

# Homeowners' Awareness and Utilization of Federal Energy Tax Credits

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Motivations for household energy conservation can be classified as either altruistic, mandated by law, or economically induced (Farhar et al., 1980). These motivations have been studied since the mid-1970's (Bultena, 1976; Curtin, 1975; Becker, 1977; Anderson and Lipsey, 1978; Gilley and Gelb, 1978), with economic incentives found to be the most motivating strategy (Opinion Research Corporation, 1975; Gallup, 1976). Further, tax credits are believed to be the most effective economic incentive for household conservation (Epstein and Barrett, 1977). This belief probably influenced the U.S. Government's enactment of the Energy Tax Act in 1978, which allowed tax credits for certain household energy conserving practices.

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The Energy Tax Act's residential energy credit is scheduled to expire in 1987, but under current Reagan administration policies there is little reason to expect the act to continue, either in its current or altered form to that time. The likely demise of the federal tax credit under Reagan, however, should be regarded less as an indication of its failure and more as a reflection of the Reagan philosophy of allowing market conditions to determine how and if conservation practices should be implemented. Indeed, in 1981 and 1982 approximately \$740 and \$800 million, respectively, will be provided in support of private conservation efforts (National Energy Policy Plan, 1981). Thus, since the Reagan administration is not explicitly passing judgment on the success or failure of residential tax credits, important questions remain to be answered regarding their efficacy. We intend to address two of these questions.

The basic direction of inquiry guiding this article focuses on homeowners' awareness and use of the federal tax credit. We will examine the influence of climate and dwelling type on these variables, as well as determine whether selected socio-demographic factors can allow us to differentiate between those

homeowners who use tax credits, those who choose not to use them, and those who are not aware they exist.

### Sample and Data Collection

Findings are based on 851 mail questionnaires returned (63 percent response rate) from adult members of Arizona households in the Spring of 1981. The sample was equally divided into metropolitan and nonmetropolitan strata with names and addresses randomly selected from the most recently published telephone directories for the respective strata. Multiple mailout procedures were employed following the total design method for mail surveys (Dillman, 1978). Whether or not the make-up of the respondents are proportional to the various socio-demographic subpopulations of Arizona cannot be determined; the applicable 1980 census figures have not been released,

**Table 1—Awareness and Use of Federal Tax Credits for Improving Home Energy Efficiency**

	Awareness and Use				Total
	Not Aware	Aware, No Claim	Aware, Made Claim	No Response	
Number of respondents	94	471	132	154	851
Percentage of respondents	11.0	55.3	15.5	18.1	100.0

and the 1970 census is too dated to provide reliable comparisons in light of the rapid growth in Arizona since 1970.

### Analysis and Results

The focal question for this analysis involves respondents' awareness of federal tax credits and whether they had used them in their 1978, 1979 or 1980 federal income tax statements. People that had made a claim were asked whether or not improvements would have been made had tax benefits not been available.

The breakdown of the sampled population with respect to their response to the first part of the question is presented in Table 1. Note that 86.5 percent of the 697 people who responded to the question were aware of the tax credit, while 21.9 percent of those aware made a claim some time between 1978 and 1980. The breakdown of the second part of the question for those who made a federal claim is presented in Table 2. An interesting finding in Table 2 is that only 3 homeowners (2.3 percent of those making a claim and .5 percent of the 603 homeowners who were aware of the tax credit) stated that they definitely would not have added an energy saving device had the tax credit not been available. In general, though, 10.6 percent of the 132 respondents who filed a federal tax claim indicated that the tax credit was either the primary or at least an important factor in their decision to add energy saving improvements, while 84.9 percent indicated that they probably or definitely would have made the improvements anyway.

**Table 2—Status of Making Home Energy Efficiency Improvements for People Claiming Federal Tax Credits**

	Made Improvements Without Tax Credit?					Total
	Definitely No	Probably No	Probably Yes	Definitely Yes	No Answer	
Number of respondents	3	14	48	64	3	132
Percentage of 132 making federal tax claim	2.3	10.6	36.4	48.5	2.3	100.0

In the following sections, we will examine these tables in more detail. The next section will introduce environmental and housing factors to examine their influence on both the awareness and use of the federal tax credits (the Tax Credit Use variable), as well as on the importance of the tax credit in making decisions about energy improvements (the Tax Credit Importance variable). In the subsequent section, we will explore how socio-demographic factors are related to both Tax Credit variables.

