ON CUSTOMER CHOICE AND FREE RIDERSHIP IN UTILITY PROGRAMS

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Introduction

One of the dominant issues in the evaluation field today is assessing the differential between gross and net program effects. A key element in estimating net-to-gross ratios involves the measurement of free-rider levels. This has proven itself to be a challenging, if not controversial, effort. Early concerns focused on the larger than expected levels of free riders estimated in individual studies; later attention turned to the divergent estimates developed from one evaluation to another (Refs. 5, 8, and 9). A number of possibilities have been put forward to attempt to explain the findings including a variety of factors likely to cause internal or external validity problems (Refs. 3, 7, and 12).

As a number of earlier papers have pointed out, many exogenous factors can influence the level of net program effects, including items such as changing appliance efficiency standards or building codes, simultaneous promotional efforts by manufacturers, and fuel pricing changes. While the influence of these factors can be substantial, much of the uncertainty over estimating net effects centers on measuring changes in customer choices. This paper discusses a number of the issues regarding free ridership as a customer choice issue, including how program design and implementation are likely to affect free ridership levels. The effects of evaluation methodology choices on free ridership estimates are also discussed. Thus, this paper is intended to review how variances in both program implementation and evaluation approaches are likely to contribute to different free ridership evaluation findings.

Program Design and Implementation

Overview

In examining free ridership from the perspective of customer choice issues, this paper explicitly excludes consideration of other factors affecting net-to-gross ratios on impacts. As an example, other research into free ridership has included equipment cycling effects when examining direct load control programs or other factors that do not reflect customer decision making about programs. Instead, this paper examines how factors determined by the utility influence consumer choice and, consequently, free ridership. With respect to program design and implementation, the following factors are examined:

- Type of DSM option promoted.
- Program standards for qualifying measures.
- Level of incentive offered.
- Type of marketing approach utilized.

Type of DSM Option Promoted

Clearly, one of the most influential factors determining whether customers would have adopted the target DSM option in the absence of a utility program is their reaction to (acceptance of) the technology itself. Thus the utility's choices of which technologies to target will affect the program's overall free ridership level. At least three types of attributes of DSM technologies can be anticipated to systematically influence free ridership levels: (1) the degree to which the target measure is perceived to resemble its "standard" alternative(s); (2) the number of features the measure has; and (3) how closely customers identify the measure's function as energy-related. The type of influence exerted by each of these technology attributes is described below.

The more closely a customer views an energy efficient measure as resembling its standard efficiency alternatives, the more likely the customers are to report that they would have installed the measure without the program. This effect is a result of the fact that customers perceive fewer barriers to the measure's adoption; in these situations customers will have greater confidence in the probable performance and reliability of the equipment (lower uncertainty), reduced concern about problems of incompatibility with existing equipment or fixtures, less concern about unanticipated effects (as on ambiance, comfort, or noise levels), and less concern about arranging servicing and maintenance in the future. The decision process for the customer is thus a simplified one relative to that for adopting more unfamiliar technologies.

These types of influences are evident in commercial sector decision making on high efficiency lighting. Numerous utilities have found free ridership levels in these programs to be quite high. This is largely a result of the inclusion of high efficiency fluorescent bulbs as eligible measures. These bulbs are seen as largely equivalent to their standard counterparts except in regard to price and operating cost. In contrast, other lighting options may be viewed as less equivalent due to their requirements for refixturing or their likelihood of affecting the facility's aesthetics. Customer survey data have suggested significantly lower free ridership levels for several of these other lighting options (Ref. 14).

Another aspect of the target technology which is likely to greatly influence free-ridership levels is the number of features which the appliance or measure has. Simply put, the greater the number of features, the greater the influence of the features on customer selections and the smaller the likely degree of influence of the utility's program. This was first demonstrated in an evaluation of an efficient appliance program promoted by NSP which targeted high efficiency water heaters, air conditioners, and refrigerators (Ref. 4). This research indicated that consumer decisions on the feature-laden refrigerator/freezer models were much less influenced by the availability of the utility's rebates than were water heater or air conditioner selections. Similar results were found in subsequent research on programs offered by NYSEG which promoted high efficiency refrigerators and air conditioners (Refs. 15 and 16). As highlighted in Table 1, these studies found that, in the case of refrigerators, there were many more attributes (such as appliance size, type of defrost, and warranty availability) that exerted more influence than the utility's program on customer selections (as compared to decisions on air conditioners.) Again, the refrigerator program was reported to be less influential than the air conditioner program in changing customer's model selection decisions, and substantially higher free ridership levels were documented in the refrigerator program.

