MARKET TRANSACTIONS AND HYPOTHETICAL DEMAND DATA: A COMPARATIVE STUDY

by

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ABSTRACT

Empirical demand studies have been based on data from: (1) actual market transactions, or (2) hypothetical survey questions. Many social scientists are skeptical of the accuracy of responses to hypothetical questions, yet few studies assess the quality of this type of data. This paper directly compares the demand relations obtained from actual market transactions and hypothetical survey questions using primary field data and limited dependent variable regression analysis. Using a log-likelihood ratio test, the null hypothesis that the two demand relations are statistically identical cannot be rejected at the 30 percent level of significance.

KEY WORDS

Accuracy of survey data; Demand data collection methods; Contingent valuation; Tobit.

1. INTRODUCTION

Empirical demand studies have been based on data obtained from one of two sources. (1) actual market transactions, or (2) hypothetical survey questions. Price and quantity data from actual market transactions have been most widely used by economists because of their accessibility from published and computerized sources as well as their obvious demand revealing properties. Well-known gaps and problems with these data, however, have stimulated interest in using hypothetical survey questions to generate the required information. For example, for private goods which change hands infrequently, such as houses, actual market transaction data are limited. As a consequence, researchers have resorted to surveys, such as the Annual Housing Survey and the Census of Population, which ask how much money the respondent could get for his house if it were sold on today's market. Additionally, for environmental goods, such as clean air or visibility, which are not separately traded in markets, actual transactions data do not exist. This situation has inspired the development of the contingent valuation method in which a survey respondent is directly asked how much money he would be willing to give up to enjoy a particular environmental improvement.

Hypothetical demand data, however, is subject to several sources of potential bias. An important type of bias, which might be termed payment bias, arises because hypothetical situations may not provide sufficient incentive for respondents to reveal their true preferences. This possibility alone is enough to arouse skepticism of results based or

this type of data. Despite this skepticism, though, widespread use of hypothetical data continues. Yet few studies, excluding those by Brookshire et al. (1982), Kain and Quigley (1972) and Kish and Lansing (1954), have attempted to evaluate the quality of hypothetical data and virtually no studies have directly compared demand relations based on hypothetical data with those obtained from actual market transaction data. Such comparisons, which are easiest to make in the context of a private good, would be of immediate value for assessing the relative usefulness of hypothetical data as well as for indicating ways to improve demand-revealing data collection methods generally.

This paper provides a statistical comparison between the demand relations for a private good estimated using actual market transactions data and survey responses. This comparison amounts to a test for the payment bias described above and is a contribution to the broader literature on the accuracy or validity of survey data (see, for example, Dillman, 1978). Since this comparison considers only the demand relation for one private good in one community, the results should be viewed only as suggestive. Nevertheless, those results still are of interest because they provide an illustration showing that a demand function based on actual market transactions data is not statistically different from one based on hypothetical responses.

The rest of this paper is organized into three sections. Section 2 describes the methodology used to generate data for the demand curve comparison. Section 3 more fully describes the empirical comparison results. Conclusions are drawn out in Section 4.

2. METHODOLOGY

Since this study focuses on payment bias, the research design attempted to control for other types of bias (considered at length by Cummings, Brookshire and Schulze, 1986) associated with hypothetical data. One potential source of bias, which is particularly relevant when dealing with public goods, is the strategic misrepresentation of preferences. For instance, a respondent who has a strong desire for an environmental good may report more than his true willingness to pay if he feels that: (1) this bid will influence the good's provision and (2) he will never actually have to pay this amount (either because the cost per person will be lower when spread across all taxpayers or because the payment per person will be based on the average response which he expects to be lower than his own). Other types of bias may result if the individual is unfamiliar with the commodity or uninformed about relevant market conditions. As an example of the former, an individual may be asked to value the hypothetical removal of toxic wastes from a dump site when no information is available concerning either the materials or the hazards present. The latter situation might arise if an individual who has not recently paid attention to the market for residential property is asked to assign a rental or sales value to his home. In a related vein, answering questions about commodities which are hypothetical, unfamiliar, or complex may require time for preference research before an accurate assessment of value can be made. Additional sources of bias include vehicle bias where the method of payment may influence results and starting point bias where an initial price suggested by the interviewer may influence the final value reported by the respondent.

