Public Support for Pollution Fee Policies for Motor Vehicles: Survey Results

Alan Krupnick, Winston Harrington,
and Anna Alberini

Discussion Paper 97-13

December 1996

Resources for the Future
1616 P Street, NW
Washington, DC 20036
Telephone 202-328-5000
Fax 202-939-3460

Public Support for Pollution Fee Policies for Motor Vehicles: Survey Results

Alan Krupnick, Winston Harrington,
and Anna Alberini

Abstract

In this paper we report on the results of a telephone survey conducted in Southern California during August and September 1996. The purpose of the survey was to inform respondents about a set of rather complex pricing policies designed to reduce motor vehicle emissions and to estimate respondent support for those policies. After receiving extensive information about these policies, respondents were polled on whether they would support, i.e., vote for, any or all of these options.

The pollution fee survey elicited support for a plan that levied a fee on vehicles in the region, depending on the vehicle's emissions per mile and on the miles driven. The sample was then split in two, with half the respondents being told that a portion of the revenues would be returned to the public in the form of reductions in motor vehicle fees or sales tax reductions, and half told that these returns would be made in the form of coupons.

Nearly 40 percent of respondents agreed to support the base plan (42 percent of those expressing an opinion). More than 50 percent supported the fees with rebates, including support of 54 percent when all the available revenues are returned to the public (57 percent of the sample expressing an opinion). Support for the coupon policy was intermediate between the base and rebate policies, attracting 42 percent of the sample (45 percent of those expressing an opinion).

Statistical analyses were performed on the data to explain the voting patterns observed. Generally, the levels of support were significantly affected by the design features of the plans, such as the size of the fee paid and the rebate, as well as by a host of socio-demographic and perceptual variables, such as ethnicity, age, political affiliation, expected efficacy of the policy, and the degree to which air pollution affects the respondent or his or her family. Examination of these statistical results may be useful in the development of pollution fee programs to present to the public, as well as in the design of public information campaigns and the allocation of marketing resources to win support for these programs.

Key Words: mobile sources, survey, emissions fees

JEL Classification No(s).: R41, Q28

Table of Contents

I. Introduction 1
II. Survey Description 5
III. Descriptive Statistics 9
IV. Support for the Alternative Plans 11
Base Survey 11
Pollution Fees with Other Fee/tax Reductions 17
Pollution Fees with Coupons Returned 20
V. Implications of the Survey 24
References 26

List of Tables and Figures

Table 1. Number of Interviews and Sampling Weights 4
Table 2. Descriptive Statistics 10
Table 3. Support for Base Pollution Fee Policy 11
Table 4. Importance of Base Policy 13
Table 5. Probit Regression Results for Voting on the Basic Plan 14
Table 6. Voting on Base Plan, By County 15
Table 7. Probit Regression Results for Voting on the Rebate Plan 19
Table 8. Voting on Rebate Plan, By County 19
Table 9. Strength of Support and Opposition to Base and Rebate Plans 21
Table 10. Voting on Coupon Plan 21
Table 11. Probit Regression Results for Voting on the Coupon Plan 22
Table 12. Voting on Coupon Plan, By County 23
Figure 1. Pollution Fee Survey 6
Figure 2. Support for Pollution Fee Policies 12

Public Support for Pollution Fee Policies for Motor Vehicles: Survey Results

Alan J. Krupnick, Winston Harrington,
and Anna Alberini[1]

I. INTRODUCTION

Despite intense regulatory efforts to reduce vehicle emissions over the past twenty years, emissions from cars and trucks continue to be major source of air pollution problems in urban areas of the U.S. [National Research Council, 1991]. Until the late seventies, the principal approach to reducing vehicle emissions had been stringent new car emission standards, enforced against the manufacturer. Although the new car emission reductions have been substantial, emissions from vehicles on the road continue to be a problem, with relatively small numbers of cars with broken or deteriorated emissions equipment accounting for the majority of the emissions [Bishop and Stedman, 1994].

Recognition of this divergence between new vehicle emission certification and actual in-use emissions caused Congress to require vehicle inspection and maintenance (I/M) programs in the more polluted urban areas as part of the 1977 Clean Air Amendments. At the time, evidently, legislators envisioned emission inspection to be a straightforward extension of vehicle safety inspection programs in operation in all the states and previously mandated by federal legislation. Many states, in fact, responded by tacking the I/M test onto the existing safety inspection.

States were given wide latitude for designing their own inspection programs and a variety of programs emerged. However, by the late 1980s it had become clear that many of the initial state programs, on which the EPA had placed such high expectations, were not effectively reducing vehicle emissions and urban areas in many states were still not in compliance with national clean air standards.

---

[1] Alan J. Krupnick and Winston Harrington, Senior Fellows, Quality of the Environment Division, Resources for the Future; Anna Alberini, Department of Economics, University of Colorado.

When the Clean Air Act was amended in 1990, Congress required "enhanced I/M in the most polluted urban areas, which required that states not set minimum repair limits at levels less than $450 per car, promoted centralized testing system with a more rigorous and extensive test procedure, and established strict restrictions on which cars were required to be tested.[2] The EPA believed that the new Enhanced I/M would improve some of the technical difficulties with the earlier tests and help to prevent at least some of the types of fraud.

These new regulations were to have been implemented by 1994, but there has been such opposition to them in so many states that the EPA has backed away from the original requirements that programs be centralized and use specific test technology. Federal regulators are considering more flexibility in how they allow states to comply with clean air statutes.

