald χ^2	Odds ratio estimate	Estimate	Wald χ^2	Odds ratio estimate
Intercept	−2.9	3.6		−2.8	3.7	
Frame (environmental=1)	−0.088	0.049	0.92	−0.20	0.30	0.82
Regulatory option (soft=1)	2.2	32***	9.4	1.21	11***	3.4
NEP score	0.62	5.4*	1.9	0.73	7.4**	2.1
SUV ownership	−0.29	0.36	0.75	0.081	0.031	1.1
Alternative energy	0.64	0.44	1.9	0.72	0.49	2.0
Green energy	0.98	1.6	2.7	1.51	3.0	4.5
Democrat	−0.44	0.70	0.64	0.43	0.74	1.5
Republican	−1.5	5.0*	0.22	−0.19	0.092	0.83
Independent	−1.4	4.4*	0.24	−0.61	0.88	0.54
Political views	0.089	0.25	1.09	0.16	0.89	1.2
Gender (male=1)	−0.28	0.55	0.75	−0.69	3.6	0.50
Age	0.0070	0.22	1.0	0.0032	0.049	1.0
Income	0.064	0.24	1.1	−0.069	0.28	0.93
Education	−0.032	0.045	0.97	−0.14	0.97	0.87
Max-rescaled R^2	0.42			0.31		

Note: Asterisks denote significance level: *$p<0.05$; **$p<0.01$; ***$p<0.001$.

significantly affected by the subsequent regulation option (hard or soft) or by whether the voluntary action was framed as addressing environmental concerns or national security concerns. Participants with higher NEP scores were again more likely to support voluntary action (the odds of supporting the action were 2.3 times higher for each one-unit increase in NEP score). Finally, men were less likely than women to pledge to buy green energy from their supplier (the odds of supporting the action were 2.7 times higher for women than for men).

5. Support for regulations

We conducted two similar logistic regressions to predict participants' support for regulations intended to limit SUVs and trucks or increase green energy use. The left side of Table 4 shows the results for limiting SUVs and trucks. Participants were significantly more likely to support the regulation if it was soft rather than hard (the odds of support were 9.4 times higher for the soft regulation than for the hard regulation). Whether the regulation was framed as addressing environmental concerns or national security concerns did not significantly affect participants' support. As was the case for voluntary actions, pro-environmental participants were more likely to support regulations to limit SUVs and trucks (the odds of supporting the regulation were 1.9 times higher for each one-unit increase in NEP score). Additionally, Republicans and Independents were less likely to support the regulation than were participants who were not sure of their party affiliation (the odds of rejecting the regulation were 4.5 times higher for Republicans and 4.2 times higher for Independents).

The right panel of Table 4 shows the results for increasing green energy use. Similar to the results for limiting SUVs and trucks, participants were more likely to support regulation to increase green energy use if the regulation was soft rather than hard (the odds of support were 3.4 times higher for the soft regulation than for the hard regulation). Whether the regulation was framed as addressing environmental concerns or national security concerns did not significantly affect participants' support. As was the case for voluntary actions, women and participants with higher NEP scores were more likely to support policies to increase green energy use (the odds of supporting the regulation were 2.1 times higher for each one-unit increase in NEP score).

Additional logistic regression results (not shown) indicated that the interaction between frame (environment vs. national security) and regulatory option (soft vs. hard) did not significantly affect participants' support for regulations to limit SUVs and trucks or regulations to increase green energy use. In other words, the magnitude of participants' preference for soft regulations over hard regulations was similar in the environmental and national security frames.

6. Reasons for choices

Two judges independently coded the reasons that participants listed for their choices into the 16 categories shown in Table 5. The coding showed sufficient reliability, as suggested by a Cohen's kappa of 0.67, where a score of 0.61–0.80 implies substantial agreement (Landis and Koch, 1977). Figs. 2 and 3 show the reasons that had a count greater than five for supporting (or not supporting) voluntary action and for supporting (or not supporting) regulation. The lengths of each of the stacked bars represent the number of times the specific reason was mentioned for the specific goal and frame. Participants supporting voluntary action to limit SUVs and trucks mainly mentioned *environmental reasons*, *economic incentives*, and *I already do this*, while those not supporting it mentioned that their *lifestyle requires an SUV* (Fig. 2A). Those supporting voluntary action to increase green energy use mentioned *environmental reasons and costs* and *economic incentives*, whereas those not supporting it mentioned that they need better *economic incentives* (Fig. 2B). For both the SUV and green energy goals, participants in the national security frame mentioned *foreign dependency* more often than the participants in the environmental frame.