Table 1. Ranked Listing of Key Decision Factors for Two Household Appliances

Refrigerators	Air Conditioners
Reliability	Cooling capacity (size)
Operating costs	Energy efficiency
Energy efficiency	Purchase price
Purchase price	Brand name
Dealer reputation	Utility's rebate
Warranty	
Size	
Type of defrost	
Utility's program	

A third technology-dependent factor affecting free ridership levels is the degree to which a measure's primary function is perceived to be energy-related. Most energy efficiency measures, in fact, serve a number of customer needs other than saving energy (*e.g.*, maintaining a comfortable temperature, filtering the air and preventing food spoilage). The greater the importance of these other functions to consumers, the more likely they are to report that they would have adopted the energy efficient measure regardless of the program's availability. This type of pattern is evident, for example, when comparing previous findings on free ridership in efficient air-conditioning purchases with weatherization measure adoption. Although both types of measures may be viewed by customers as contributing to household comfort, air-conditioning purchases tend to be explained almost exclusively in those terms, while weatherization measures are as likely to be reported to be undertaken "to save energy." Previous evaluation efforts show significantly higher free rider estimates for air-conditioner programs (often over 60%) as compared to weatherization programs (generally under 50%) (Ref. 8).

Program Standards

Whereas the utility can do little to alter some of the technology-related influences on free ridership levels, it does have complete control over one key factor influencing free ridership: the standards set for defining qualifying measures. The more stringent the standards set for qualifying measures, the lower the free ridership levels for the program should be. For example, if similar programs are offered at two utilities but one qualifies 20% of available models while the other qualifies 40%, the more stringent program should exhibit less free ridership. Of course this program is also likely to have lower overall participation levels as well, and it is difficult to predict in advance which program design will ultimately yield the better result. However, when attempting to compare free ridership levels across programs, the differences in program standards must be acknowledged as a key determinant of the variances in evaluation findings. At least one study has demonstrated such an effect in promoting high efficiency refrigerators although these data also reflect the influence of simultaneously varying incentive size (Ref. 13). The influence of efficiency standards alone has not been documented or discussed in any systematic manner by any of the reviews of free ridership levels conducted to date.

Level of Incentive Offered

Incentive size also clearly affects free ridership levels—larger incentives are more influential in customers' choices (thus we would expect free ridership levels to decline as incentives increase). For incentives intended to offset the cost of new equipment, part of the influence of the incentive is linked to its size relative to the price of the DSM measure. This relationship between incentive influence and proportion of initial cost being offset probably is not a strictly linear function; instead, there are probably distinct "price points" for setting incentives which determine their influence in shifting customer choices. Nonetheless, it is reasonable to assume that, as incentive size increases, the level of free ridership will decrease (all other factors being held constant). A handful of experimental/pilot programs have demonstrated this effect. These typically have been rebate programs for high efficiency residential appliances. Less information is available for other types of DSM programs.

Interestingly, the relationship between "incentive size" and free ridership takes on a somewhat different cast in the case of direct load control (DLC) programs. Here it is useful to think of these programs as offering both an incentive (typically, a bill credit or a cash incentive) as well as a disincentive in the form of utility intervention into the normal affairs of the household. Recent research has demonstrated a significant linkage between this "disincentive" and free ridership levels.

A pilot DLC program offered by LILCO in 1989 promoted control of central air conditioning as well as other end uses. Within the pilot study on air-conditioning control, three control strategies were offered, with corresponding incentives (see Table 2). At the conclusion of the pilot, the impact evaluation for the program demonstrated that free ridership was higher in the most aggressive cycling strategy (Ref. 1). Essentially, as the program's design became more intrusive, customers with greater peak usage of their air conditioning opted out. (This is reflected in the average ratio of summer to spring usage for households in each strategy.) This self-selection tendency was recently corroborated in a market research study for Consolidated Edison Company, which demonstrated that prospective participants also tended to make participation decisions in part based on peak usage patterns. This study showed that for both DLC of central air conditioning and pool pumps, the proportion of probable free riders increased as the control strategy became more aggressive (Ref. 17). Thus there is a limited body of evidence that demonstrates that program design directly influences free ridership levels. More research is needed in this area to investigate how this relationship holds up across a variety of DSM programs.