This paper considers the viability of one such option championed by economists [see Harrington, McConnell, and Alberini, 1996; Harrington, Walls and McConnell, 1995; Kessler and Schroeer, 1993; Eskeland and Devarajan, 1996; and Stephen Smith, 1995] -- a pollution fee program where vehicles are charged a fee based on their emissions rate (grams per mile) times their miles driven. Such an approach (with an I/M program used solely for establishing the emissions rate) has the potential to substantially increase economic welfare over current regulatory policy for reducing vehicle emissions. Under the current I/M policy motorists must repair a vehicle if it does not pass the inspection, regardless of the benefits of doing so. With an emissions fee the motorist has a choice about whether to repair the vehicle and costly repairs can be avoided if they are unlikely to produce significant emissions reductions. Further a pollution fee system can especially target vehicles that contribute the most emissions, i.e., that have a high emissions rate and high mileage, whereas IM programs treat all dirty vehicles equally.

There are a number of objections to a fee system, not the least of which is that it is unfair to high mileage drivers (it is reasoned that most miles are attributable to commuting, where elasticity of travel demand is very low) and low income people (because they

---

[2] EPA developed a technically sophisticated emission test protocol that included use of expensive automatic analyzers and a dynamometer, called the "IM240" test. This test is supposed to be more accurate and somewhat less susceptible to motorist evasion than the simpler idle tests, but it is also more expensive.

disproportionately own dirty vehicles). To partly address these problems and to raise the general political viability of a pollution fee system, some have suggested that revenues be recycled to citizens of the affected area, in such a way as not to interfere with the incentives to reduce polluting behavior.

In this paper we report on the results of a telephone survey sponsored by the REACH Task Force[3] and conducted in Southern California during August and September 1996. This survey was designed to estimate voting patterns in a hypothetical referenda concerning alternative pollution fee policies with and without various revenue recycling options.

This is not the first survey to test for public support of pollution fees on vehicles [J. Moore Methods, 1994; Godbe Research and Analysis, 1996]. However, it is unusual in several respects. First, it is quite explicit about the specific policy instrument that would be implemented and links it to benefits it will bring (bad air days reduced from 120 to 60 per year). The latter estimates were developed in modeling exercises by contractors for the REACH Task Force. Previous surveys ask for support for very general policies ("to make people pay for the emissions from their vehicles") or in combination or in sequence with congestion policies (e.g., "use and impact fees" tested by J. Moore Methods, Inc.). No prior survey is devoted exclusively to this instrument and examines variations of it.

Second, the survey is also unusually explicit about the fate of the collected revenues, and in particular it includes examination of policies that return varying portions of the revenues to the public, either in the form of cash (through reductions in sales taxes and vehicle registration fees or through income tax credits) or in the form of coupons to be used for vehicle emissions equipment repair, transit, and the like.

Third, the fees are personalized to a degree, based on reported vehicle-miles-traveled (VMTs) and on the age of the vehicle (the latter associated with higher emissions. This personalization required the use of a Computer-Assisted Telephone Interview (CATI) protocol.

Survey Development. The survey was developed after extensive focus group testing and in consultation with the REACH Task Force. The draft instruments were then pre-tested.

---

[3] **R**educing **E**missions **a**nd **C**ongestion on **H**ighways.

From Harrington and Krupnick [1996], which reports on the focus group results, we found that the survey needed to include a section emphasizing the health effects of air pollution, a section asking respondents about their support for an odometer reading plan and about a more technology-intensive "pay-at-the-pump" approach, and the possibility that owners of low mileage, clean cars could "make money" in the revenue recycling version of the pollution fee. These factors were included in the final survey. A number of other issues that seemed important to focus group participants were not included in the survey, most notably a clear statement about what programs would be put in place if the pollution fee program was not implemented and whether this program would be a substitute for the enhanced I&M program that California is slated to introduce.

Survey sampling. The survey samples were stratified random samples of adults (age 18 or greater) in the 5-county region comprising the greater Los Angeles area. Oversampling was necessary to ensure adequate geographical coverage; we undersampled in Los Angeles County and oversampled in the other four counties. For each county, the number of completed interviews and the sampling weights (persons represented by each respondent) are shown in Table 1. We screened out anyone who did not own or lease a motor vehicle. The excluded adults might be expected to be more supportive of the fee policies, as they will not be paying into the system but are likely to benefit from cleaner air and government spending of the revenues. After adjusting for the oversampling, the samples appear to resemble the population of Southern California, with the exception that there appears to be an excess of persons over age 65 (14% of respondents in the survey versus 11.6% of the population in the 5-county area).

Table 1. Number of Interviews and Sampling Weights

County	Number of interviews	Sampling weights
Los Angeles	473	15,136
Orange	453	4,560
Riverside	191	5,435
San Bernardino	263	4,381
Ventura	196	2,794

Survey response data. In total, 1,715 surveys were completed in the pollution fee survey. The cooperation rate, defined as the quotient of the total completed interviews and the total viable contacts who have the potential to pass through the screeners and speak the appropriate language, was 30 percent. Provision was made for speakers of Spanish only, and the number of interviews conducted in Spanish was 29 percent. 139 respondents were dropped who failed to provide essential information on their miles driven.