Participants supporting soft regulation intended to limit SUVs and trucks cited *economic savings* as their primary reason; those not supporting soft regulation for this purpose indicated that better *economic incentives* were needed and noted the undesirable infringement on *personal freedom and need for choice*. Those supporting hard regulation mentioned that the *government is needed*, whereas those not supporting hard regulation mentioned *personal freedom and need for choice*. One participant stated "I think whoever wants to buy one should be allowed to." Similarly, for the goal of increasing green energy use (Fig. 3B), *government is needed* and *personal freedom and need for choice* were the main reasons for supporting soft regulation, while *environmental reasons and cost* was frequently mentioned as reasons for supporting hard regulation. Finally, *personal freedom and need for choice* was frequently mentioned by those

Table 5 – Reasons provided by participants to explain their support or lack of support for voluntary actions and regulations

Reason category	Count
Economic incentives	167
Personal freedom and need for choice	129
Environmental reasons and cost	109
Lifestyle requirement	70
I already do this	60
More information is needed	31
Safety and health reasons	31
Better choices needed	24
Other reasons (mentioned only once)	24
Government needed	19
Foreign dependency, cost, and environmental reasons	11
I do not believe in global warming	7
People will accept this	5
This requires too much effort	2
This is a drop in the bucket	2
I do not care	2

The count indicates the number of times a specific reason was mentioned in the whole study, without differentiating between questions or survey versions.

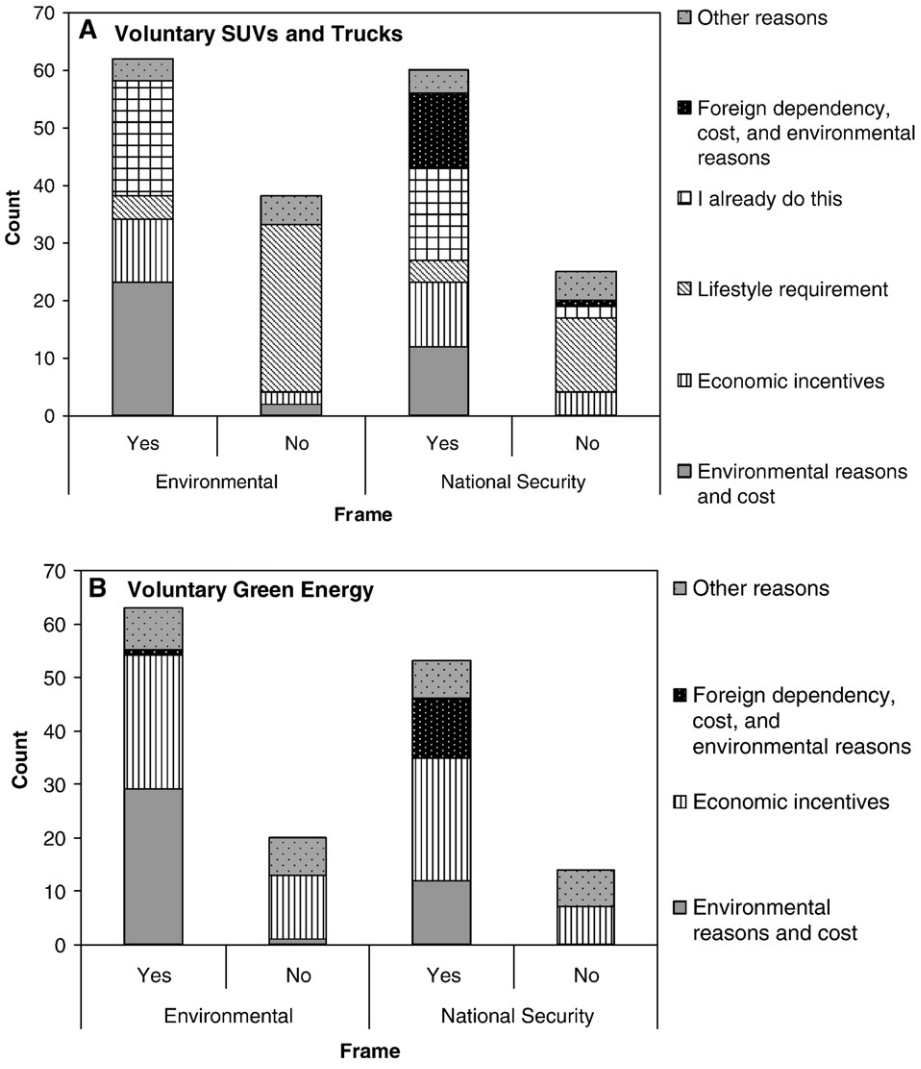

Fig. 2 – Reasons most often given by participants for supporting or not supporting voluntary actions. Panel A shows the results for voluntarily limiting SUVs and trucks: A pledge that the next vehicle you purchase will not be a high emission vehicle such as an SUV or truck. Panel B shows the results for voluntarily increasing green energy use: A pledge to buy green energy from your energy supplier.

not supporting soft or hard regulation (e.g., "this would be restricting free choice").