Table 2. Overview of LILCO DLC Pilot Program

Cycling Strategy	Incentive ($)	Ratio of Summer-to-Spring Usage
20 min. off/hr.	50	1.7
30 min. off/hr.	100	1.6
40 min. off/hr.	150	1.5

Type of Marketing Approach Used

The last program implementation influence to be discussed here is the manner in which promotional and advertising activities may affect free ridership. At first glance, it may seem that the more highly visible and broad-reaching the promotional effort, the more likely customers are to indicate that the program influenced their decisions. However, this may not be the case at all. A number of program experiences have shown that "in-the-store" influences such as retailer recommendations and point of purchase displays are more influential in engendering customer acceptance of target DSM measures. How this effect influences free ridership is unclear. To the author's knowledge, there is no known assessment of how alternative promotional approaches and advertising influence free ridership relative to one another.

The preceeding discussion was intended to demonstrate that comparisons of free ridership data across utility programs must formally address program design in explaining at least part of the variances documented from one program to another. The remainder of this paper is intended to demonstrate that evaluation methodologies also must be considered when comparing results across studies.

Evaluation Approaches

Initial efforts to estimate free ridership generally relied upon customer survey data. Over time, surveys of equipment dealers or other trade allies were added and attention has been turning to collecting appliance/equipment sales data. A portion of the differences in results across utility studies is, in fact, linked to the different sources of data, and the inherent strengths and weaknesses of these approaches. The severity of different sources of bias varies with the type of data collection approach; furthermore, the direction of this variation may differ as well. In addition, the severity of the bias can be affected by the skill with which the data collection effort is carried out, particularly in the design and administration of survey questionnaires. Examples of these types of problems are discussed throughout the remainder of the paper, with illustrations contrasting and comparing customer surveys, dealer surveys, and sales data.

Bias Due to Incomplete Information

This bias arises when the respondent is asked to provide information on a subject without access to full information on the same. In the case of estimating free ridership, this issue is particularly germane to the use of surveys in estimating whether the customer would have purchased the same model in the absence of the program. The customer can, of course, answer this only in the context of the other models seen at the time of purchase. The customer's answer, then, assumes that the dealer's decisions about which models to stock would have been the same without the program. As a result, a significant area of program impacts is ignored—and free ridership is overestimated. This bias probably accounts for some of the dramatic differences in free ridership levels documented for the dealer rebate and customer incentives programs offered by NEES in the mid-80's (Ref. 11).

As for dealer surveys and sales data, the issue of lack of information is less important. Equipment stocking trends are captured in this data. If anything, there is a loss of information on how consumer purchase decisions are affected by the utility program; however, it may be possible to infer this indirectly through analysis of the sales data. Effects on free ridership estimates would tend to be less.

Stakeholder Effects

Other biases arise when the respondent perceives that it is in his or her best interest to give the questioner specific types of answers or data. This obstacle can be anticipated by the market researcher, and the data collection effort designed to minimize this effect. For example, questions printed on a rebate application form should as a rule be as neutral as possible. It must be recognized that an individual applying for a rebate will tend to feel that the "proper" answers to questions on program importance indicate that the program determined his/her decision. This effect subsides after receipt of the utility's incentive. In fact, there is concern among some evaluators that follow-up surveys conducted substantially after the time of purchase will suffer from bias in the opposite direction. In this case, the respondent is no longer concerned about receiving an incentive. Instead, it is felt that people tend to become psychologically committed to the decisions or purchases they have previously made and are more likely to indicate that they would have made the same decision on their own, program or no program. Interestingly then, the direction of bias due to customer stakeholder effects is very likely to change with the amount of time which elapses between purchase and market research.

The severity of the stakeholder problem in follow-up surveys with participating customers is generally very modest when compared with the stakeholder issues involved in surveying equipment dealers. The customer actually has very little to gain or lose as a consequence of answering the utility's questions. In contrast, equipment dealers are likely to feel that a great deal hinges on the utility's evaluation results. Frequently, dealers use utility rebate programs as sales tools to boost their own overall sales volume and profitability. As such, dealers have a considerable vested interest in seeing the program continue (and, if possible, expand). From their perspective, then, it is highly desirable that the utility feel that the program is successful. As a result, dealer survey data may indicate relatively lower levels of free ridership than other market research approaches as the dealers strive to convey a favorable picture of the program's influence. A few evaluation efforts have demonstrated this to be the case (Refs. 2, 12). Most likely, sales data collected from the same dealers would not suggest impacts as favorable as those described through dealer surveys.