These biases were controlled by attempting to minimize the likelihood that they would occur or at least to make this likelihood roughly equal in both the actual and hypothetical components of the study. Thus, a private good, fresh strawberries, was chosen in order to minimize the incentives for strategic bias. Moreover, because strawberries are a simple and familiar commodity, and because the data were collected from individuals who regularly shopped for groceries, any biases associated with lack of familiarity with the commodity or the market should be minimal, as should the time and information needed for preference research. Finally, the method of payment was identical and the quoted prices were distributed identically in both the actual market transaction and the hypothetical sales portions of the study. Besides allowing greater focus on the single issue of payment bias, fresh strawberries were selected as the commodity for analysis for three additional reasons. First, since strawberries are nondurable, the demand for them can be viewed in a static framework. Second, strawberries are a relatively inexpensive commodity which makes analysis of demand feasible on a limited research budget and avoids the need to analyze income effects from changing prices. Third, fresh strawberries are seasonal and normally exhibit price fluctuations even on a week-to-week basis, a characteristic that facilitates the estimation of demand relations over a range of prices.

Primary field data were collected during the summer of 1984 in Laramie, Wyoming in order to generate information for both the actual market transactions and hypothetical survey portions of the study. This community was chosen primarily on the basis of cost and convenience. Laramie is a town of approximately 25,000 residents and is the location of

the University of Wyoming. The following multistage sampling procedure was adapted from Sudman (1976). The City Planning Office has demarcated 19 divisions in Laramie, and these are the smallest neighborhood units for which 1980 Census data are available. From these census data, the number of households and their average income in each division were determined, and approximately one-third of the city population was assigned to each of a low-, middle-, and high-income stratum. Then six divisions were randomly selected (two in each income stratum) with probability proportional to their population. These six primary sampling units (PSUs) were partitioned into clusters of approximately 40 households each, so that any given cluster could accommodate 12 sample points. Next, two clusters were randomly selected from each of the six PSUs, with one cluster assigned to actual market transactions and the other to hypothetical surveys. Finally, after a random start in each cluster, every third house was chosen until 12 sample points had been obtained from all six clusters. If a regular grocery shopper was unavailable at one of the households chosen from sampling, the survey team would return to the house at a later time. If this second attempt to contact a regular grocery shopper failed, or in the rare case where this person refused to participate in the study, one of the two houses next door was chosen.

Thus, 72 households were selected for inclusion in the actual market transactions portion and 72 additional households were drawn in a parallel manner for the hypothetical survey portion. This sample size was selected in light of the probable range of price elasticities and income variation in the resulting data. Three survey teams of two persons each collected the data for both portions over a four day period in July 1984 during the

late afternoon and early evening hours by means of a questionnaire administered in door-to-door, in-person interviews. The questionnaire was first pretested on six Laramie households in order to improve its design and to give the survey teams practice with administration procedures. To minimize the possibility of survey team bias, each team completed interviews with at least one cluster in each income category in both the actual and hypothetical portions of the study.

To implement the actual market transactions surveys, initial contact with the household identified the individual who regularly shopped for groceries. The interviewer gave a brief introduction in which the available strawberries were displayed and the respondent was informed of the selling price per pint. Six prices ($0.60, $0.80, $1.00, $1.20, $1.40, $1.60), which span the seasonal range of prices charged by Laramie grocery stores, were used with two households in each cluster (for a total of 12 households) randomly assigned to each price. If the respondent desired to purchase at least one pint, an exchange of strawberries and money was completed. Immediately thereafter, however, the respondent was told that the purpose of the visit really was to collect market research information from households in Laramie. The respondent then had his money refunded and was allowed to keep the strawberries in return for supplying the survey team with information needed to complete a questionnaire (available from the authors on request). On the other hand, if no strawberries were purchased, the interviewer offered them to the respondent at no charge in return for help in completing the questionnaire. The first items on the questionnaire called for the survey team to record the price and quantity data obtained. Other variables measured included: (1) number of household

members (NUMBER), (2) total monthly household income (INCOME), (3) hours since last full meal was eaten (ATE), (4) days since household last shopped for groceries (SHOP), (5) respondent's years of age (AGE), (5) whether respondent is white (WHITE), and (6) respondent's years of formal schooling (SCHOOL).

