MODELLING MEDICARE AS A PRICE SUBSIDY: ESTIMATION RESULTS

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I. SUMMARY OF TASK

INFORUM (INterindustry FORecasting at University of Maryland), as part of a contract for the Health Care Financing Administration, has re-examined the manner in which LIFT forecasts health services output and final demand.[2] Personal consumption expenditures (PCE) are the largest health services final demand category, thus, the way in which one models PCE will have a major impact on our forecasts. While influenced by many things, PCE is determined primarily by the level of personal income and changes in relative prices. Thus, how one models the effects of income and relative prices on PCE will greatly influence forecasts of PCE.

The current version of LIFT treats all government transfers as personal income. This is incorrect as some of these programs are in-kind transfers and some are price subsidies. Modelling a price subsidy as an income transfer leads to inaccurate forecasts. For example, one would expect the effects of an increase in Medicare benefits to be concentrated in health services. In the current version of LIFT, increased Medicare benefits translate into increased spending in **all** categories. This is because LIFT treats the increase in benefits as increased income.

Earlier work (Janoska 1994b) showed that modelling a price subsidy as an income transfer leads to inaccurate forecasts of the effects on PCE of changing the program. Janoska (1994b) gave several recommendations on how one could correctly model these price subsidy programs. The current work estimates a system of PCE equations that incorporates those recommendations in regard to the Medicare program. Toward this goal, we were to redefine the income concept used by the equations to exclude the value of Medicare payments. Similarly, the price variables used in the estimation and forecasts were to be redefined to adjust for the value of the Medicare subsidy.

All of the current work was conducted under a contract with the Health Care Financing Administration.[3] Work conducted in support of task 11 also included several items not explicitly

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[2]LIFT (The Long-term Interindustry Forecasting Tool) was developed at the University of Maryland under the guidance of Clopper Almon. McCarthy (1991) presents an excellent overview of LIFT.

[3]The current work was done as part of task 11. All tasks were in support of contract 500-93-0007.

called for in the task description. These items included: reexamining the theory underlying the system of PCE equations; estimating the system with equations for Hospitals and Nursing homes; and deciding which equations could be improved with the addition of "non-economic" variables.

Most of these additional modifications to the PCE system were suggested by earlier work. For example, as part of task 1, we expanded the number of PCE categories from 78 to 80 (Janoska 1994a).[4] At the time of the expansion, we did not estimate the two new equations (*Hospitals* and *Nursing homes*) within the PCE system. This was done for expediency and not for theoretical reasons. In support of this task, we revised the regression software so that it would more readily adapt to increases in the number of PCE commodities.

Similarly, work done under task 4 suggested that the addition of non-income and non-price variables could improve the fit of the equations (Monaco 1994). In support of task 4, we allowed the real interest rate and residential construction activity to influence the composition of aggregate PCE. As part of the present task, we have modified the system by allowing other equation-specific variables to influence PCE. Additional variables used in the equations now include: the labor force participation rate, the over-85 population and housing stocks.

As part of task 11, we reexamined the underlying theoretical basis of the PCE system and modified our estimation procedure accordingly. Previously, the coefficient on the income variable was imposed via a soft-constraint (Devine 1983; Chao 1991), but our understanding of the theory implied that the value of this coefficient should be imposed exactly.[5] The regression software was modified so that this parameter would be imposed exactly in all of the equations. As part of the examination of the underlying theory, we reviewed the composition of the various commodity groups and sub-groups to determine if alternate combinations and groupings produced more stable results.

The rest of this paper is organized as follows. Section two discusses the theory behind the system of equations. Section three discusses the data used in the estimation. Section four reviews the old estimation procedure and the changes that we implemented in support of this task. Section five presents the estimation. Section six contains concluding remarks.

II. A THEORY OF SYMMETRIC CONSUMPTION FUNCTIONS

There has been a long search for a system of demand equations derived explicitly from demand theory. With the exception of the Almon system (Almon 1979), all of these systems assume the existence of a representative agent. That is to say, the economy is populated by

[4]For a list of the 80 PCE categories, please see Appendix A.

[5]See the reader to Almon (1994) for a more detailed discussion of how one imposes a soft-constraint. In short, a soft-constraint allows one to establish a trade-off between equation fit and his a-priori beliefs on the sign and magnitude of a parameter.

persons with identical utility functions and identical incomes. This means that distributional effects play no role in consumer spending decisions since all consumers have identical incomes. These systems can be thought of as belonging to one of the following types:

> Systems derived from an explicit utility function. These include the linear expenditure system (Stone 1954) , the logarithmically-additive system (Houthakker 1960), and the double-log additive system (Sato 1972).
>
> Systems derived from an implicit or indirect utility function. These include the Rotterdam model (Barten 1969), the Translog model (Christensen, Joregenson and Lau 1975), and the Almost Ideal Demand System (AIDS) (Deaton and Muellbauer 1980).
>
> Systems which are not derived from either an explicit or implicit utility function. This group includes the Almon system (Almon 1979).

The theoretical foundation of these systems is derived from demand theory. Ideally, a demand system must meet the following conditions (Deaton and Muellbauer 1988):

1. **Adding Up:** The demand functions must exhaust the available income. Or, in other words, the sum of spending on all of the individual goods must equal total spending.