To analyze the data, the methods of log-linear contingency table analysis developed by Goodman (1972) will be used. These techniques allow multivariate analysis of nominal data and provide a systematic strategy for testing the significance of relationships and establishing estimates of the effects. The outcome of the use of these techniques is the selection of a preferred model whose expected frequencies are used to calculate estimates of population effects. Three basic criteria will be used in the analysis for selecting a model: (1) the p-value of the model is .10 or larger; (2) adding any additional effects to the model does not significantly improve its fit at the .01 level of significance; and (3) the model contains no effects which, if dropped out of the model, do not significantly decrease the fit at the .10 level.

#### *Environmental and Housing Factors*

It is expected that one of the most important factors influencing the two Tax Credit variables is whether respondents rent or own their residence. Generally, federal tax credits are not directed at renters since they are less likely than homeowners to make improvements that would qualify for a credit. For this reason, it was decided to focus solely on respondents that own their residence. Analogously, it was decided to eliminate owners that reside in multiple dwelling units since the improvements they make would also be less likely to qualify for a tax credit. Thus, our first factor is housing type, which consists of two categories: mobile home (those respondents that live in their own mobile home) and single family unit (those respondents that live in their own single family unit).

The environment, a factor with considerable variability across Arizona, is operationalized in the

form of heating degree days (defined as the number of degrees the average day's temperature is less than 65°, summed up for one year and averaged over 50 years). These data were provided by zip code region. Preliminary evaluation suggested that heating degree days be broken into three categories: few—less than 1,800 hours per year; moderate—between 1,800 and 6,000 hours per year; and many—more than 6,000 hours per year. While this index of the environment may be less than totally adequate for a predominately warm weather state, it does focus on what the federal tax credits were predominantly designed to influence (i.e., heating related energy improvements).

Another factor is age of dwelling insofar as age is an indicator of whether the dwelling can be economically insulated or weatherized (retrofitted) and whether the dwelling was built with insulation and weatherization. In the latter case, if a home was built with insulation after April 20, 1977, then the owner would be eligible to claim a federal tax credit (Energy Tax Act, 1978). If the home was built a few years prior to April, 1977, then the home would be sufficiently new to have had relatively few owners and hence less likely than older homes to have been insulated or weatherized. If that is the case, then it is a likely candidate to be insulated or weatherized in light of tax credits. A third possibility suggests that the oldest homes are too expensive to insulate and hence no tax credit is claimed. Aside from the 1977 date, these three possibilities do not pinpoint any specific age categories. Therefore, age break points in the data were determined empirically, with before and after 1970 being the more telling break.

Log-linear contingency table techniques were used to analyze the resultant fourway table: Tax Credit Use x Heating Degree Days x Housing Type x Age of Dwelling. The results of the analysis indicate that the Tax Credit Use variable is related to both heating degree days and age of dwelling, but is not related to housing type. Since the two questions of interest to us with respect to the Tax Credit Use variable are the awareness of the tax credit and the subsequent use of it by claiming the credit on the federal income tax, the percentage of the population that knew about the tax credit as well as the percentage of the population that claimed a tax credit are listed in Table 3.

An examination of this table reveals that as the number of heating degree days increases, so does the percentage of the population that claimed the tax credit on their income tax. At the same time, an increase in heating degree days results in a decrease in those that had known about the tax credit. Finally, houses that were built before 1970 had a higher awareness of the tax credit than those built after 1970, but also exhibited a smaller proportion that made use of the tax credit.

**Table 3—Percentage of the Sampled Population That Was Aware of the Tax Credit and the Percentage That Filed a Federal Tax Credit Claim<sup>a</sup>**

Heating Degree Days	Age of Dwelling	% Aware of the Federal Tax Credit <sup>b</sup>	% Filed Claim on Federal Income Tax
Few	More 10 yrs	92.0	16.4
	Less 10 yrs	89.0	26.6
Moderate	More 10 yrs	90.2	20.7
	Less 10 yrs	87.0	32.1
Many	More 10 yrs	88.5	33.4
	Less 10 yrs	86.2	46.8

<sup>a</sup>n = 477; the preferred model = {12}, {14}, {34}  $\chi^2 = 12.05$  with 33 df, p = .9563  
 where 1 = Tax Credit Use  
 2 = Heating Degree Days  
 3 = Housing Type  
 4 = Age of Dwelling

<sup>b</sup>The percentages were computed from the table fitted by the preferred model. They are constant across Housing Type.

A more detailed analysis of the Tax Credit Importance variable using the three explanatory variables (i.e., heating degree days, housing type and age of dwelling) was also performed. Because of the sparseness of data in the table, it was decided to re-define the categories of the Tax Credit Importance variable in the following manner: no = definitely no and probably no; and yes = probably yes and definitely yes. The decision to make the break between these cells can be explained by noting that the direction of this article is to determine how effective tax credits have been in motivating people to add energy improvements to their homes. Thus, we have decided that any negative response to the second part of the

survey question can be interpreted as support of the purpose of the credit.