The hypothetical survey data were collected using the same procedure as just described except for two differences. First, instead of informing the respondent of the price at which strawberries would be sold, the survey team stated that they were gathering information for market research purposes. Second, after this introduction and displaying the strawberries, the respondent was told, "Suppose that a pint of strawberries can be purchased for $_____. How many pints would you buy?" The prices inserted in the preceding statement were the same as those used to generate the actual market transactions data and an identical procedure was used to match the prices to the households. After obtaining the answer to the question, the respondent was offered strawberries at no charge and the interview commenced.

3. AN EMPIRICAL COMPARISON

The basic demand relation estimated using the actual market transactions and hypothetical survey data is shown in equation (1).

$$QPHM_i = f(PRICE_i, INCPHM_i, ATE_i, AGE_i, SHOP_i, WHITE_i, SCHOOL_i) \qquad (1)$$

The variable $QPHM_i$ denotes the number of pints of strawberries per household member that would have been purchased by the i^{th} respondent (i=1, ... 144) at $PRICE_i$ and $INCPHM_i$ denotes income per household member (i.e., $INCOME_i/NUMBER_i$). For the first 72 observations, $PRICE_i$ denotes the

price quoted to the i^{th} household by the survey team and for the last 72 observations, that variable denotes the hypothetical price quoted to the i^{th} household. Thus, estimating equation (1) involves pooling the actual market transactions data with the hypothetical survey data. The remaining explanatory variables were collected from the questionnaire administered to each respondent and were defined in Section 2.

Table 1 presents the results of estimating two versions of equation (1). The first version uses the explanatory variables just discussed, while the second adds a dummy variable (MARKET) together with interaction variables between MARKET and all other explanatory variables. (These interaction variables are explicitly named in Table 1.) MARKET is unity for the first 72 observations and zero for the last 72 observations. Thus, this variable denotes whether an observation was obtained from the actual market transactions of the hypothetical survey portions of the study. The results from adding MARKET together with the interaction variables can be used to: (1) test the null hypothesis that the actual market transactions and hypothetical survey demand curves are statistically identical and (2) identify the source(s) of structural shifts in the event that this hypothesis is rejected.

Both versions of equation (1) were estimated in a tobit framework since the dependent variable $QPHM_i$ was zero for 58 percent of the observations in the actual market transactions portion of the study and for 47 percent of the observations in the hypothetical survey portion. In the case of the restricted equation (the one estimated without the MARKET dummy and the interaction variables), the coefficients of the key variables $PRICE_i$ and $INCPHM_i$ have the correct sign (negative and positive,

TABLE 1

COMPARISON OF ACTUAL MARKET TRANSACTIONS AND HYPOTHETICAL SURVEY DEMAND FUNCTIONS[a]

Independent Variable	Normalized Coefficient[b]	Normalized Coefficient[b]
Constant	3.7388	3.9206
	(4.7748)	(3.7120)
PRICE	-1.3004	-1.4246
	(-4.3287)	(-3.4282)
INCPHM	.0005229	.00099138
	(2.5591)	(2.5776)
ATE	-.094670	-.11915
	(-1.4557)	(-1.4154)
ATE^2	.0071681	.0076337
	(2.5287)	(1.9469)
AGE	-.013861	-.020841
	(-2.0450)	(-2.2604)
SHOP	-.025481	-.045796
	(-1.4729)	(-1.7407)
WHITE	-.50623	-.61886
	(-1.7515)	(-1.6514)
SCHOOL	-.10073	-.074108
	(-2.7382)	(-1.3600)
MARKET		-.51941
		(-.33385)
MKTPRICE		.15270
		(.24831)
MKTINCPHM		-.0006197
		(-1.4105)
MKTATE		.061840
		(.43325)
$MKTATE^2$		-.0020343
		(-.34212)
MKTAGE		.0093137
		(.66731)
MKTSHOP		.038698
		(1.0359)
MKTWHITE		.37770
		(.56723)
MKTSCHOOL		-.041342
		(-.54008)
Standard Error	.87151	.81593
Predicted Probability of $QPHM_i > 0$	.4387	.4452
Observed Frequency of of $QPHM_i > 0$	.4722	.4722
Log of Likelihood	-127.43244	-122.85735