2. **Homogeneity:** There must be no money illusion -- if all prices and income double, then demand must be unchanged.

It is a common, but incorrect belief among economists that absolute Slutsky symmetry is required for systems of market demand. Slutsky symmetry is the condition that the income-compensated partial derivative of the demand for good X with respect to the price of Y must equal the income-compensated partial derivative of the demand for good Y with respect to the price of X. Slutsky symmetry must hold for any given individual. If one assumes the existence of a representative agent, then it also must be true that Slutsky symmetry holds for the system of market demand equations. However, if one relaxes this assumption and allows for differences among consumers in **either** their income level or their utility functions, absolute Slutsky symmetry does not hold. Among systems of demand equations, only the Almon system allows for these differences.

It is possible, however, to reduce the number of parameters to be estimated by assuming approximate Slutsky symmetry. Thus, we add the further condition that a demand system should have:

3. **Approximate Slutsky symmetry:** At the initial set of prices, the functions should possess exact Slutsky symmetry (Almon 1979).

All of the above systems meet these conditions, but the Almon system allows for more flexible price-income interactions than the other systems. Gauyacq (1985) examined the theoretical foundations, estimation techniques, and possible applications of these systems and found that "... only the Almon model is from a practical view, convenient for determination of disaggregated demand functions."

The system of PCE equations used by LIFT is based on the Almon theory as well as periodic cross-section and time-series analysis (Devine 1983; Chao 1991; Janoska 1994a). Devine (1983) expanded the Almon model to include cross-section estimations and performed the original empirical analysis. Chao (1991) improved the system's treatment of durable goods. Janoska (1994a) building on the work of Monaco (1984), expanded the system and added real interest rate and construction demand variables to the automotive and household durable expenditure categories. In related work, Pollock (1986) significantly improved the system for forecasting income variables used in the PCE system.

A two-step approach is used when estimating the equations. First, a cross-section analysis using data from the Consumer Expenditure Survey (CEX) estimates the effects of demographic, age, and income variables. Then, the parameters estimated in the cross-section analysis and data from the National Income and Product Accounts (NIPA) are used in a time-series analysis that estimates the effects on consumer spending caused by changes in relative prices, taste trends and business cycles. This two-step approach lets users of LIFT simulate the effects of different demographic projections on the U.S. economy, as well as the effects of different income distributions and relative prices.

We employ a two-step procedure for several reasons. One reason is to correct for definitional differences between the CEX and the NIPA.[6] The primary reason, however, we use the two-step method is the lack of price variation in a single year of cross-section data.

CROSS-SECTION ANALYSIS

The foundation of the system is the cross-section estimation that uses data from the CEX. The cross-section equation estimated for each expenditure category is of the form:

$$C_i = \left(a + \sum_{j=1}^{K} b_j Y_j + \sum_{j=1}^{L} d_j D_j\right) * \left(\sum_{g=1}^{G} w_g n_g\right) \tag{1}$$

where:

C_i = household consumption expenditures on good i,
Y_j = the amount of per capita household "income" within income category j,
D_j = a zero/one dummy variable used to show membership in the j_{th} demographic group,

[6]The CEX only records out-of-pocket spending by households, while the NIPA uses a much broader definition of spending.

n_g = the number of household members in age category g,
K = the number of "income" groups,
L = the number of demographic categories,
G = the number of age groups,
a,b,d,w = parameters to be estimated for each commodity.

Conceptually, the above function has two components: consumption expenditures per "adult equivalent" and the "size" of the household in adult equivalents. Household per-capita income and demographic characteristics determine the value of the first component. The size of the household is determined by the second term. For the purposes of the cross-section work, the size of a household does not equal the number of people in the household, but is a function of the ages of the household members and the commodity under examination.

The cross-section estimation defined an "Adult" as an individual between the ages of 30 and 40 years. By definition, anyone in this age cohort equals one "adult." The effect of being a member of the other seven age cohorts on consumption is determined relative to the effect of this adult cohort. For example, according to our estimates, an additional infant in a household will not significantly increase the expenditures on alcohol by the household, but adding a person in their mid-twenties will increase household alcohol expenditures. Similarly, an additional twenty-year-old in the household will not increase the expenditures by the household on children's clothing, but a newborn will. In terms of adult equivalents, a newborn will count as less than one adult in the equation for alcohol expenditures, but will count as several adults in the equation forecasting children's clothing. Since the size of the weights for each age group is relative to the adult weight, we refer to them as Adult Equivalent Weights (AEW).

There are eight age cohorts (called gpops in LIFT) in the system. There are three cohorts of the "young," four cohorts of the "middle aged," and one cohort of the "elderly" (aged 65 or higher). The cohorts are given below:

- **Gpop1**: Age 0-5 years
- **Gpop2**: Age 5-15 years
- **Gpop3**: Age 15-20 years
- **Gpop4:** Age 20-30 years
- **Gpop5:** Age 30-40 years (This cohort is our Adult cohort.)
- **Gpop6:** Age 40-50 years
- **Gpop7:** Age 50-65 years
- **Gpop8:** Above 65 years

Some demographic dummy variables included in the cross-section estimation are:

- **Region**: North East, North Central, South and West.
- **Family Size**: One person, two person, three or four person, and five or more person households.
- **Education**: One if the household head was college educated.
- **Age of Household Head**: Households with heads: under 35; between 35 and 55; and over 55.