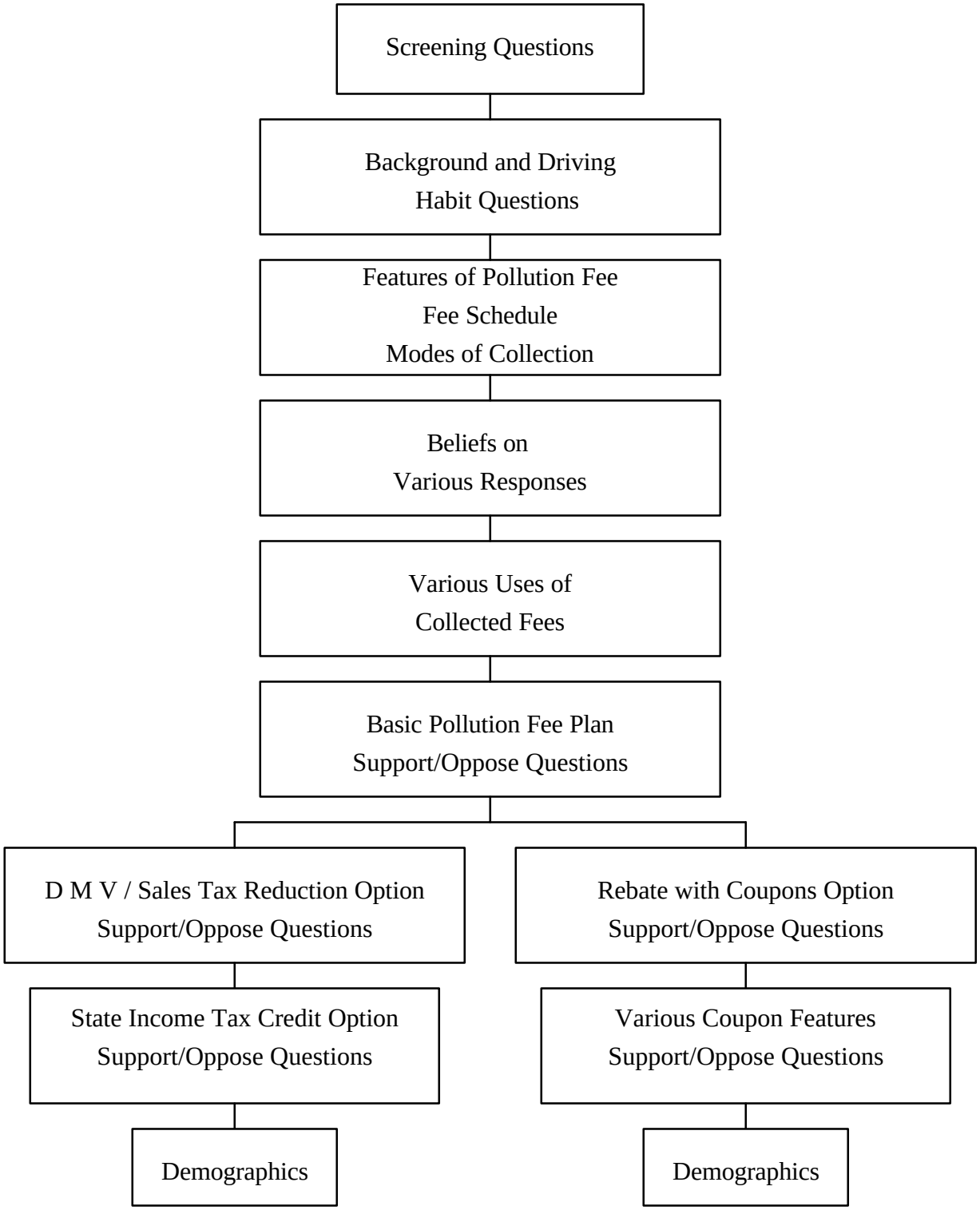
II. SURVEY DESCRIPTION

The pollution fee survey consisted of four parts (see Figure 1). In the first part the interviewer elicited from the respondent information about their driving habits and their vehicles as well as the degree to which air pollution bothers them and their families.

In the second part it was necessary to convey to the respondent a great deal of information about the pollution fees: information about the features of the basic plan, such as the technology and uses of the revenues. In order to keep the respondent engaged in the interview process, we presented this information to respondents in questions of the form, "Suppose X [e.g., 'dirty cars paid a higher rate than cleaner cars.']. Would you be more or less likely to support the fee policy?" In addition, we wanted to remind respondents of the different ways that people might respond to the fees, such as getting their vehicle repaired or driving a cleaner vehicle more. We presented this information as a series of questions structured as: "Some people say that pollution fees will cause people to do X. Do you think this will happen most of the time, some of the time, or almost never?.

While the main function of these questions was to convey information to the respondent, the answers are also available for analysis. We found, however, that the responses to the features of the plan are difficult to interpret. For example, most of those opposed to the base fee described themselves as "less likely' to support any given feature. Such respondents were apparently choosing the most negative category to the question and did not want the interviewer to get the impression that they might support any feature of it. The responses to the "belief" questions appear to be more meaningful, and in general we found that those who

Figure 1. Pollution Fee Survey



thought the pollution fees would be effective at changing behavior were more likely to support the policy. It is difficult, however, to determine which is causing which.

Next, respondents were informed about possible ways in which the money could be spent, again through questions meant to keep them involved in the phone survey. They were told that 16% of the funds would be spent on administration of the plan, and that the remaining funds could be spent on new transit options, rebates of taxes or fees, and low income vehicle repair programs

The third and most important part of the survey elicited opinions on several different pollution fee policies. The base plan was described to individuals using a set of questions structured as: "Would you be more or less likely to support the pollution fee if you knew that...." This structure was used instead of simply providing them a narrative because we felt the former approach would be more involving. These features include:

- the fee is based on the miles driven and the pollution per mile
- dirtier cars pay $0.05/mile, average cars pay $0.015/miles, and clean cars pay $0.01/mile.[4]
- the vehicle's pollution per mile rating would be updated during the Smog Check
- the fees would be phased in over a three year period

The sample was then split, with each half asked for the likelihood of their support if they knew that the fee would be figured by (a) having the odometer read or (b) having an electronic system at the gas pump that would read the pollution rate from a chip on the vehicle and charge on the basis of the gallons purchased.