[a] t-statistics shown in parentheses.

[b] Normalized coefficients are defined as the coefficients of the original regression model divided by the standard error of the regression.

respectively) and are significantly different from zero at the 1 percent level. As a group, the remaining explanatory variables also perform reasonably well. Younger, non-white, and less formally educated respondents tended to purchase larger amounts of strawberries. The effect of length of time since the last full meal was eaten on $QPHM_i$ follows a quadratic pattern, first falling and then rising after 6.6 hours have elapsed. The coefficients of ATE and SHOP, however, only are significantly different from zero at the 10 percent level using a one-tail test.

In the unrestricted version of equation (1), shown in the second column of Table 1, the signs, magnitudes, and statistical significance of the coefficients just discussed are not greatly altered. Also, and of particular relevance to this study, neither the MARKET dummy variable nor the interaction variables are significantly different from zero at the 5 percent level using a one-tail test. In general, however, tests of individual coefficients are not as powerful as joint tests of significance. Consequently, following Tobin (1958), a likelihood ratio test was made for the joint significance of the MARKET dummy variable and all interaction variables. This test fails to reject the null hypothesis of structurally identical actual and hypothetical demand curves at the 30 percent level of significance.

Experimentation with alternative specifications of the demand equation involved the inclusion of different subsets of the variables in Table 1 as well as the addition of a gender dummy. Investigation of the curvature of the demand relation also was undertaken by taking natural logs of strictly positive variables and squaring terms other than ATE. Using likelihood ratio tests for these alternative specifications, the significance levels

up to which the null hypothesis of identical actual and hypothetical demand curves cannot be rejected vary from 20 percent to 50 percent. This result is reinforced by t-tests on the individual coefficients of MARKET and the interactions, which reveal that these variables remain statistically insignificant. Only MKTINCPHM is occasionally significantly different from zero at the 10 percent level. These supplementary results are available from the authors on request.

4. CONCLUSIONS

This paper has compared demand relations for fresh strawberries based on actual market transactions and hypothetical survey data. The empirical analysis reveals that the null hypothesis of structurally identical demand curves obtained with these two data collection mechanisms is not rejected even at the 30 percent level of significance. In other words, the results suggest that hypothetical demand data may be useful proxy when actual market transactions either do not take place or information about them are unavailable. This conclusion, however, should not be overgeneralized for three reasons. First, demand is analyzed for only one commodity (fresh strawberries) in one community (Laramie, Wyoming). Second, the commodity is quite simple particularly in comparison with other goods such as houses for which hypothetical values often are obtained. Third, fresh strawberries are a purely private good. As a consequence, several types of hypothetical response bias associated with analyzing demand for public goods are not present.

Despite these qualifications, however, the results presented still are significant and perhaps even surprising. In their study of housing in St. Louis, Kain and Quigley (1972) found an average deviation of 19 percent

between owner and professional appraiser estimates of value. Kish and Lansing (1954) in a similar analysis discovered that only 37 percent of owner's estimates were within 10 percent of appraised value. Of course, estimates of value by professional real estate appraisers will not correspond exactly to the selling prices of houses on the market. Nevertheless, the comparisons drawn do not inspire great confidence in hypothetical valuation data, except possibly in aggregated form where the errors made by individual owners may cancel out. Moreover, in reviewing studies of public goods, particularly those by Bohm (1972) and Bishop and Heberlein (1979), Cummings, Brookshire, and Schulze (1986) stated that ". . . the literature abounds with evidence that suggests that . . . actual vs. hypothetical payment does result in different choices."