In addition to estimating the effects of the various demographic and age variables on consumption expenditures, the cross-section equations estimate five separate income parameters. A distinct marginal propensity to spend out of income is estimated for each income variable and cross-section commodity. This is known as a piecewise linear Engle curve (PLEC). The PLEC allows the effect of income to vary as per-capita household income rises. For example, a household in the lowest income bracket might spend only $0.04 out of every dollar on jewelry, but a household in the highest income bracket might spend $0.40 of every dollar of disposable income on jewelry. The pattern of expenditures might be reversed for some goods. For example, poorer households might have a higher propensity to consume used automobiles than do richer households.

The amount of income, Y_j, in each income bracket, J, depends on household income and the range or size of the bracket. Algebraically, this can be represented as:

$$\mathbf{Y_j} = \begin{cases} \mathbf{B_j - B_{j-1}} & \textbf{if} \quad \mathbf{B_j \le Y} \\ \mathbf{Y - B_{j-1}} & \textbf{if} \quad \mathbf{B_{j-1} \le Y \le B_j} \\ \mathbf{0} & \textbf{if} \quad \mathbf{Y \le B_{j-1}} \end{cases}$$

where:

Y	=	household per-capita income,
K	=	the number of income brackets,
B_{j-1}	=	the lower boundary of bracket J,
B_j	=	the upper boundary of bracket J,
B_0	=	0, by definition,

B_k = infinity, by definition.

For example, assume our bracket borders are set at \$ 0, \$1000, \$2000, \$3000, \$4000, and infinity. Then a household with a per-capita income of less than \$1000 would have all of its income attributed to the first income bracket. A household with a per-capita income of \$2500 would have the first \$1000 of per-capita income allocated to the first income bracket; the second \$1000 of per-capita income allocated to the second income bracket; and the last \$500 of per-capita income allocated to the third income bracket. The income in each bracket becomes the Y_j used in equation **(3)** as the income variables.

For the boundaries given above, B_0=0, B_1=1000, B_2=2000, B_3=3000, B_4=4000, B_5= infinity. Table 1 shows how a set of hypothetical per-capita incomes are allocated to the various income brackets, Y_j.

Table 1

Income	Y_1 \$0 - \$1000	Y_2 \$1001-\$2000	Y_3 \$2001-\$3000	Y_4 \$3001-\$4000	Y_5 Above \$4000
\$800	\$800	\$0	\$0	\$0	\$0
\$2100	\$1000	\$1000	\$100	\$0	\$0
\$3900	\$1000	\$1000	\$1000	\$900	\$0
\$10000	\$1000	\$1000	\$1000	\$1000	\$6000

The table shows that income is allocated to the first bracket until the upper boundary of the bracket is reached or income is exhausted. If income remains, unallocated income is allocated to the second bracket until income is exhausted or the upper income boundary of the second income bracket is reached. This process continues until either all income has been allocated or we reach the final bracket, where the remaining income is allocated.

TIME-SERIES ANALYSIS

Using the cross-section parameters and the income distribution, a time-series variable, C^*, is constructed for each PCE category. C^* for any year equals consumption in that year assuming: no relative price movements, no changes in taste, and perfect complimentarity between the cross-section and time series data (Devine 1983). C^* captures the effects of the demographic and income variables across time. C^* is given by:

$$C_i^* = a + \sum_{j=1}^{K} b_j \, Y_j + \sum_{j=1}^{L} d_j \, D_j \qquad \textbf{(2)}$$

Where :

C^*_i = cross-section variable for commodity I,
Y_j = the amount of per capita household "income" within income category j,
D_j = percent of US population within demographic group j,

a,b,d,w = parameters from the cross-section estimation.

Similarly, the AEWs are used to construct a time-series of the adult equivalent population, WP_t. WP is given by:

$$WP_{i,t} = \sum_{m=1}^{8} w_{i,m} \; N_{m,t} \tag{3}$$

where:

WP_{it} = age-weighted population size of commodity i in year t,
$w_{i,m}$ = age group coefficient on bracket m, commodity i,
$N_{m,t}$ = number of individuals in age group m, year t.

C^* and WP are then used as variables in the time-series estimation of the consumption expenditure system.

The LIFT consumption system divides 80 categories of PCE into 10 Groups. Parameters are estimated as a system to insure cross-price symmetry and adding up (see the next sub-section for a discussion of the rationale behind these constraints). Each group then is divided into two or more sub-groups. The system is designed so that: (1) weak price effects occur between categories in different groups; (2) moderate price effects occur between categories in different sub-groups within a group; (3) and strong price effects occur between categories within a sub-group. The system imposes price effect symmetry between each group in the system and between each sub-group within a group.

We introduce the following notation before providing the general equation used in the time-series estimation:

M = the number of groups,
$\mathbf{S_L}$ = the sum of the budget shares of categories in group **L** in the base year, where the budget share is defined as the category's share of total PCE.