7. Discussion

Participants preferred voluntary actions to hard regulations for both goals of limiting SUVs and trucks and increasing green energy use. Participants favored soft regulations over voluntary actions for the goal of limiting SUVs and trucks, but showed no clear preference between voluntary actions and soft regulations for the goal of increasing green energy use. Thus, our results suggest that there may be more public buy-in for softer regulations, such as market-based mechanisms intended to change behavior. Participants were more resistant to hard regulations when the goal was to limit SUVs and trucks than to increase green energy use. Possibly, participants found the hard regulation more restrictive in the SUV goal, leading to more psychological reactance (Brehm, 1966). Indeed, the need for *personal freedom and choice* was the most frequently mentioned reason by participants who did not want to accept hard regulations. *Economic incentives* (such as monetary savings) were commonly mentioned as reasons for supporting voluntary action and soft regulation to limit SUVs and trucks (see Figs. 2A and 3A).

Framing regulations as addressing either environmental or national security concerns did not significantly affect participants' responses to any of the survey questions, in contrast to the results of previous research on framing (Kahneman and Tversky, 1984; Levin and Gaeth, 1988). Possibly, our manipulation was too weak to make a difference. Although our two frames provided different contexts in which to evaluate possible actions, they did not include a clear distinction between gains and losses, as in many previous framing studies. However, framing did play a role in the reasons that individuals gave to justify their preference for voluntary behaviors, with participants mentioning more environmental reasons when an environmental frame was presented and more security