Further research would be useful in establishing whether the result presented here is an isolated statistical accident or whether it can be extended to other circumstances. For example, individuals may be better able to accurately answer hypothetical questions about what quantity to buy at given prices (the situation considered in this study) in comparison with questions asking for hypothetical valuations (the situation considered in the two housing studies). Additionally, can the result be extended to other instances where less control can be exercised over potential sources of hypothetical response bias? One generalization would be to analyze a good of a more public character and thereby allow for the possibility of strategic bias. Other possible cases include consideration of goods with which subjects are less familiar, both in terms of the nature of the commodity and the prior valuation experience they have had with it.

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SURVEY QUESTIONNAIRE ADMINISTERED IN BOTH
ACTUAL MARKET TRANSACTIONS AND
HYPOTHETICAL DEMAND PORTIONS OF STUDY

PART A: PURCHASING AND CONSUMPTION HABITS

Q1: How long has it been since you last ate any foods?

_____HOURS

Q2: How long has It been since you last ate a full course meal (main dish, salad, breads, desserts)?

_____HOURS

Q3: In how many hours till you eat again?

_____HOURS

Q10a: What type of meal will you eat? _____

Q4: How many permanent members are in your household?

_____NUMBER

Q5: How many of the permanent members of your household do you regularly buy groceries for?

_____NUMBER

Q6: Of these, how many eat strawberries? _____NUMBER

Q7: Please give us your age and the ages of each of the permanent members of your household and their relationship, if any, to you.

_____RESPONDENTS AGE _____SEX

Ages	Relationship
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Q8: Do you currently have out-of-town visitors staying with you?

_____NO _____YES

If yes,

Q8a: how many? _____NUMBER

It is Important for our study that we know whether the permanent members of your household pool their incomes together to meet household expenses or whether they meet these expenses individually. Please indicate whether or not the members of your household share these expenses.

Q9: Does your household share FOOD expenses?

_____YES _____NO

Q9a: Does your household share HOUSING expenses, including rent or house payment and utilities?

_____YES _____NO

Q9b: Does your household share TRANSPORTATION expenses, such as vehicle payments, fuel, maintenance, insurance?

_____YES _____NO

PART B: BUDGET SHARE BREAKDOWN

Before continuing let us remind you that all your responses will be kept completely confidential. What we would like you to do now is to complete a Budget Share Breakdown Sheet in which you divide up your household's monthly expenditures among various general categories. In other words, we need to know how much you spend on things like food, housing, and transportation, as well as your monthly income and savings. The next page describes how each of these categories are defined.

BREAKDOWN SHEET

INCOME: What is the total monthly income, after taxes, of your whole household?

SAVINGS AND INVESTMENTS: Of this amount, how much is saved, or invested in stocks, bonds, annuities, IRA's, etc.?

HOUSING : The housing category includes not only your rent or house payment, but also utilities, maintenance, and any homeowners. mortgage, or renters insurance that you may have. How much do you spend monthly on these items?

TRANSPORTATION: By transportation expense, we mean total vehicle payments. fuel, maintenance, and vehicle insurance. How much do you spend in this category on a monthly basis?

PERSONAL CARE: Before we get to the food category, we need to know how much is spent monthly on such "personal care" items as shampoo, toothpaste, cosmetics, and so on. Many people buy these things at the grocery store, so you may have to estimate how much they contribute to your total grocery bill.

FOOD: Finally, the food category. Since this is the main point of our study, we need to get a little more detail here. First, we need to know the amount spent on food for "in-home-use." This is basically your total monthly grocery bill, after subtracting out all non-food items such as personal care, magazines, pet foods, tobacco, etc., that you may buy at the grocery store.

Next, how much do you spend eating out, per month?

Finally, how much do you spend monthly on alcoholic beverages and tobacco?