The time-series equation is written:

$$\frac{q_{it}}{WP_{it}} = (a_i + b_i C^*_{it} + c_i \Delta C^*_{it}) \prod_{L=1}^{M} \left(\frac{P_{it}}{\bar{E}_{Lt}}\right)^{-S_L \lambda_{IL}} \tag{4}$$

where:

q_{it} = expenditures on category i during year t,
WP_{it} = weighted population size, good i, in year t,
C^*_{it} = cross-section variable, good i, in year t,
$\underline{P}_{it}$ = price good i in year t,
E_{LT} = average price of group L in year t,
S_L = share of total consumption, group L, in base year,
a_i,b_i,c_i,λ_{IL} = parameters to be estimated.

The variables WP and C^* are determined from the parameters estimated in the cross-section work.

The earlier estimations (Devine 1983; Chao 1991; Janoska 1994a) imposed a "soft" constraint on the b_i coefficients so that the system would satisfy the adding-up restriction described earlier. Each b_i was softly constrained so that the elasticity of consumption with respect to C^*_{it} equalled unity (η_{C*} = 1.0).[7] After reviewing the literature, we decided that this coefficient should be imposed exactly via a "hard" constraint. The software was modified so that this parameter would be imposed automatically.

TREATMENT OF MEDICARE

Previous work on the LIFT PCE system treated Medicare payments as income (Devine 1983; Pollock 1986; Chao 1991; Janoska 1994a). Upon closer examination, it is apparent that the program functions as a price subsidy and not as an income transfer (Pauly 1986; Hurd 1990; Jacobs 1991; Janoska 1994b). Recent work has shown that treating Medicare as an income transfer incorrectly models the effect of the program. In general, modelling Medicare as an income transfer will understate the effect of a change in Medicare on medical PCE (Janoska 1994b).[8] As outlined in Janoska (1994b), one can avoid this problem by modelling the program as a price subsidy. We model Medicare as a price subsidy by the following method:

- Step 1. Redefine the income variable used by PCE system as follows:

$$\textit{LIFT Disposable Income} = \textit{NIPA Disposable Income} - \textit{Medicare Benefits} \qquad \textbf{(5)}$$

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[7]However, due the nature of soft-constraints, most of these elasticities did not equal 1.0 exactly.

[8]A-priori, we cannot determine if the income transfer modelling method over-states medical PCE demand. This depends on the own-price and income elasticities of the good. The Appendix to Janoska (1994b) shows this relationship.

- Step 2. Redefine price deflators used by PCE system as follows:

$$Medicare\text{-}Adjusted\ DEFL_i = C_i * DEFL_i \tag{6}$$

where C_i, the coinsurance rate, is given by:

$$C_i = 1 - subsidy\ rate_i = 1 - \frac{Nominal\ PCE_i - Medicare_i}{Nominal\ PCE_i} \tag{7}$$

Medicare-Adjusted $DEFL_i$	= LIFT PCE Deflator, category i
$DEFL_i$	= NIPA PCE Deflator, category i
Nominal PCE_i	= Nominal PCE in Category as Defined by NIPA
$Medicare_i$	= Medicare Spending, category i

- Step 3. Estimate parameters for the current system of PCE equations, but use the newly defined disposable income and deflators as independent variables.

There are two possible sources of errors from this approach. The first is that we assume that the average coinsurance rate equals the marginal insurance rate across all individuals (Newhouse et al. 1979). This leads to errors in our estimated parameters since coinsurance rates vary across individuals and average coinsurance rates do not equal marginal rates. However, because we cannot measure the true marginal coinsurance rate, we assume that the average rate equals the marginal rate.

Our estimated price parameters will be inaccurate for another reason as well -- deductibles. Keeler et al. (1977) show that deductibles will lead to errors in the estimated price parameters, but the direction of bias cannot be determined a-priori. Keeler et al. (1977) and Newhouse et al. (1979) show that by either eliminating individuals with deductibles from the data set or lumping individuals together who have the same deductible, the bias is eliminated. These solutions could not be implemented because our data is aggregate and provides no information on deductibles. We acknowledge that our estimated parameters may be in error, but feel that the size of the bias is small relative to the improvement gained through modelling Medicare benefits as a price subsidy.

III. DATA

The data on which the cross-section consumption functions are estimated is the 1972-1973 Consumer Expenditure Survey (CEX) (Devine 1983).

The time-series data on PCE and NIPA-style deflators are gathered from published and unpublished National Income and Product Account (NIPA) data. Data on levels of Medicare funding by PCE category come from the National Health Expenditure Accounts (spreadsheet data from the Health Care Financing Administration). The Medicare-adjusted price deflators are constructed as shown in equations **(5)** and **(6)**.

The data for all age and demographic variables is gathered from published reports of the U.S. Census Bureau (Various Current Population Reports Series P-20 and P-25). Income distribution data comes from the Internal Revenue Service (various Statistics of Income reports).

IV. ESTIMATION PROCEDURE

This section discusses the procedure by which we estimate the system of equations. Comparisons between the old and new procedure are included. We first discuss the construction of the price deflators. Next, we describe how we incorporate the cross-section estimations into the time-series work. In the third sub-section, we discuss changes to the commodity group and sub-group structures that were undertaken as part of this task. In the next sub-section we discuss changes in the software that were implemented in support of this task. Next, we review the estimation technique. We then turn our attention to our use of "equation specific" variables. Last, we discuss the criteria we used in determining whether our equations were suitable for use in LIFT.

