

FROM FREE RIDERS TO MORAL BUYERS:
THE MARKET FOR "GREEN" FUELS AND VEHICLES

by

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ABSTRACT

Recent surveys have found that a large number of consumers are willing to pay extra and/or accept diminished performance for more environmentally benign fuels and vehicles. Are these surveys accurate? Yes, to the extent that environmentalism has taken hold in many countries, and that many consumers desire less environmentally intrusive fuels and vehicles. But this phenomena should not be interpreted to mean that individuals will necessarily pay more for a "green" fuel or vehicle. This paper provides initial evidence of the magnitude and dimensions of the market for cleaner fuels and vehicles, and explores the public policy implications of this consumer market for environmentally-friendly cars and fuels.

INTRODUCTION

A recent survey found that 84% of the residents of the San Francisco Bay Area would pay \$0.10 per gallon more for "clean" gasoline (Transactions, 1991). Is this survey accurate? Are individuals indeed willing to pay considerably more for cleaner and more efficient vehicles and fuels? Evidence suggests environmentalism has taken hold in many countries, including those of North America and Northern Europe, to the extent that environmentally benign products have taken on added value in the marketplace. But this phenomena should not be interpreted to mean that individuals will necessarily pay more for a "green" fuel or vehicle.

This paper provides initial evidence of the magnitude and dimensions of the market for cleaner fuels and vehicles, and explores the public policy implications of this consumer market for environmentally-friendly cars and fuels.

Governments around the world are imposing increasingly stringent environmental requirements on motor vehicles and transport fuels. These requirements may increase the cost of supplying vehicles and fuels and/or may result in a degradation of non-environmental vehicle and fuel attributes. Vehicle and fuel suppliers generally resist these initiatives because they fear consumers will not value the positive environmental attributes sufficiently to offset the perceived diminishment of cost, performance, and/or convenience attributes; the market uncertainty and risk associated with these more expensive fuels and vehicles and/or diminished attributes frightens them. Is this fear justified? How large is the market for environmentally-enhanced vehicles and fuels?

Free-Rider Effect

These questions are difficult but not impossible to answer. The difficulties are theoretical, methodological, and empirical. The fundamental underlying problem is the poor understanding of the "free rider" effect in the purchase of environmentally-superior vehicles and fuels.

Free riders in this case are individuals who will not pay for cleaner air and avoidance of global climate change because the benefits of those goods accrue as much to others as themselves; that is, the purchase of environmentally-superior fuels and vehicles accrues to the collective society. Thus, the rational self-interested buyer of cleaner and more efficient fuels and vehicles will not purchase such fuels and vehicles if they cost more than an otherwise identical fuel or vehicle, or if the fuels and vehicles provide less performance and convenience.

But all individuals are not purely economic beings, and purchases are not based strictly on self-interested economic criteria (Uusitalo, 1989). The challenge is twofold: 1) to determine how many individuals behave as purely economic beings, and 2) to understand how the remaining individuals behave in a market with free-rider goods.

THEORETICAL AND METHODOLOGICAL DIFFICULTIES

The theoretical problem is that of understanding the relationship between environmental values and beliefs, and actual purchase behavior. Will individuals with strong environmental values and beliefs actually purchase a vehicle or fuel that is environmentally superior, given the presence of the free rider effect? As shown later, environmentally-positive attitudes often do not lead to environmentally-sound purchase decisions.

The methodological problem is how to measure the demand for air quality, reduced greenhouse gas emissions, and other

environmental attributes that were previously free. Essentially two approaches can be followed: 1) analyze actual purchase behavior that has been revealed in the past in similar market situations with analogous goods; or 2) analyze preferences as stated in response to hypothetical survey questions.

Revealed preference data is heavily influenced by free-rider concerns; studies that use this approach generally indicate that individuals are not willing to pay extra for cleaner and more efficient fuels and vehicles.