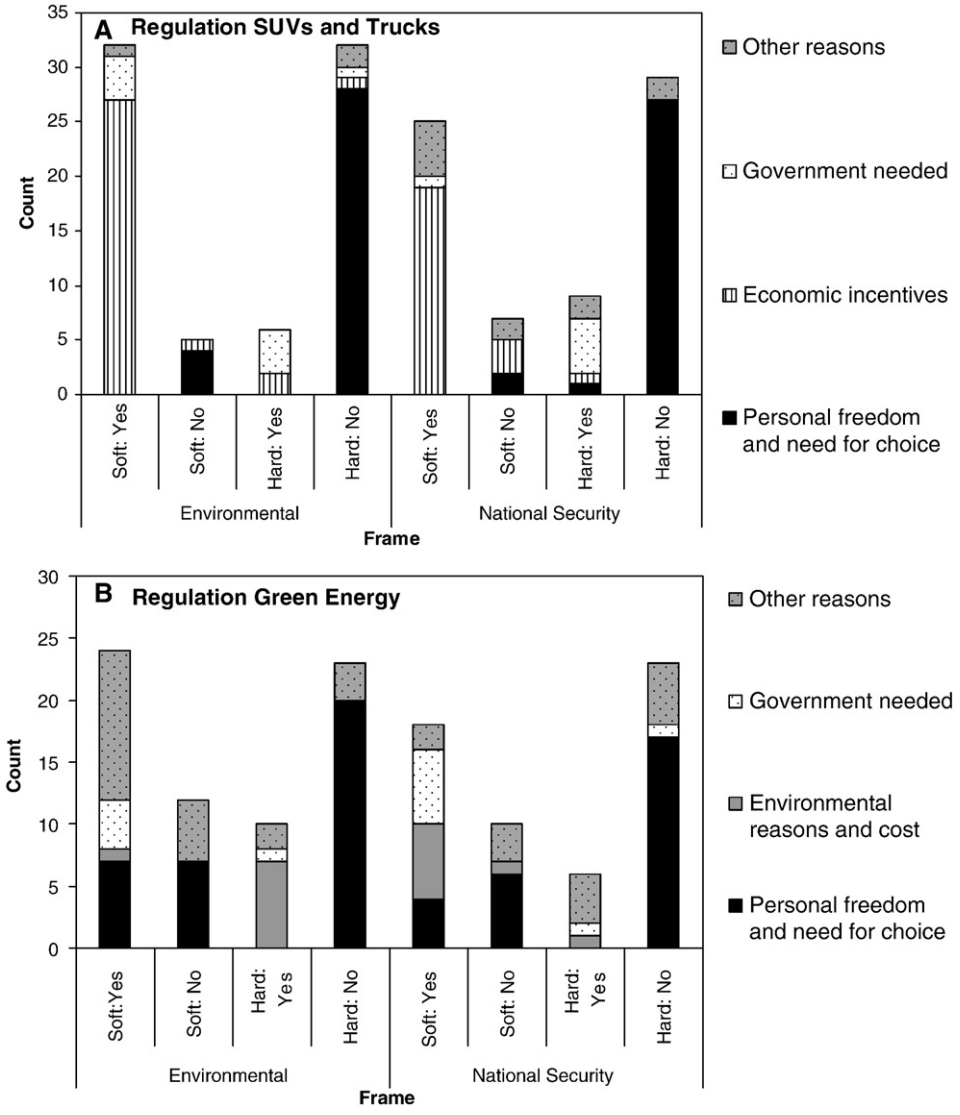

Fig. 3 – Reasons most often given by participants for supporting or not supporting soft and hard regulations. Panel A shows the results for regulating SUVs and trucks: providing tax breaks for compact cars (soft) or restricting the purchase of SUVs and trucks (hard). Panel B shows the results for regulating green energy: changing the system so that customers automatically purchase a percentage of renewable energy unless they specifically decide not to (soft) or requiring that customers purchase of a fraction of electricity from green energy suppliers (hard).

reasons when a security frame was presented (Fig. 2). Of course, it is possible that participants' reasons did not actually drive their choices, but were provided merely as justifications after the fact. An alternative explanation for the lack of a framing effect is that regulations were so salient to the participants that their preferences were not affected by the nuances of changing frames. Finally, environmental and national security frames may have been similarly compelling to the study participants (or compelling to similar numbers of participants).

Even though our study employed a convenience sample, there was enough heterogeneity to detect significant effects of participant differences on support for decreasing fossil fuel consumption in the ways studied. Participants with stronger pro-environmental attitudes were more likely to support voluntary action and government regulation, both for limiting SUVs and trucks and for increasing green energy use. Women were more likely than men to support voluntary actions in both goals, replicating previous research showing that women tend to engage in more pro-environmental behaviors than men (Zelezny et al., 2000). Additionally, participants who were Republican or Independent were less likely to support regulations limiting SUVs.

The voluntary actions and regulations investigated in this study are but snapshots of a range of possible voluntary actions, soft regulations, and hard regulations that can be used to affect behavior change. The specific actions and regulations used here were designed to cover a variety of factors such as degree of inconvenience, type of economic incentive, and extent of governmental control. In order to make more generalized conclusions about preferences for behavior change, we recommend investigating a variety of

behavioral domains using specific actions and regulations, as there may be situations in which hard regulations are preferred to soft regulations and voluntary actions. Examples include regulations intended to protect personal health and safety. Repeating portions of this study may also be of interest, to see whether different demographic groups respond differently, or to study whether preferences have changed in response to recent steep increases in energy prices.

Acknowledgments

This work was supported by the Environmental Research and Education Foundation that granted the Francois Fiessinger Scholarship to the primary author, as well as the National Science Foundation Center for Sustainable Engineering (CSE) grant number DUE-0442618. The authors would also like to thank Elizabeth M. Hohenstein for her assistance in data collection. Additionally, we gratefully acknowledge the suggestions made by George Loewenstein and the anonymous reviewers.