Non-representativeness of Sample

If the analysis population is not representative of the larger population to which evaluation results are generalized, there is the risk of introducing errors into program impact estimates. In the case of customer surveys, utilities have typically examined demographics and annual bill size to establish whether a problem of a non-representative sample exists. These variables may very well be correlated with others that impact the energy intensity of purchased appliances, *e.g.*, income may be positively correlated with the selection of refrigerator/freezers with more ice makers, water dispensers, and the like. However, these relationships may not be particularly strong and thus may not lead to seriously incorrect estimations of impacts. To the author's knowledge, there is no study demonstrating a linkage between such variables and free ridership misestimation.

In contrast, there is a very strong likelihood that a non-representative sample of appliance dealers will strongly skew program impact estimates, including free-rider estimates, developed from either sales data or dealer surveys. This is a result of the fact that different retailer market niches (*e.g.*, discount pricing versus premium merchandise versus customer service) lead to different equipment stocking patterns. Omissions of certain types of retailers thus may lead to significant data gaps for specific types of models. Also, because dealerships often specialize in the brands offered, there is a risk of over- or understating the relative importance of individual manufacturers. This has direct consequences for free-ridership estimates as each manufacturer will have varying numbers of qualifying models. For example, if store A carries manufacturers with product lines in which 50% of the models qualify and store B carries product lines in which only 15% of the models qualify, there will be very different levels of free ridership among those stores' customers (all other things being equal).

Other factors also work to confound the representativeness of sales data samples from appliance dealers. This type of data collection effort may be viewed as intrusive and very burdensome by dealerships. A number of evaluators have found this to be the case. For example, in the pilot program SRC helped New York State Electric and Gas conduct in 1986, refrigerator sales data were collected from participating dealers and from dealers in a comparison area. A number of dealerships opted to forego participation in the program, some as a matter of company policy and others as a matter of the degree of effort required for data collection. On this latter point, we found a relationship between dealership size and (un)willingness to provide sales data. Smaller shops tended to provide data more readily, as they had fewer records to sift through and they tended to perceive more significant program impacts on their sales. Some of the largest dealerships also complied willingly; these retailers had computerized their recordkeeping and could easily retrieve the desired information. However, a number of moderately sized retailers who had not computerized their sales data found the data collection effort to be too burdensome and did not comply as often.

Thus dealership size, recordkeeping procedures, arrangements with equipment manufacturers, as well as concerns over the proprietary nature of the data, may contribute to significant non-representativeness of sales data samples. These tendencies are a very serious weakness to reliance on sales data for estimating free ridership and are, unfortunately, difficult to correct.

Instrumentation Errors

A great deal of the variation in free-ridership estimates that now exists across studies is due to variations in the design of the data collection instruments used and, in too many cases, to poor instrument design. This is particularly true in the case of questionnaires used in survey research. Inadequate attention has been devoted to the wording of survey questions, leading to misunderstanding on the part of respondents and misinterpretation on the part of analysts.

The most frequent mistake in free-rider estimation is oversimplification of the data collection process. For example, utilities have tried to estimate free ridership on the basis of the following question: "Would you have purchased this same appliance without the (utility name) program?"

This question is completely inadequate for its intended purpose as it leaves too much room for interpretation on the part of the respondent. Many customers will not answer this in the context of whether they would have purchased a high-efficiency model, but simply whether they would have made any purchase at all. The question is thus capturing equipment turnover rates as well as (probably more than) capturing free ridership, contributing to the very high "free ridership" findings of some studies. Poor questionnaire design such as this is the crux of the free-rider estimation problem for far too many studies previously conducted in the industry.

Summary and Implications

As mentioned in the introduction to this paper, considerable variations have been found across studies on free ridership levels in utility DSM programs. Table 3 summarizes some of the findings to date. It is hoped that the preceding discussion provides a useful context in which to begin to compare these findings (as well as others yet to be released.)

Much analysis remains to be done in assessing the linkages between program design and marketing and free ridership levels. This paper suggests a handful of vari-