The methods of log-linear contingency table analysis were then used on the four-way table: Tax Credit Importance x Heating Degree Days x Housing Type x Age of Dwelling. None of the explanatory variables were found to be related to the Tax Credit Importance variable.<sup>1</sup> The results indicate that 14.9 percent of the people that made an energy related improvement to their homes did so primarily because of the existence of the tax credit.

#### *Socio-Demographic Factors*

Let us now consider differentiating between the memberships in the categories of the Tax Credit Use and Tax Credit Importance variables based on socio-demographic factors. The following list of socio-demographic variables was initially proposed as potentially offering a way to differentiate between the categories of the Tax Credit variables:

- Employment Status: Full time, part time, retired;
- Education: high school or less, some college, college degree or more;
- Income: less than \$15,000, between \$15,000 and \$30,000, more than \$30,000;
- Marital Status: married, not married;
- Age: less than 40, between 40 and 65, over 65.

The six-way table of Tax Credit Use by the socio-demographic variables was analyzed via log-linear contingency table techniques. It was found that marital status was the only variable directly related to the use of the tax credit.<sup>2</sup> Table 4 lists the percentages of the population that were aware of tax credits and the percentages that made a claim on their federal income tax. The results indicate that married people are both more aware and use the tax credit to a greater extent than people who are not married.

**Table 4—Percentage of the Sampled Population That Was Aware of the Tax Credit and Percentage That Filed a Claim on Federal Income Tax<sup>a</sup>**

Marital Status	% Aware of the Federal Tax Credit <sup>b</sup>	% Filed Claim on Federal Income Tax
Married	91.0	26.0
Not Married	81.1	13.5

<sup>a</sup>n = 462; the preferred model = {15}, {56}, {45}, {26}, {24}, {46}, {34}, {36}, {25} x<sup>2</sup> = 166.50 with 192 df, p = .99

where 1 = Tax Credit Use  
 2 = Employment Status  
 3 = Education  
 4 = Income  
 5 = Marital Status  
 6 = Age

<sup>b</sup>The percentages were computed from the table fitted by the preferred model.

The six-way table of Tax Credit Importance by the socio-demographic variables was also analyzed by log-linear contingency table techniques. It was found that none of the socio-demographic factors were related to Tax Credit Importance.<sup>3</sup>

### Summary

In summary, almost nine of ten homeowners were aware of federal energy tax credits while one in six made a federal tax claim between 1978 and 1980. Of respondents making a claim, two of every hundred said they would not have made an energy improvement without the tax credit. It is somewhat surprising, however, that people living where there are few heating degree days (warmer climate) are more likely to be aware of federal tax credits. One explanation for this finding rests with the fact that the few heating degree day regions are comprised of the two major metropolitan areas where becoming aware would more likely occur.

As expected, people living in areas with many heating degree days (colder climate) are more likely to have filed a federal energy tax claim. Perhaps the biggest surprise comes from the lack of association between tax credit use and socio-demographic characteristics. Marital status is the only characteristic (the others were age, income, education, and employment status) that was related to tax credit use. Married

homeowners are more likely to have filed a claim than unmarried homeowners, and are also more likely to be aware of tax credits.

Perhaps the most interesting finding is the lack of relationship between any of the variables and whether or not a homeowner who made an energy improvement would have done so without the tax credit. This result can be viewed both positively and negatively. On the positive side is the notion that homeowners, regardless of their socio-demographic makeup, age of their home, climate, or whether or not they are a mobile unit or a single family unit, are equally likely to need a tax credit in order to make improvements. On the negative side is the notion that there seems to be no information about which specific groups of the population to target in any effort to improve the efficiency of the federal tax credit program.

### Footnotes

- n = 114; the preferred model = {1}, {2}, {3}, {4} x<sup>2</sup> = 7.79 with 18 df, p = .9815

where 1 = Tax Credit Importance  
 2 = Heating Degree Days  
 3 = Housing Type  
 4 = Age of Dwelling

- Because of the small sample size and the number of variables used, the models were fit under the assumption that all four-way interactions and higher were negligible.
- n = 117; the preferred model = {1}, {25}, {34}, {45}, {35} x<sup>2</sup> = 15.96 with 13 df, p = .25

where 1 = Tax Credit Importance  
 2 = Employment Status  
 3 = Income  
 4 = Marital Status  
 5 = Age

Because of the small sample size, the number of variables used, and the patterns of zeros in the three-way marginals, the models were fit under the assumption that all three-way interactions and higher were negligible.

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