An example of revealed behavior was the market for low-lead and unleaded gasoline in the U.S. in the early 1970s. Most of the major oil companies introduced gasoline with reduced lead levels at that time, expecting that the new environmental consciousness and the heightened concern for lead poisoning would motivate demand for these fuels (when priced \$0.01 to \$0.04 more per gallon than regular leaded gasoline) (Time, 1971:92).

Sales were disappointing, slowly increasing up to only 5% of the gasoline market in 1974, the year before catalytic convertors were widely introduced on automobiles (U.S. Senate, 1978). This illustrative analysis of revealed behavior suggests that consumers were not willing to pay extra for an environmentally superior fuel.

Stated preference studies generally find just the opposite: that consumers are willing to pay quite a bit extra for environmentally attractive vehicles and fuels. Stated preference studies find higher willingness-to-pay estimates because individuals tend to ignore or downplay the free-rider effect. Since they are not being confronted by an actual purchase decision, they are more likely to express their social preference, and to ignore for the moment the tradeoff with their own economic utility. The study cited at the beginning of this paper that found drivers are willing to pay much more for cleaner fuels is an (unsophisticated) example of a stated preference study.

The higher estimates of demand for environmental attributes in stated preference studies are not wrong. What they indicate, as elaborated upon below, is that individuals value those attributes highly, and would support initiatives that reward those attributes, but that as individuals they will remain free riders and not willingly pay much for those environmental attributes, when given a choice.

UC DAVIS SURVEY OF TRANSPORTATION FUEL DEMAND

A stated preference questionnaire was administered in February 1989 to 5000 randomly selected owners of cars in New York State and California (for details, see Sperling et

al., 1991). The response rate for usable questionnaires was 42%.

Vehicle owners were asked whether they would be willing to pay a specified amount extra per gallon for "a fuel that produced less air pollution" but was identical to gasoline in all other ways. A contingent valuation method was used (see Haneman, 1984; and Loomis, 1988) in which each respondent responds to only one bid amount -- 10 cents per gallon extra, for instance. Eight different bid amounts were assigned randomly, one to each questionnaire; the bid amounts ranged from 2 cents per gallon extra to 45 cents. The responses are aggregated to create a willingness-to-pay function for the entire sample population, as shown in Figures 1 and 2.

Overall, 54% of the respondents responded that they were willing to pay 10 cents extra for cleaner-burning fuels, 37% were willing to pay 25 cents, and 25% were willing to pay 45 cents. Given that regular unleaded gasoline prices at the time were about \$1 per gallon, and that voters and politicians have strenuously opposed all but minimal increases in gasoline taxes, we considered these willingness-to-pay responses to be high (though not necessarily inaccurate as indicated above).

Some of the more important findings from that survey are the following.

- 1) Income is not related to willingness to pay for cleaner fuels (Fig 1). We did find that more affluent individuals were willing to pay more for premium (higher octane) gasoline than poorer people, so the survey seems to be reliable. While the willingness to pay is probably more overstated by less affluent respondents, we suggest that the more powerful explanation is that environmental concern indeed cuts across all socio-economic groups.
- 2) Female drivers are willing to pay significantly more (about 40%) than male drivers, a finding corroborated elsewhere (Wirthlin Group, 1990).
- 3) Californians are willing to pay considerably more than New Yorkers (Fig 2). This finding was expected because of the greater air pollution problems and the greater media attention to air pollution in California. This finding supports the perception that consumer response to green fuels and vehicles could vary quite a bit across regions.

INTERPRETATION OF WILLINGNESS-TO-PAY ESTIMATES

The willingness-to-pay estimates for cleaner fuels generated in the UC Davis survey should not be interpreted to mean that when confronted at a fuel pump with two fuels, one cleaner but more expensive than the other, that a motorist would select the