REFERENCES

Bord, R.J., O'Connor, R.E., 1997. The gender gap in environmental attitudes: the case of perceived vulnerability to risk: research on the environment. Social Science Quarterly 78 (4), 830–840.
Brehm, J.W., 1966. A Theory of Psychological Reactance. Academic Press, New York.
Brehm, J.W., Stires, L.K., Sensenig, J., Shaban, J., 1966. The attractiveness of an eliminated choice alternative. Journal of Experimental Social Psychology 2 (3), 301–313.
Buttel, F.M., Flinn, W.L., 1978. The politics of environmental concern: the impacts of party identification and political ideology on environmental attitudes. Environment and Behavior 10 (1), 17–36.
California State, 2007. Governor Schwarzenegger Announces Lawsuit against U.S. EPA for Failing to Act on California's Tailpipe Emissions Request. Retrieved September, 20th, 2008, from http://gov.ca.gov/press-release/8047/.
Choi, J., Laibson, D., Madrian, B., & Metrick, A. (in preparation). Active decisions: A natural experiment in savings. Manuscript in preparation.
Clean Air Act, 1970. 202 Cong. Rec.
Commonwealth of Pennsylvania, 2007. Voter Registration Statistics— Unofficial.
Community Energy. (2006). This value comes from an approximation of the cost of buying a block of 100 kilowatt-hours per month of wind energy in Pennsylvania from PECO wind, supplied by Community Energy, Inc. (a surcharge price of 2.5 cents per kilowatt-hour) Retrieved June 20th, 2006, from http://www.cleanyourair.org/pabuy.html.
Davidson, D.J., Freudenburg, W.R., 1996. Gender and environmental risk concerns: a review and analysis of available research. Environment and Behavior 28 (3), 302–339.
Dietz, T., Stern, P.C., Guagnano, G.A., 1998. Social structural and social psychological bases of environmental concern. Environment and Behavior 30 (4), 450–471.
Dunlap, R., Van Liere, K., Mertig, A., Jones, R., 2000. New trends in measuring environmental attitudes: measuring endorsement of the new ecological paradigm: a revised NEP scale. Journal of Social Issues 56 (3), 425–442.
Hansen, J., Johnson, D., Lacis, A., Lebedeff, S., Lee, P., Rind, D., Russell, G., 1981. Climate impact of increasing atmospheric carbon dioxide. Science 213 (4511), 957–966.
Hardin, G., 1968. The tragedy of the commons. Science 162 (3859), 1243–1248.
IPCC, 2007. Climate Change 2007: Synthesis Report, Summary for Policymakers.
Kahneman, D., Tversky, A., 1979. Prospect theory of decisions under risk. Econometrica 47 (2), 263–291.
Kahneman, D., Tversky, A., 1984. Choices, values, and frames. American Psychologist 39 (4), 341–350.
Kornberg, A., Linder, D., Cooper, J., 1970. Understanding political behavior: the relevance of reactance theory. Midwest Journal of Political Science 14 (1), 131–138.
Landis, J., Koch, G., 1977. The measurement of observer agreement for categorical data. Biometrics 33 (1), 159–174.
Levin, I.P., Gaeth, G.J, 1988. How consumers are affected by the framing of attribute information before and after consuming the product. Journal of Consumer Research 15 (3), 374–378.
Loewenstein, G., O'Donoghue, T., Rabin, M., 2002. Projection Bias in Predicting Future Utility. University of California-Berkeley.
Mazis, M.B., Settle, R.B., Leslie, D.C., 1973. Elimination of phosphate detergents and psychological reactance. Journal of Marketing Research 10 (4), 390–395.
Orbell, J.M., Dawes, R.M., 1993. Social welfare, cooperators' advantage, and the option of not playing the game. American Sociological Review 58 (6), 787–800.
Samuelson, W., Zeckhauser, R., 1988. Status quo bias in decision making. Journal of Risk and Uncertainty 1 (1), 7–59.
Scott, D., Willits, F., 1994. Environmental attitudes and behavior: a Pennsylvania survey. Environment and Behavior 26 (2), 239–260.
Stone, A., Turkkan, J., Bachrach, C., Jobe, J., Kurtzman, H., Cain, V., 2000. The Science of Self-report: Implications for Research and Practice. Lawrence Erlbaum Associates, Mahwah, New Jersey.
Thaler, R.H., Sunstein, C.R., 2003. Libertarian paternalism. American Economic Review 93 (2), 175–179.
U.S. Census Bureau, 2007. American Community Survey, Data Profile Highlights:2006 Pittsburgh city, Pennsylvania. Retrieved September 20th, 2008, from http://factfinder.census.gov/servlet/ACSSAFFFacts?_event=&ActiveGeoDiv=geoSelect&pctxt=fph&_lang=en&_sse=on&geo_id=16000US4261000&_state=04000US42.
Van Liere, K., Dunlap, R., 1980. The social bases of environmental concern: a review of hypotheses, explanations and empirical evidence. The Public Opinion Quarterly 44 (2), 181–197.
Viscusi, W.K., 1993. The value of risks to life and health. Journal of Economic Literature 31 (4), 1912–1946.
Wade-Benzoni, K., Li, M., Thompson, L., Bazerman, M., 2007. The malleability of environmentalism. Analysis of Social Issues and Public Policy 7 (1), 163–189.
Wilms, W.W., 1982. Soft policies for hard problems: implementing energy conserving building regulations in California. Public Administration Review 42 (6), 553–561.
World Commission on Environment and Development, 1987. Our Common Future.
Zelezny, L., Chua, P.P., Aldrich, C., 2000. New ways of thinking about environmentalism: elaborating on gender differences in environmentalism. Journal of Social Issues 56 (3), 443–457.