Base Plan Vote. The base plan carries the 5 cent/1.5 cent/1.0 cent per mile charges, as described above and the feature that revenues are to be used "for regional government pollution reduction programs and on public transportation alternatives in your area." The benefits of the plan are described in terms of reductions in unhealthy air days from 120 per year

[4] These figures appeared in the survey. In calculating the fee, the actual rate for dirty vehicles was $0.07/mile. These rates were derived from transportation and air quality modeling under the direction of the REACH Task Force.

to 60 per year. Such improvements are then linked to health and visibility improvements. The respondents are then told that if they continue driving as they do now they would pay a fee of $X per year. The fee is actually computed by multiplying the number of miles they say they drive per year times 1.5 cents if the vehicle is no older than a 1980 model year, or 7 cents/mile if the vehicle is older than 1980. They are then asked whether they would be better or worse off, whether they would vote for this plan on a ballot, whether they definitely or probably support (or oppose) the plan, and, if they oppose, why.

Split Sample. The sample is then split into two subsamples. One subsample is asked for their support of the base plan with a rebate in the form of reductions in various fees and taxes. The other subsample is asked for their support of the base plan with a rebate of coupons rather than cash, where the coupons can be spent on auto repair, transit, and the like.

The Cash Rebate Plan. The respondent is told that either 25%, 50%, or 84% of the revenues will be returned to the "people of Southern California" through cutting vehicle "registration and license fee and some local sales taxes." The implication of these phrases is that the revenues will not be returned to drivers in proportion to their pay-in. The CATI program assigns rebates of $23 for the 25% rebate, $46 for the 50% rebate, and $77 for the 84% rebate. Respondents are then told that their fee, as before, is X dollars per year, but that the rebate will save them Y dollars per year, so they would actually pay Z dollars per year on net. Finally, they are told that the tax/fee reduction plan would be implemented at the same time as the pollution fee. Then, they are asked for support (opposition) and the strength of such support (opposition). Then, they are asked for support/opposition to the same plan, except that they would get a tax credit on their state income tax.

The Coupon Plan. This plan, developed by COALESCE,[5] is the same as the cash rebate plan, except that instead of cash a percentage (25%, 50%, or 84%) of the revenues would be returned in "the form of coupons good for the repair of polluting vehicles, as well as

---

[5] Coalition for Local Environmental Solutions and a Competitive Economy. This proposal, relative to the cash rebate plans, has the advantage of revealing, without additional survey research, where coupon users place the most value on services that the coupons can buy. Its' chief drawback is the limitation on fungibility of the coupon relative to cash.

for the use of improved and convenient transportation alternatives, such as community shuttle vans and express buses in your area." The questions are in other respects identical to the cash rebate plan. Finally, an additional set of questions asks whether upon knowing various features of the coupon plan, the respondent would be more or less likely to support the plan. These features include various transit options, plus redeeming the coupons for cash at a 50% discount, building better park and drive lots, trading coupons in the market, and using coupons for vehicle repairs.

The final part of the survey asked a set of standard demographic questions: age, marital status, education, family composition, work status and income, as well as for additional information on vehicles and driving.

III. DESCRIPTIVE STATISTICS

Table 2 provides statistics on the key dependent and independent variables used in the study. The CATI program must calculate the pollution fees, the rebates, and the net fees. The pollution fee calculations are based on miles traveled and the age of the vehicle, while the rebates are determined by the percentage rebate chosen at random for the respondent. Descriptive statistics for these key variables are shown on Table 2. The average fee was $225, with 2% of the sample given a fee greater than $1,000 and 21% of the sample given a fee of $100 or less. These estimates reflect the distribution of miles driven, which averaged slightly over 12,000 per year, and the distribution of model years, of which 8% of the vehicles driven by the respondents were produced before 1980. The rebates and coupons averaged around $50 in value. Thus for both the cash rebate and coupon plans, the net fee averaged about $180. About 13% of the subsamples received a refund. Note that the sample size is approximately half for the cash rebate and coupon plans relative to the base plan.

Table 2. Descriptive Statistics (population-weighted)

	Basic Plan ***Average Fee = $225*** ***N = 1574***	***Rebate Plan*** ***Average Fee = $180*** ***N = 767***
Pollution Fee	Percent	Percent
Refund	NA	13
$0-100	21	22
101-200	35	33
201-300	29	18
301-400	5	6
401-500	5	3
501-1000	3	4
>1000	2	2

Miles Driven	**Percent**
<5000	21
5001 - 10000	28
10001 - 15000	28
15001 - 20000	14
20001 - 25000	4
25001 - 30000	5
>30000	0
Average Miles	***12,126***

Model Year	**Percent**
1990-1996	55
1980-1989	37
1970-1979	6
Pre-1970	2
Average Year	***1989***

Variable	**Mean (or fraction)**	**Standard Deviation**	**Minimum**	**Maximum**
Age	44	16	17	96
Republican	0.33	0.47	0	1
Asian	0.06	0.23	0	1
Hispanic	0.15	0.35	0	1
Air Pollution Effect (1-11 scale)	5.5	2.5	1	11
Response Beliefs*	1.32	0.75	1	3
Years Schooling	14.5	2.5	4	19
LA Resident	0.6	0.5	0	1
Household Income	$40-50,000 (median)	71000	0-10,000	>100,000
Household Size	2.7	1.5	1	12
Number of Children	0.7	1.1	0	6
Own/rent home	0.6	0.5	0	1
Number of Vehicles	2.1	1.1	1	7
Males	0.49	0.50	0	1
Odometer Method	0.5	0.5	0	1

* Of several questions on how respondent felt that people's behavior would be affected by the pollution fee (i.e., "drivers would do [...] almost never (=1), some of the time (=2), most of the time (=3)," the question used in the analysis as representative was "Drivers with at least two cars would drive their more polluting vehicle less and their cleaner vehicle more."

IV. SUPPORT FOR THE ALTERNATIVE PLANS

For ease of comparison, the support and opposition to each of the policies examined are shown in Figure 2. As shown the base support for pollution fees is 39 percent, compared to 53 percent opposed and 9% who did not express a preference. Linking the fees to other fee/tax reductions increases the support significantly, to 50 percent of respondents. The coupon proposal on average attracted somewhat more support than the base policy (particularly if the "don't knows" are not counted), but not as much support as the tax/fee rebate plan. However, there were significant differences in the levels of support for the different amounts of rebates/coupons distributed, as discussed further below.