**FIG. 1 Willingness to Pay for Premium Gasoline
By Household Income**

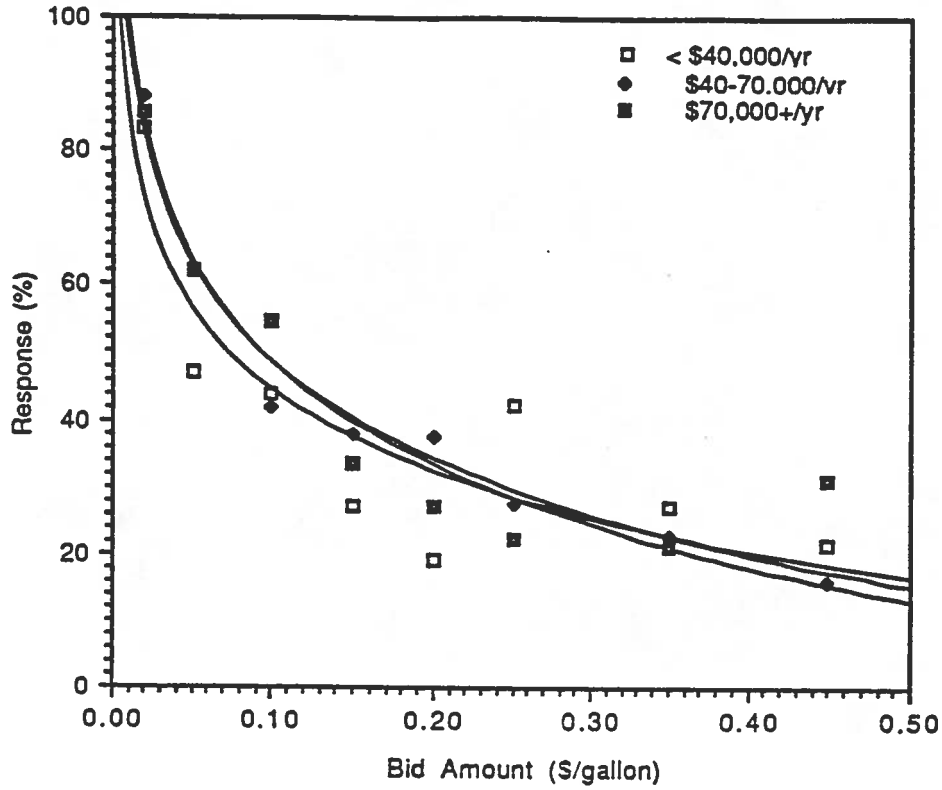
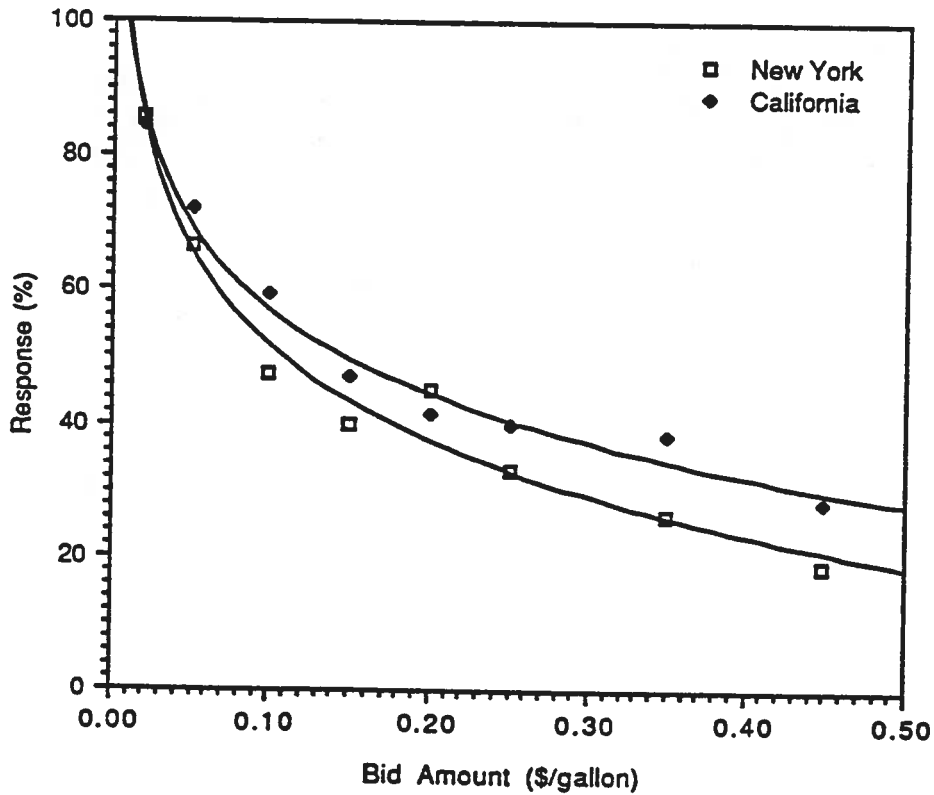