CONSTRUCTING PRICE DEFLATORS

The first step in estimating the equations given in **(4)** is the construction of the PCE category price deflators. For all categories (excluding PCE categories receiving Medicare funds, hereafter referred to as Medicare categories)[9], price deflators were derived by rebasing the NIPA deflators so that $DEFL_{1972} = 1.00$. The first step in constructing the Medicare-adjusted deflators was to rebase the NIPA deflators so that $DEFL_{1972} = 1.00$. The second step was to apply equations **(6)** and **(7)**.[10]

[9]These categories are: Ophthalmic and orthopedic goods (PCE15); Physicians (PCE64); Dentists and other professionals (PCE65); All hospitals (PCE66); and Nursing Homes (PCE80). Figures 1-10 show the deflators and the ratio of the Medicare-Adjusted deflator to the NIPA deflator.

[10]Under the old (or Medicare-as-a-transfer) procedure, all of the deflators would be derived from the NIPA PCE deflators and rebased so that $DEFl_{1972} = 1.0$.

Figure (1) Deflators for Ophthalmic goods
Note: All NIPA deflators = 1 in 1972

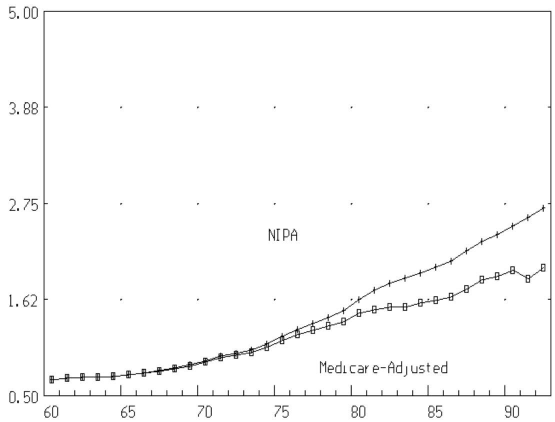


Figure (2) Ratio of Deflators:
Ophthalmic Goods

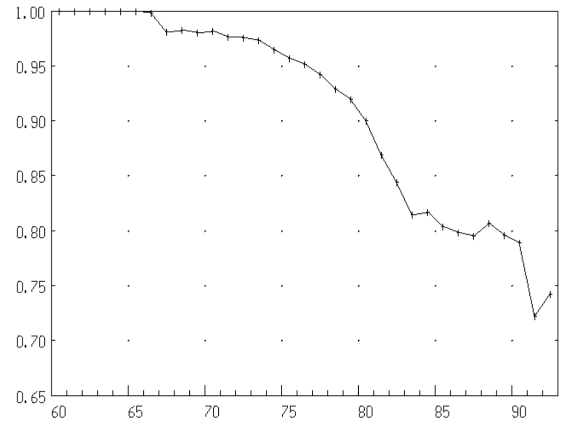


Figure (3) Deflators for Physicians

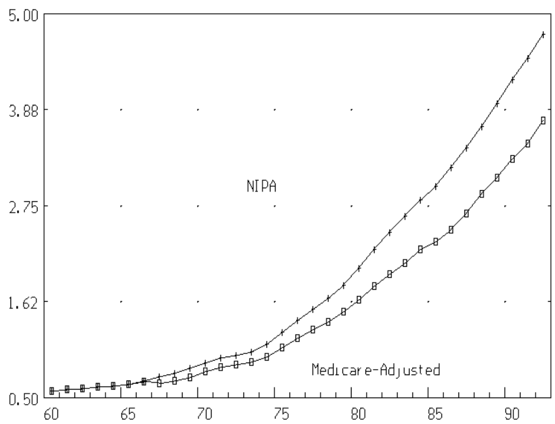


Figure (4) Ratio of Deflators:
Physicians

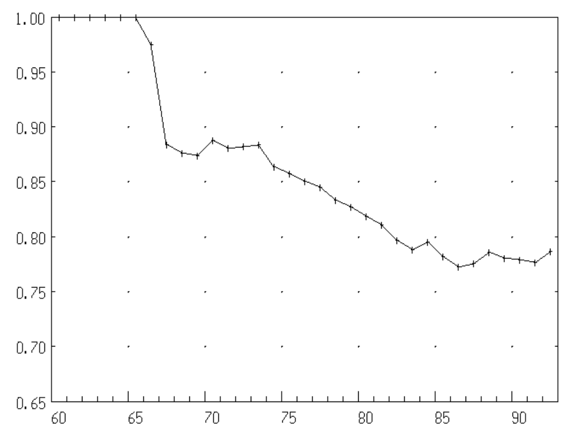


Figure (5) Deflators for Dentists

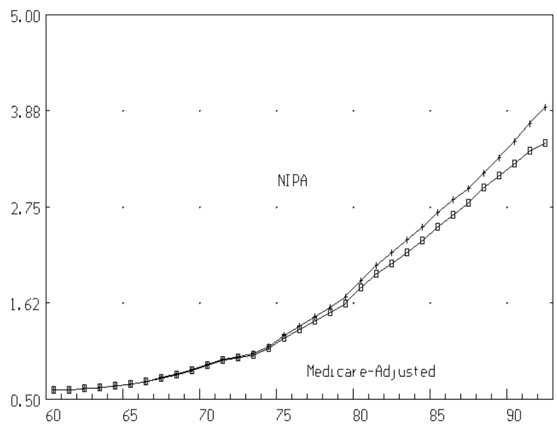


Figure (6) Ratio of Deflators: Dentists

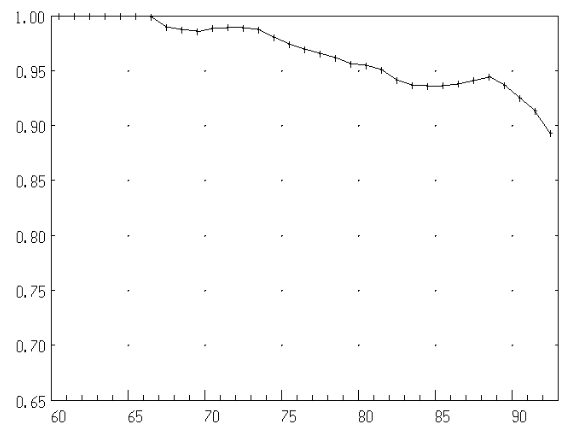


Figure (7) Deflators for Hospitals

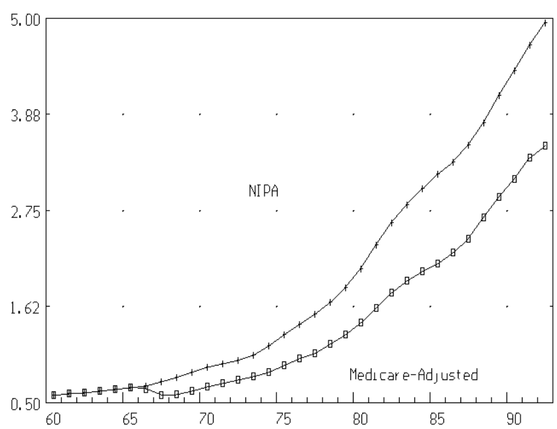


Figure (8) Ratio of Deflators: Hospitals

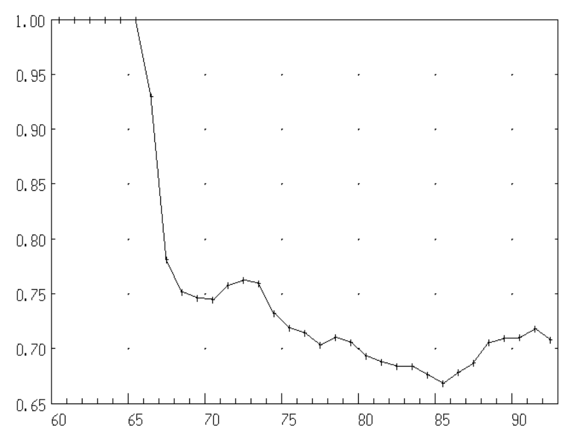


Figure (9) Deflators for Nursing Homes

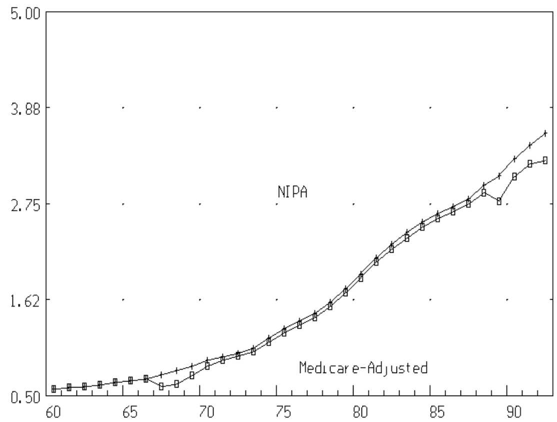
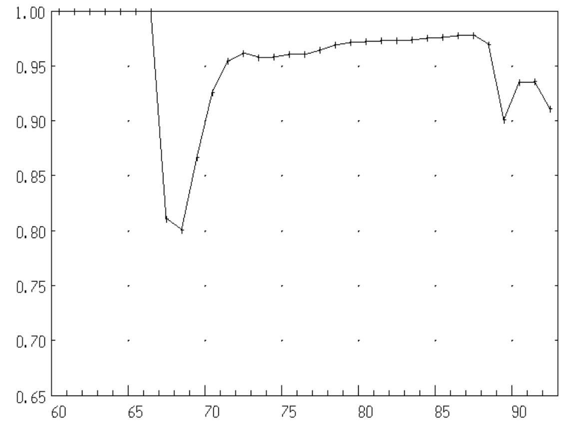


Figure (10) Ratio of Deflators: Nursing Homes



INCORPORATING THE CROSS-SECTION RESULTS

Next, the weighted population and C^* variables are constructed using data on disposable income, population and Medicare transfers. The weighted populations were constructed from equation **(3)**.