Base Survey

As shown in Table 3, a solid majority (53 percent) opposes the base pollution fee policy, with only 39 percent in favor. If we consider the intensity of preferences, we see that a much higher fraction of the opposers are "definites," suggesting that this policy enjoys soft support and faces hard opposition.

Table 3. Support for Base Pollution Fee Policy

Support		Oppose		Don't Know
39%		53%		9%
Definite	Probable	Probable	Definite	
15%	24%	16%	37%	9%

Although support for other policies is stronger, the respondent's attitude toward this base question is by far the best predictor of the response to those other policies. This point can be illustrated by the data in Table 4, a cross-tabulation of support for the base policy and the combined pollution fee/tax reduction.

Figure 2.

Table 4. Importance of Base Policy

	Support pollution fees with tax reductions?		
Support base policy? ↓	No	Yes	Don't know
No	75%	20%	5%
Yes	9%	87%	4%
Don't know	11%	63%	26%
Average support for fees/tax reduction	44%	49%	7%

The rows of Table 4 can be thought of as the conditional support for the fees with tax reductions given respondents' support or opposition to the base policy. Thus, among opponents of the base policy, 75 percent oppose the fees combined with tax reductions. An even higher percentage of base fee supporters -- 87 percent -- support fees with tax reductions. The fact that 20 percent of base fee opponents change their vote, compared to only 9 percent of supporters, is the reason that support for the fees with tax reductions is higher than support for the base policy.

Explaining base fee support. To aid in the design of a policy that will garner significant public support, the factors that influence the votes need to be understood. Attitudinal factors can be elicited directly, while other factors can be examined through statistical analyses, such as multivariate regressions. When the opposers were polled on their reason for opposition, the category with the highest response rate (22%) was "Just a tax increase," followed by "Doesn't trust or believe the government" (18%).

A large number of more concrete factors can be reasonably hypothesized to affect support for the base policy. To isolate the influences on support, we estimate a set of probit regression equations. The estimated dependent variable in this equation can be interpreted as the probability that an individual with the given characteristics will support the policy, and the coefficients on the independent variables indicate their influence on the probability of support. The results of these estimations are shown in Table 5.

Table 5. Probit Regression Results for Voting on the Basic Plan.
(Standard error in parentheses)

	I	II	III	IV
Pollution fee	-.0011 (.0002)		-.0011 (.0002)	
Miles driven (000)		-.0279 (.0052)		-.0260 (.0052)
Pre-1980 vehicle		-.6143 (.1446)		-.6642 (.1462)
Respondent age	-.0094 (.0025)	-.0099 (.0025)	-.0102 (.0025)	-.0104 (.0025)
Republican	-.3588 (.0777)	-.3570 (.0779)	-.3325 (.0783)	-.3320 (.0784)
Asian/Hispanic	.2882 (.0936)	.2815 (.0943)	.2337 (.0951)	.2333 (.0956)
Rating of air pollution effect	.0586 (.0146)	.0605 (.0146)	.0569 (.0146)	.0589 (.0147)
Response beliefs	.4000 (.0512)	.4035 (.0514)	.3847 (.0514)	.3884 (.0516)
Years of Schooling			-.0446 (.0149)	-.0443 (.0151)
Los Angeles resident			.1602 (.0795)	.1536 (.0801)
Mean Log Likelihood	-0.603	-0.600	-0.599	-0.595
Sample Size	1355	1355	1355	1355

We used two specifications (I and II): one in which the pollution fee paid is an independent variable, another where the factors used to calculate the fees are variables, i.e., the miles driven and whether the car is a pre-1980 model. Each of these factors influence support, e.g., the higher the fee paid, the lower the probability of support; or alternatively, the more miles driven and driving a pre-1980 vehicle, are associated with a lower probability of support. In addition, we found, after a reasonably thorough search of independent variables, that younger respondents, Democrats and Independents, and Asians and Hispanics are more likely to support the base plan. Two other variables were always significant. If a respondent rated him- or herself or their family as highly bothered by air pollution, they were more likely to

support the plan. In addition, if the respondent believed that many people would respond to the fees in the ways suggested to them in the survey, they were more likely to support the plan. This result leads to the tentative conclusion that an effective campaign to educate the public on the benefits and mechanics of pollution fees may produce dividends. Finally, two other variables appear to influence support, but need further discussion (see below). The first is the effect of region of residence on support, where respondents living in LA appear to have a higher propensity to support the base plan. The second is that respondents with *less* schooling are more likely to support the plan.

County Support. Table 6 provides estimates of support for the base plan by county of residence. Except for Los Angeles, where support is significantly higher than for the other counties, there are small and insignificant differences in percentage support across the counties. This lack of variation implies that the factors explaining the probability of support will not include the county of residence, except possibly for Los Angeles. Regional variables, to the extent that they serve as proxies for regional differences in age, income, race, etc. might be expected to influence support of the plan. Such variables might also serve as proxies for factors that we cannot measure within the survey, such as highway and transit access, distance to place of work, and other characteristics.

Table 6. Voting on Base Plan, By County (percentage)

Region	**Support**	**Oppose**	**Don't Know**
Los Angeles	43	50	7
Orange	33	58	9
Riverside	36	53	12
San Bernardino	32	59	10
Ventura	32	58	10

We found that respondents living in Los Angeles were significantly more likely to support the base plan than those living elsewhere when this factor alone was used to explain support. More revealing, even when this variable is used with the other explanatory variables

to explain support, a significant relationship is found (at the 6% level) (as shown in Table 5, specifications III and IV). This means that there are characteristics of Los Angelenos not already captured by factors included in the survey that influence support. As for the other counties, we infer from their similar degrees of support and lack of significance in the regression analysis that either: (a) there are no county-specific influences on support not otherwise captured in our analysis or (b) the county is too large and diverse a geographical unit to discern such influences.