FIG. 2 Willingness to Pay for Cleaner Fuel



more expensive cleaner-burning fuel. Rather, we interpret the high willingness to pay for cleaner fuels as a willingness to pay if the cost burden is shared by all -- if the environmental externalities can be internalized and spread among all buyers by government action.

Thus, willingness-to pay estimates are overstated relative to actual observed behavior if the environmental externalities are left external, and consumers are left to act as free riders.

In practice, though, it is not a question of who is a free rider and who is not. There is a continuum. At one extreme are free riders, responding strictly to market prices and oblivious to social goods in their purchasing behavior; at the other extreme are moral buyers, acting principally on conviction. Moving from free riders toward moral buyers, are the "bureaucratic majority" and then "social choosers".

The bureaucratic majority are people who want government to tell them what do, and will respond accordingly. They do not want to be worrying about what is appropriate behavior: whether they should be following their morals or their economic interests. They prefer to rely on the law to achieve social goals.

The other in-between group, toward the moral buyer end of the spectrum, are social choosers, those who depend on group action to achieve moral choices in free rider situations. These people are distinct from moral buyers in that they will not act on their moral beliefs unless their intended behavior is suggested or supported by a peer social group to which they belong, such as the Sierra Club or a neighborhood environmental organization.

Research is needed to determine what proportion of vehicle and fuel buyers fall in each of these four groups. The answer will vary across regions and countries, and over time. At UC Davis, we are pursuing this research with respect to clean-burning fuels and vehicles.

POLICY IMPLICATIONS

As suggested above, the implication of stated willingness-to-pay estimates is that consumers would support efforts by government to impose costs, directly or indirectly, on buyers roughly up to the amount they stated they are willing to pay.

The challenge for rulemakers and lawmakers, therefore, is to internalize environmental externalities to the extent supported by voters -- as indicated by surveys of willingness to pay for environmental quality. Externalities can be internalized

directly via taxes or subsidies, or indirectly through production mandates, marketable (tradeable) credits, and other mechanisms. These initiatives are much more likely to be supported if the following conditions are met:

- 1) Any surcharge is specifically targeted to supporting cleaner fuels and clean air (or whatever environmental goal is being pursued), and is not deposited in the general budget.
- 2) It is clear that large corporations (or politicians) will not benefit by the government effort to internalize the environmental costs and/or spread the costs across the user population.

CONCLUSIONS

The market for "green" cars and fuels is large. Most U.S. consumers believe that an appropriate price for a cleaner transportation fuel, considering only air pollution, is at least \$0.10 per gallon more than the price for conventional gasoline; many believe that an appropriate price is much higher than that. If one were to consider the greenhouse and energy security advantages of fuels, the premium would be still greater.

With premiums of, say, \$0.30 per gallon, several "green" options become highly attractive: indeed, methanol and compressed natural gas would be preferred options almost everywhere (DeLuchi et al, 1988), and the demand for more energy efficient vehicles would be enhanced (Difiglio et al, 1989).

But few people will make a personal sacrifice to purchase more environmentally benign fuels and vehicles; they will, however, presumably support government initiatives that target those fuels and vehicles, if the those initiatives are seen to be fair, effective, and not benefitting any private interests.

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