[CONTINUE WITH NEXT PAGE]

BUDGET BREAKDOWN

MONTHLY INCOME _____

MONTHLY SAVINGS & INVESTMENTS _____

MONTHLY HOUSING _____

MONTHLY TRANSPORTATION _____

MONTHLY PERSONAL CARE _____

MONTHLY FOOD: IN HOME _____
EAT OUT _____
ALC. & TOB. _____

TOTAL FOOD _____

Now, focus your attention on the FOOD category and the amount that you indicated as your monthly in home food expense. We would like your answer to some questions about how often you buy and eat fruit.

Q10: Do you buy most of your groceries at one store?

_____YES _____NO

[IF YES GO TO Q11]

[IF NO CONTINUE WITH Q10a]

Q10a: Is most of your grocery shopping done at some of the four largest grocery stores in Laramie (Albertsons, Buttrey's, Ideal, Safeway)?

_____YES _____NO

[IF YES GO TO Q12]

[IF NO CONTINUE WITH Q10b]

Q10b: Do you buy most of your groceries in Laramie?

_____YES _____NO

[GO TO Q12]

Q11: At what store do you buy most of your groceries?

_____

[CONTINUE WITH Q12]

Q12: How many times per month do you make major grocery purchases?

_____NUMBER

Q13: When was the last time you made a major grocery purchase?

_____

Q14: Do you normally make your major fruit purchases at the same time as you make major food purchases?

_____YES _____NO

[IF YES GO TO Q17]

[IF NO CONTINUE WITH Q15]

Q15: How many times per month do you make major fruit purchases?

_____TIMES PER MONTH

Q16: When was the last time you made a major fruit purchase?

_____

[CONTINUE WITH Q17]

Q17: Try to recall your last major fruit purchase. Was this last fruit purchase representative of other purchases over the last month?

_____YES _____NO

[IF YES GO TO Q19]

[IF NO CONTINUE WITH Q18]

Q18: We have here a table which lists fruits that have been available recently in Laramie. Please indicate the quantities of fruits you purchased in the past month.

Q19: We have here a table which lists fruits that have been available recently in Laramie. Please indicate the quantities of fruits you purchased at your last major grocery purchase or the last time you purchased fruits.

LIST OF FRUITS AVAILABLE IN LARAMIE

FRUITS	UNITS SOLD BY	QUANTITY PURCHASED
Apples	individually/lb.	
Apricots	individually/lb.	
Avocados	individually/lb.	
Bananas	bunch	
Blueberries	pint	
Blackberries	½ pint	
Cherries	individually/lb.	
Coconut	individually/lb.	
Cantelope	individually/lb.	
Grapes	bunch/lb.	
Grapefruit	individually/lb.	
Honey Dew Melon	individually/lb.	
Kiwi Fruit	individually	
Lemons	individually	
Limes	individually	
Mangos	individually	
Nectarines	individually/lb.	
Oranges	individually/lb.	
Papayas	individually	
Peaches	individually/lb.	
Pears	individually/lb.	
Pineapples	individually/lb.	
Plums	individually/lb.	
Raspberries	½ pint	
Strawberries	pint	
Watermelon	individually/lb.	

PART E: SOCIOECONOMIC QUESTIONS

We have just a few more questions.

These questions are about the sex, race, education and occupation of the wage earners in your household, and the amount of time they spend working.

Q20: How many wage-earners are there in your household?

_____ NUMBER

If there is more than one wage earner in your family, complete for both.

Wage Earner #1	Wage Earner #2
Q21: Sex: Male_____ Female_____	Sex: Male_____ Female_____
Q22: Race: _____White _____American Indian _____Black _____Asian _____Hispanic	Race: _____White _____American Indian _____Black _____Asian _____Hispanic
Q23: How much formal education has this person completed? (Please circle the number) 1 0- 5 GRADES 2 6- 8 GRADES; FINISHED GRADE SCHOOL 3 9-11 GRADES; SOME HIGH SCHOOL 4 12 GRADES; FINISHED HIGH SCHOOL 5 VOCATIONAL PROGRAMS 6 SOME COLLEGE 7 COLLEGE DEGREE: BA OR BS 8 SOME GRADUATE WORK 9 ADVANCED COLLEGE DEGREE OR PROFESSIONAL DEGREE	How much formal education has this person you completed? (Please circle the number) 1 0 - 5 GRADES 2 6 - 8 GRADES: FINISHED GRADE SCHOOL 3 9-11 GRADES: SOME HIGH SCHOOL 4 12 GRADES; FINISHED HIGH SCHOOL 5 VOCATIONAL PROGRAMS 6 SOME COLLEGE 7 COLLEGE DEGREE; BA OR BS 8 SOME GRADUATE WORK 9 ADVANCED COLLEGE DEGREE OR PROFESSIONAL DEGREE