For all PCE categories excluding Hospitals (PCE66) and Nursing homes (PCE80), we created these variables using the cross-section parameters estimated by Devine (1983). The cross-section parameters in the Hospitals (PCE66) equation and the Nursing homes (PCE80) equation are from Janoska (1994a).[11]

REVISIONS TO COMMODITY GROUPS AND SUB-GROUPS

As part of task 11, we have revised some of the commodity groups -- either through addition/deletion of a PCE category from the group or by changing the sub-groups within the commodity group. For example, under the old system, Food off premise (PCE19) was a member of *Group 1, Food and Alcohol, off premise*. Under the new system, this category is in *Group 1, Food*. We list these changes from earlier work below:

[11]The old procedure used the cross-section weights estimated by Devine (1983) for all of the PCE categories.

Group 1: Food, Alcohol and Tobacco

PCE Category	Old sub-group	New sub-group
Food, off premise (PCE19)	Food and Alcohol, off premise	Food
Food, on premise (PCE20)	Food and Alcohol, on premise	Food
Alcohol, off premise (PCE21)	Food and Alcohol, off premise	Alcohol
Alcohol, on premise (PCE22)	Food and Alcohol, on premise	Alcohol

Group 6: Medical Services

Nursing homes (PCE80) new PCE category, previously included in PCE66- Hospitals

PCE Category	Old sub-group	New sub-group
Physicians (PCE64)	Physicians and Hospitals	Physicians and Professionals
Dentists (PCE65)	Physicians and Hospitals	Physicians and Professionals
Hospitals (PCE66)	Physicians and Hospitals	Facilities
Nursing homes (PCE80)	Physicians and Hospitals	Facilities
Health insurance (PCE67)	Physicians and Hospitals	Health Insurance

Group 7: Personal Services

PCE Category	Old sub-group	New sub-group
Brokerage services (PCE68)	Personal Business Services	Financial Services
Life insurance (PCE70)	Personal Business Services	Financial Services
Bank service charges (PCE69)	Personal Business Services	Imputed Service
Legal services (PCE71)	Personal Business Services	Other Business Services
Funerals and other (PCE72)	Personal Business Services	Other Business Services

Group 10: Reading and Education

PCE Category	Old sub-group	New sub-group
Education (PCE76)	Education and Religious	Education
Education housing (PCE44)	Education and Religious	Education
Religious and Welfare(PCE77)	Education and Religious	Religious

CHANGES TO ESTIMATION SOFTWARE

The old software allowed for the imposition of "soft-constraints" when undertaking the estimation. Devine's work imposed a soft constraint on the coefficient associated with C^* so as to impose a C^*-elasticity of one for every equation (see section II of this document). Our understanding of the theory was that there could be **no** trade-off between equation fit and the size of the C^* parameter. Consequently, our work modified the software to impose these values via a "hard" constraint (i.e., imposed exactly) on the coefficient.

As part of the work allowing us to impose hard-constraints, we enhanced the software so that changing the form of the equations is easier. Using the old software, it was very difficult to change the form of an equation. For example, to estimate an equation without a time trend, one needed to impose a soft-constraint of zero on the time coefficient. Because we solve this non-linear system in an iterative fashion, the estimated coefficients one obtains by imposing a soft-constraint, differ from the results one obtains by estimating the equation without the variable (i.e., dropping it altogether).[12] For this reason, the software was revised to allow the user to specify the specific form each equation would take. This customization lets us impose a hard constraint of zero on any of the coefficients, thereby dropping the associated variable from the equation and

[12] Non-linear equations are sensitive to the starting values used when estimating the equation. By imposing a hard-constraint on the system, we change the initial values used. The results obtained using the soft-constraint are fairly close to the hard-constraint results and are almost certainly caused by this property of non-linear equations.

giving us seven different forms we could estimate.[13] These are:

Equation 1: $Y = (a + b\mathbf{C}^* + c\Delta\mathbf{C}^* + d\,\mathbf{time})$ * Price effects
Equation 2: $Y = (a + b\mathbf{C}^* + c\Delta\mathbf{C}^* + d\,\mathbf{time} + e\,\mathbf{stock})$ * Price effects
Equation 3: $Y = (a + b\mathbf{C}^* + c\Delta\mathbf{C}^* + e\,\mathbf{stock})$ * Price effects
Equation 4: $Y = (a + b\mathbf{C}^* + c\Delta\mathbf{C}^*)$ * Price effects
Equation 5: $Y = (a + b\mathbf{C}^* + d\,\mathbf{time})$ * Price effects
Equation 6: $Y = (a + b\mathbf{C}^* + e\,\mathbf{stock})$ * Price effects
Equation 7: $Y = (a + b\mathbf{C}^* + d\,\mathbf{time} + e\,\mathbf{stock})$ * Price effects

ESTIMATION TECHNIQUE

The system represented by **(4)** is difficult to estimate because of the interdependence of the parameters dictated by Slutsky symmetry and the adding-up constraint.[14] To insure that these two conditions hold, the equations must be estimated as a system. This joint estimation, in turn, creates the problem of heteroscedasticity -- the variance of the error terms for each equation do not have the same value. This heteroscedasticity arises because we are forced to group the equations into a single estimation. Since the level of consumption for the different categories varies greatly, we expect that the variances of the error terms will vary, thereby violating the assumption of homoscedasticity. We correct for this heteroscedasticity by dividing the data for each category by an estimate of the standard deviation of the error term in the equation for that item prior to estimation (Johnston 1984). These estimates of the standard deviations are obtained by performing separate regressions of a linear version of the consumption function for each of the 80 categories.