Schooling. The survey presents a fairly complex program to individuals. For this reason we hypothesized that those with more education would understand and appreciate the usefulness of the pollution fee concept more than those with less education. In fact, we found that those with less schooling evidenced far greater support for the base plan than those with more schooling. In particular, the difference in attitude was distinct between the group with a high school education or less versus the more educated group. We thought that perhaps education was acting as a surrogate for income, but this was not found to be the case. It also could be a surrogate for miles driven, age, or sex. But these hypotheses were also found wanting. Finally, we thought it could be a surrogate for commuting behavior, hypothesizing that the noncommuters or transit users do mostly discretionary driving and therefore may have felt that they could cut back their driving (and pay a lower fee) more easily than other groups. In spite of the fact that those with at most a high school degree were far more likely than those with more education to take a bus to work (by 59% to 41%) and of those in the less educated group, a relatively large fraction did not commute. Nevertheless, a variable representing the "discretionary driving" group was insignificant in explaining voting patterns. Further analysis of this finding therefore appears warranted.

Insignificant Factors. Note that we used all of the appropriate variables available to us in the survey to explain voting patterns, but that only those noted above were consistently significant. In particular, the respondent's household's income was NOT a significant factor in explaining support. If anything, the lowest income categories tend to be more supportive of the policy (although such support is not statistically significant). Other variables that were

generally insignificant include: household size, number of children, whether the home is owned or not, the number of vehicles owned or leased by the household, and the sex of the respondent. Also, focus groups expressed a clear preference for the "pay at the pump" method of collecting pollution fees. However, in the survey support was not sensitive to whether the respondent received the odometer or the pay at the pump "treatment."

Note that we did not think it appropriate to use answers to the "informational" questions as explanatory (independent) variables. These questions, of the form "would you be more or less likely to support the policy if you knew that . . .", appear to be another way of expressing support or opposition to the plan, not an independent measure of factors that could explain such support or opposition.

Pollution Fees with Other Fee/tax Reductions

Table 3 above suggests that 50 percent of respondents favor the rebate alternative, but a closer look at the subsamples of individuals presented with the cash rebate alternative suggests that this support can vary significantly, depending on the amount of the rebate. In particular, support appears to increase with the amount of the rebate, where support, as measured as a fraction of those providing an opinion, increases from 44% with a $23 rebate to 54% with a $77 rebate.[6] Not counting the "don't knows," 57% of those receiving the $77 rebate said they would support the rebate plan. While such an outcome might be unsurprising if a given set of respondents were asked their opinions in a *series* of questions involving higher and higher rebates, a much more powerful protocol was followed here where the subsample receiving the rebate question was split randomly into three treatments, each receiving one of the rebate amounts. Thus, the increasing support is a result of independent trials and is a strong indication of the sensitivity of support to the rebate amounts or percentages.

---

[6] These estimates do not exactly match the raw scores for voting on the fee/tax reductions because adjustments were necessary to correct for differences in the fraction of supporters of the base plan assigned the rebate "treatments" for the rebate plan. We used conditional probabilities to adjust the level of support to reflect the support for the base policy in the overall sample. These adjustments are made in all estimates of the rebate support level used in this report. Note that this problem is not present with the subsample assignments to the coupon plan; hence no corrections to the raw scores were made.

The statistical significance of this relationship can be tested using probit regressions where the *net* pollution fee replaces the pollution fee variable in the basic regressions on Table 5, or where the rebate amount (or percentage) is added to the alternative specification in Table 5. The results (Table 7) reveal that these variables are highly significant in determining the probability of support for the cash rebate.

Note that some ambiguity is present in the effect of the rebate on voting patterns because respondents were presented with the rebate expressed in two ways -- as the percentage of the revenues returned to the "people of Southern California" and as the dollar amount to be returned to the respondent. Thus, in Figure 2, note that the 25% rebate is also expressed as a $23 return to the individual, and so on. Because in our survey these two measures are simply alternative ways of expressing the same rebate we cannot discern their independent effects on voting patterns.

These analyses also reveal that the variables affecting support for the base plan also affect support for the rebate plan. Note, however, that the Los Angeles variable (LA) and the schooling variable (HIGHSC=1 if a person has no higher degree than a high school diploma) are no longer significant, although the schooling variable is significant at the 11% level. The result for county of residence is unsurprising in light of the crosstab (Table 8) showing that support for the rebate is fairly similar across counties.[7]

The fact that the same set of variables influences support for both the cash rebate and base plan while, at the same time, support for the rebate plan is significantly higher than for the base plan, suggests that we examine the characteristics of those who switched from opposition to the base plan to support of the cash rebate (and vice-versa). We were unable to explain why

---

[7] This change may have occurred because the sample size has shrunk approximately in half compared with that for the base plan. A possible way to augment the sample size and increase the power of the analysis is to re-estimate these regressions with the full sample, setting the rebate amount to zero for all respondents who did not receive the cash rebate question. We find that the LA variable is still not significant, but that the other variables have increased in significance owing to the larger sample size.