Q21: Is this person presently:

Employed ___ or Unemployed ___

[IF UNEMPLOYED, GO TO END OF SURVEY]

[IF EMPLOYED, CONTINUE]

Q25 : What is this person's occupation? _____

Q26: Is this person paid an hourly wage?

[IF NO GO TO Q27]

[IF YES CONTINUE WITH Q26a]

Q26a: What is the hourly wage?

$_____PER HOUR

[CONTINUE WITH Q27]

Q27: How many weeks per year does this person work?

#_____WEEKS

Q28: On average, how many hours per week does this person work?

#_____HOURS

Q29: Approximately what percentage of household income does this person earn?

_____%

Is this person presently:

Employed ___ or Unemployed ___

[IF UNEMPLOYED, GO TO END OF SURVEY]

[IF EMPLOYED, CONTINUE]

What is this person's occupation? _____

Is this person paid an hourly wage?

[IF NO GO TO Q27)

[IF YES CONTINUE WITH Q26a]

What is the hourly wage?

$_____PER HOUR

[CONTINUE WITH Q27]

How many weeks per year does this person work?

#_____WEEKS

On average, how many hours per week does this person work?

#_____HOURS

Approximately what percentage of household income does this person earn?

_____%

CA70 53 --- 61 11 10 54

VAR	B	T
X61-DOCH	-0.21947D-02	-3.4507
X11-MAGE	0.13055	14.010
X10-NONW	0.47916	2.9515
X54-CI68	0.40723D-02	3.8269
CONSTANT	-2.2308	-6.9029

R-SQUARE= 0.7940
SSR= 1.966 DF= 55

CA70 53 --- 31 56 57 59 60 61 11 10 54

VAR	B	T
X31-NO69	0.73467D-01	0.84265D-01
X56-LEAD	-0.87004D-01	-1.5781
X57-SO70	0.12237D-02	0.84610
X59-SU90	-0.36639D-02	-0.82723
X60-PA70	0.12810D-02	1.3360
X61-DOCH	-0.15284D-02	-2.0358
X11-MAGE	0.13174	12.067
X10-NONW	0.46477	2.6482
X54-CI68	0.39882D-02	3.4068
CONSTANT	-2.3451	-6.4144

R-SQUARE= 0.8122
SSR= 1.793 DF= 50

CA70 53 -- 10 11 13 31 57 59 60

VAR	B	T
X10-NONW	0.14131	0.74380
X11-MAGE	0.11631	10.884
X13-IN69	-0.80371D-04	-2.8908
X31-NO69	0.55137	0.63458
X57-SO70	0.16568D-02	1.0711
X59-SU90	0.13642D-02	0.30195
X60-PA70	0.81694D-03	0.84995
CONSTANT	-0.75537	-1.8123

R-SQUARE= 0.7728
SSR= 2.168 DF= 52

TABLE 4

MORTALITY AND AIR QUALITY

Hypotheses Not REJECTED AT 982 CONFIDENCE LEVEL
(Two Tailed t-TEST, $t \geq 2.4$)

	Total Mortality Rate	Vascular Disease	Heart Disease	Pneumonia & Influenza	Emphysema & Bronchitis	Cirrhosis	Kidney Disease	Congenital Birth Defects	Early Infant Diseases	Cancer
Nitrogen Dioxide										
Lead										
Sulfur Dioxide									+	
Sulfate										
Particulates				+						