Table 3. Overview of Free Rider Estimates from Prior Studies

Type of Program	Reference Study	Utility	Free Ridership Estimate (%)	Research Approach
Refrigerator	McRae *et al.* (9)	SCE	66	Customer Survey
		WP&L	72	Customer Survey
		CMP	78	Customer Survey
		NU	89	Sales Data
	SRC (15)	NYSEG	65-68	Customer Survey
		NYSEG	59-77	Sales Data
	Wilder and Hoch (18)	WEPCO	75	Customer Survey
		WEPCO	73	Sales Data
	Mystakides (10)	NEES	69-73	Customer Survey
	Saxonis (12)	NYSEO	65	Customer Survey
	Jenkins *et al.* (6)	NSP	52-57	Sales Data
Air Conditioner Rebate	Wilder and Hoch (18)	WEPCO	66	Sales Data
	SRC (16)	NYSEG	19-28	Customer Survey
	Saxonis (12)	NYSEO	79	Customer Survey
	Jenkins *et al.* (6)	NSP	62-71	Sales Data
	Arganbright *et al.* (2)	WPSC	61-67	Customer Survey
		WPSC	17	Dealer Survey
Air Conditioner Loan	Arganbright *et al.* (2)	WPSC	56-67	Customer Survey
Heat Pump Rebate	ICC (5)	CILCO	40-60	Customer Survey
		CIPS	60	Customer Survey
	Jenkins *et al.* (6)	NSP	70	Sales Data
Weatherization	McRae *et al.* (9)	PG&E	29-70	Customer Survey
		SCE	33	Customer Survey
	ICC (5)	IDENR	33-49	Customer Survey
		NI-Gas	6-14	Customer Survey
Efficient Water Heater	Jenkins *et al.* (16)	NSP	40-42	Sales Data
C/I Lighting	Nadel (11)	NEES	6-23	Customer Survey
		NEES	60-80	Customer Survey
	SRC (4)	NU	13-44	Customer Survey

ables that should be rigorously examined for their influences on customer acceptance.[1] Until such analysis has been completed it will remain difficult to explain the variances observed among related research efforts. In the interim, it is hoped that the reliability of the data on free ridership levels will be improved by refinements to the market research practices in the utility industry. Some suggestions for future market research efforts are offered here.

All forms of market research are subject to a variety of internal and external validity problems. The strengths and weaknesses of customers surveys, dealer surveys, and dealer sales data approaches differ. Table 4 summarizes the strengths and weaknesses discussed here. As this table indicates, in many cases it is impossible to generalize about whether these approaches will over or underestimate free-ridership levels. However, it can be

Table 4. Comparison of Research Validity Problems

	Direction and Severity of Effect		
Type of Validity Problem	Customer Surveys	Dealer Surveys	Dealer Sales Data
Respondent has incomplete information	↑ Significant	↓ Minor	NA Minor
Stakeholder effects[a]	↑↓ Moderate	↓ Significant	- Moderate
Non-representativeness of sample	- Moderate	- Significant	- Significant to Extreme
Instrumentation error	- Significant	- Significant	- Minor

Key
↑ = Likely to lead to overestimate of free ridership
↓ = Li kely to lead to underestimate of free ridership
- = May lead to overestimation or underestimation
NA = Not applicable

[a]Note: The direction of misestimation in customer surveying changes with the amount of time elapsed between the time of purchase and the time of surveying.

seen that the direction of misestimation due to certain validity problems can be anticipated and, in fact, that this varies across data collection methods. This suggests that an evaluation which combines two or more of these approaches can offset some of the validity problems inherent to individual market research approaches.

Other implications that can be drawn from the points made earlier in this paper include:

- The timing of customer surveys can affect the direction and severity of stakeholder biases. Timing also can affect data quality by its relation to recall of the decision process. A best-case solution is to survey customers as soon after their purchase as possible. For program participants, this may be accomplished by mail surveys that accompany the rebate check or telephone interviews scheduled as the checks are issued.

- Questionnaires must be scrutinized closely to assess whether the wording can be made more precise. Issues such as free ridership often must be addressed through a series of questions. Pretesting of surveys should be standard practice.

- Dealer surveys should not be conducted too frequently as the respondents will become sensitized to the evaluation issues and "gaming" may increase. More indirect questions may also be needed in these surveys for the same reason.

- Great care must be taken in analyzing sales data. The issue of sample representativeness must be addressed explicitly through examination of data on manufacturers, efficiency levels, cost, size, and appliance features.

All in all, the standards for how to conduct evaluation research into free ridership need to be strengthened. While there will inevitably be uncertainties in all estimates of net effects on the market, these can be reduced by modifying current practice. The need for high quality information will, in fact, demand changes in current evaluation practice and in the approaches taken to developing transferable implications. It is hoped that the points presented here will provide some useful guidance to DSM evaluators in refining the existing approaches taken to assessing net impacts of utility programs.

Endnote

[1]Due to space limitations, this discussion has intentionally been limited almost exclusively to customer acceptance issues. Much of this discussion can, and should, be extended to an examination of influences on trade ally or third party behavior.

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