Table 7. Probit Regression Results for Voting on the Rebate Plan.
(Standard error in parentheses)

	I	II
Net fee	-.0014 (.0003)	
Rebate amount		.0078 (.0024)
Miles driven(000)		-.0371 (.0071)
Pre-1980 vehicle		-.6009 (.2003)
Respondent age	-.0069 (.0034)	-.0080 (.0034)
Republican	-.3490 (.1075)	-.3389 (.1083)
Asian/Hispanic	.3375 (.1415)	.3067 (.1428)
Rating of air pollution effect	.0480 (.0199)	.0483 (.0201)
Response beliefs	.4272 (.0715)	.4428 (.0723)
High School or less	.1879 (.1182)	.1710 (.1198)
Los Angeles resident	-.0188 (.1145)	-.0637 (.1154)
Mean Log Likelihood	-0.614	-0.605
Sample Size	683	683

Table 8. Voting on Rebate Plan, By County (percentage)

Region	**Support**	**Oppose**	**Don't Know**
Los Angeles	51	43	6
Orange	47	48	4
Riverside	46	43	12
San Bernardino	50	42	8
Ventura	46	47	6

respondents switched from support of the base plan to opposition to the cash rebate. But, very few respondents are in this category. We found, however, that of those opposed to the base plan, the "switchers" (those who also support for rebate plan) are more likely to be female, favor both tax rebates and public spending on transportation, get larger rebates, travel fewer miles, and drive newer vehicles.

Finally, it is useful to consider a comparison of the strength of support among the subsample who received both the base plan and the cash rebate plan (Table 9). Two-thirds of the subsample did not change their opinion. The largest gains were made in the definitely support category, which increased from 13% to 23% from the base to the rebate plan. The largest contributors to this increase came from the group who "probably supported" the base plan and those who "didn't know" whether they supported or opposed the base plan. Indeed, 63% of this "don't know" group registered support for the cash rebate while only 11% registered opposition (with the rest still saying they "didn't know." Finally, while only 7% of those who were definitely opposed to the base plan supported the rebate, 42% of those who probably opposed the base plan supported the rebate. Thus, we might consider that all but about one-third of the population is a reasonable target for building support for a rebate plan.

Pollution Fees with Coupons Returned

Of the subsample who received both the base and the coupon plans, 42 percent of respondents favor the coupon alternative, while 40 percent favor the base plan. This is not a statistically significant difference. The poor performance of this plan can be expected on theoretical grounds (the lack of fungibility of coupons relative to cash), and was borne out in the focus group sessions. Nevertheless, support for the coupon plan appears to increase somewhat with the amount of coupons distributed. A crosstab of support/opposition to the coupon plan with the amount of the coupons rebated (Table 10) reveals that a higher fraction of the subsample favor the plan when they receive either $46 or $77 worth of coupons than when they receive $23 worth (43-44 percent versus 40 percent, respectively).

Table 9. Strength of Support and Opposition to Base and Rebate Plans

	Rebate Plan					
Base Plan	**definitely support**	**probably support**	**probably oppose**	**definitely oppose**	**don't know**	**Total**
def sup (#) row % column % cell %	*650525* 83.33 49.83 11.24	*92106* 11.80 6.10 1.59	*15136* 1.94 2.05 0.26	*4560* 0.58 0.25 0.08	*18377* 2.35 4.35 0.32	*780704* 100.00 13.49 13.49
prob sup	*387539* 28.18 29.69 6.70	*741292* 53.90 49.11 12.81	*136444* 9.92 18.49 2.36	*38501* 2.80 2.13 0.67	*71414* 5.19 16.90 1.23	*1375190* 100.00 23.76 23.76
prob opp	*102238* 9.72 7.83 1.77	*337133* 32.05 22.33 5.83	*411446* 39.11 55.75 7.11	*84666* 8.05 4.67 1.46	*116461* 11.07 27.57 2.01	*1051944* 100.00 18.18 18.18
def opp	*43888* 2.19 3.36 0.76	*95488* 4.78 6.33 1.65	*148537* 7.43 20.13 2.57	*1648257* 82.43 90.98 28.48	*63379* 3.17 15.00 1.10	*1999549* 100.00 34.55 34.55
don't know	*121308* 20.92 9.29 2.10	*243478* 41.99 16.13 4.21	*26469* 4.57 3.59 0.46	*35707* 6.16 1.97 0.62	*152854* 26.36 36.18 2.64	*579816* 100.00 10.02 10.02
Total	*1305498* 22.56 100.00 22.56	*1509497* 26.08 100.00 26.08	*738032* 12.75 100.00 12.75	*1811691* 31.31 100.00 31.31	*422485* 7.30 100.00 7.30	*5787203* 100.00 100.00 100.00

Table 10. Voting on Coupon Plan, in percent

Value of Coupons	**Support**	**Oppose**	**Don't Know**
$23	40	56	4
$46	44	47	9
$77	43	53	4

A more conclusive test of support for the coupon rebate plan can be made by running probit regressions with specifications similar to those used for the cash rebate plan. These results, summarized in Table 11, show that the rebate is insignificant in explaining support unless the sample receiving both the $46 and the $77 rebate is combined and compared to that receiving the $23 rebate.

Table 11. Probit Regression Results for Voting on the Coupon Plan.
(Standard error in parentheses)

	I	II	III
Net fee	-.0013 (.0003)		
Miles Driven		-.0310 (.0074)	-.0304 (.0074)
Pre-1980 vehicle		-.6190 (.1966)	-.6202 (.1961)
Coupon Value		.0033 (.0023)	
Coupon Worth either $46 or $77			.2111 (.1073)
Respondent age	-.0107 (.0035)	-.0111 (.0036)	-.0110 (.0036)
Republican	-.0753 (.1070)	-.0786 (.1078)	-.0840 (.1079)
Asian/Hispanic	.2452 (.1312)	.2330 (.1324)	.2344 (.1324)
Rating of air pollution effect	.0487 (.0207)	.0499 (.0208)	.0494 (.0208)
Response beliefs	.4681 (.0708)	.4759 (.0715)	.4730 (.0714)
High School or less	.2769 (.1170)	.2795 (.1185)	.2783 (.1184)
Los Angeles resident	.1701 (.1088)	.1663 (.1098)	.1731 (.1097)
Mean Log Likelihood	-0.604	-0.599	-0.598
Sample Size	720	720	720

The probit regressions also reveal that, with the exception of political affiliation, the factors that were found to influence support of the cash rebate and the base plan also influence support for the coupon plan. As for the rebate plan, Los Angelenos are *not* more likely to support the coupon plan than those living in other counties, although this factor is almost significant at the 10% level. However, as shown in Table 12, *not* holding other things equal, this group is much more likely than respondents from other counties to support the plan, with San Bernardino residents much *less* likely to support it.

Table 12. Voting on Coupon Plan, By County (percent)

Region	**Support**	**Oppose**	**Don't Know**
Los Angeles	46	48	6
Orange	40	56	4
Riverside	41	54	5
San Bernardino	31	63	6
Ventura	37	57	6

While the "switchers" commanded our attention in comparing responses to the base and rebate plans, the issue is less important here because the switching is more balanced. That is, about 15% of those opposed to the base plan supported the coupon plan, but 12% of those supporting the base plan opposed the coupon plan. At the same time, the phenomenon that those who did not vote on the base plan tended to support the cash rebate is evidenced for coupons, as well, albeit to a lesser degree. That is, whereas the "don't knows" for the base plan favored the rebate 6:1, this ratio falls to 2:1 for the coupon plan. Put another way, 46% of the "don't knows" for the base plan supported the coupon plan and 22% opposed it.
The survey permits some probing into why opposing respondents didn't like the coupon plan. The modal reason was "other" (30%), followed by "no reason." These responses suggest that some people did not understand the concept.

IV. IMPLICATIONS OF THE SURVEY

The survey results clearly indicate that pollution fees on motor vehicles in southern California can attract majority public support. We have found that this support can be significantly enhanced by returning at least some of the revenues in the form of tax reductions. Offering larger rebates and lower pollution fees can further enhance support. Offering rebates in the forms of coupons garners less support than offering cash. The results also indicate where (both geographically and demographically) support and opposition to these plans may be found to aid in targeting publicity and informational campaigns.

There are several "public support" issues that remain to be explored in furthering the design of viable pollution fee plans. First, we do not know whether support is more sensitive to the percentage of revenues returned to the people or to the actual amount returned to the individual. Second, we do not know why those with less schooling and those who are Hispanic (and to a lesser extent Asian) appear to favor the plans disproportionately. Third, we do not have confidence that individuals voting on the coupon and rebate plans fully understood that in these alternative less money would be available for public investments in transportation or pollution control. And fourth, the weighting of survey results by population across the counties does not correct for the tilt in the sample towards older (>65) respondents. The sample fraction is 14 percent while the five-county fraction is 11.6%. As older respondents are more likely to oppose the pollution fee plans, correcting for this tilt should slightly increase the estimates of support. Fifth, we were not able to examine how support might vary with details of the cash rebate plans. For instance, the precise way in which the rebate might be distributed (more than proportionally to poor households or to long distance commuters) and the precise form of the rebate (e.g., through vehicle registration fees alone, as opposed to some unspecified combination of such fees and "sales tax reductions") might affect support and help design a better rebate system.

Finally, we do not know the extent to which one overarching issue influenced results. This issue is the "counterfactual" to the pollution fee plan, that is, the plan that would be in effect if the pollution fee plan were *not* implemented. It is our contention that the pollution fee

plan is a *substitute* for an inspection and maintenance program, such as southern California's Smog Check I or II, although the inspection stations would still be needed to measure emission rates. Because Smog Check II was not yet implemented in Southern California, we could not test the effect on voting in the survey of specifying this change in policy. One can also question whether additional policies on existing vehicle emissions would be needed beyond Smog Check II in the even the pollution fee is not implemented. Not suggesting a counterfactual policy is likely to bias voting on the pollution fee policy, but the direction of bias depends on the attractiveness of the counterfactual policy. For instance, if one believes that the pollution fee policy is more cost-effective (less costly) and flexible than the counterfactual policy, then the observed support will underestimate support for the pollution fee plan. We expect that this is the appropriate direction of bias for a Smog Check II counterfactual.

REFERENCES

Bishop, Gary A. and Donald H. Stedman. 1994. "Remote Sensing and Vehicle Variability," presented at the Fourth Annual CRC On-Road Vehicle Workshop, March.

Eskeland, Gunnar S., and Shantayanan Devarajan. 1996. *Taxing Bads by Taxing Goods: Pollution Control with Presumptive Charges* (Washington, D.C., The World Bank).

Godbe Research and Analysis. 1996. Initial Public Opinion Survey. Prepared for REACH Task Force and Southern California Association of Governments (February).

Harrington, Winston and Alan Krupnick. 1996. Report of Focus Groups Conducted for REACH Task Force, March 1996.

Harrington, Winston, and Virginia D. McConnell. 1993. "Cost-Effectiveness of Remote Sensing of Vehicle Emissions," in Richard F. Kosobud, William A. Testa and Donald A. Hanson, eds., *Cost-Effective Control of Urban Smog* (Chicago, Ill., Federal Reserve Bank of Chicago).

Harrington, Winston, Margaret Walls, and Virginia D. McConnell. 1995. "Driving Our Way to Cleaner Air," *Issues in Science and Technology*, Winter 1994/1995.

J. Moore Methods, Inc. 1994. Southern California Congestion Pricing Study, various survey versions.

Kessler, Jon, and William Schroeer. 1993. "Meeting Mobility and Air Quality Goals: Strategies that Work," U.S. Environmental Protection Agency, Office of Policy Analysis, Final Draft, October.

National Research Council. 1991. *Rethinking the Ozone Problem in Urban and Regional Air Pollution* (Washington, D.C., Committee on Tropospheric Ozone Formation and Measurement, National Academy Press).

Smith, Stephen. 1995. " 'Green' Taxes and Charges: Policy and Practice in Britain and Germany," Institute for Fiscal Studies, London, November.