The system represented by **(4)** is extremely nonlinear in the price terms. This nonlinearity increases the difficulty of estimating the system. We avoid this problem by iteratively estimating a linear version of the system. For purposes of illustrating this technique, suppose we have the following general nonlinear equation:

$$Y_i = F(x_i, B) + U_i \qquad (8)$$

where Y_i and x_i are the observations of the dependent variable and the vector of independent variables in the i^{th} period; U_i is the disturbance term in the i^{th} period; and B is the vector of parameters to be estimated.

We select estimates of B to minimize the following:

$$\sum_i \{Y_i - F(x_i, B)\}^2 \qquad (9)$$

[13]For a list of the commodities and the equation form used in the estimation, please see Appendix B.

[14]Slutsky symmetry requires that $\lambda_{IK} = \lambda_{KI}$.

We then employ the Gauss-Newton method to estimate iteratively the value of B by performing ordinary least squares regressions.[15]

Consider the following Taylor expansion of F( ) around B_0, an estimate of B. We have

$$F(x_i, B) = F(x_i, B_0) + F^{/}(x_i, B_0)\{B-B_0\}$$
$$= F(x_i, B_0) - F^{/}(x_i, B_0)B_0 + F^{/}(x_i, B_0)B \qquad (10)$$

where $F^{/}(x_i, B_0)$ is the vector of first derivatives of F( ) with respect to B, evaluated at B_0. If we substitute **(10)** into **(9)** we have:

$$\Sigma_i \{[Y_i - F(x_i, B_0) + F^{/}(x_i, B_0)B_0] - F^{/}(x_i, B_0)B\}^2 \qquad (11)$$

The expression within the brackets contains no unknown parameters. Likewise, $F^{/}(x_i, B_0)$ is a vector that can be calculated for a given value of B_0. It follows that the value of B that minimizes the expression **(11)** is the same as the value that results from performing an ordinary least squares regression of the expression in brackets on $F^{/}(x, B_0)$. That is:

$$Y_i - F(x_i, B_0) + F^{/}(X_i, B_0) = F^{/}(x_i, B_0)B \qquad (12)$$

The estimate of B obtained from this regression is used to re-linearize equation **(8)**. Another regression is performed to obtain a second estimate of B. This iterative procedure continues until no further reductions are made in the sum of squared errors. Convergence is usually achieved within five or six iterations.

EQUATION-SPECIFIC VARIABLES

It is a long-established tradition that non-income and non-price variables play a key role in determining household PCE (Heien 1972; Denton and Spencer 1976; Devine 1983; Monaco 1984; Deaton et al. 1989; Chao 1991; Malley and Moutos 1993; Monaco 1994). Most of this work has focused on the effects of demographic and age variables, but some work has examined the effects of "other" variables (Devine 1983; Chao 1991; Malley and Moutos 1993; Monaco 1994). The LIFT PCE system has acknowledged these influences through the use of the cross-section effect variable, C^*, the adult equivalent weights, and equation-specific variables (Devine 1983). Devine included the following equation-specific variables:

Housing Demand Proxy Owner-occupied housing (PCE40) and Tenant-occupied housing(PCE41). A proxy for the speculative demand for housing. Calculated as the ratio

[15] Our description of the Gauss-Newton method is a slight variation of the presentation found in Maddala (1977).

of the current price of owner-occupied housing to a three-year moving average of its price.

Natural Gas Price Control Dummy Natural gas (PCE46), Electricity (PCE45) and Fuel oil (PCE28). A dummy for Natural gas price controls. Equals one for the years 1974, 1975, 1976.

Mortality Rate Funeral expenses and other personal business expenses (PCE72). An attempt to capture the impact of increased longevity on funeral expenses. Expressed in deaths per thousand persons.

Availability of Used Cars Used cars (PCE02). A proxy for the potential stock of cars for the used car market. Equaled a three-year moving average of new car purchases lagged three years.

For our work, we felt that Devine's variables, except for the natural gas price control dummy, were inappropriate for our estimation. For example, the availability of used cars for market should be reflected in the price term and so this variable was rejected for theoretical reasons.

In our first attempt to estimate the system, we estimated all of the equations without the use of a time trend.[16] Any commodity that appeared trended was examined to determine if there existed a known reason for the trend. For example, the growth in Nursing home expenditures (PCE80) was thought to be linked to the increased numbers of over-85 years of age persons. Unfortunately, we were forced to estimate the system with time trends included in some equations, and, for three of the commodities, were forced to add a second time trend. The equation-specific variables we used included:

Two-Year Moving Average of 3-month T-Bill Rate (Interest Rate) New Cars (PCE01), Used Cars (PCE02), and New and used trucks (PCE03). Calculated as a two-year moving average of the 3-month treasury bill rate. This variable attempted to capture the sensitivity of automobile financing to changes in the interest rate.

Residential Construction Activity (Construction) Furniture and mattresses (PCE06), Kitchen and other household durables (PCE07) and Durable furnishings, N.E.C. (PCE11). Equalled per-capita spending on Single-family residential construction (STR01) and Additions and alterations (STR04). Purchases of furniture, kitchen appliances and other miscellaneous household items often occur with a new house purchase and/or renovation of an existing structure.

Natural Gas Price Regulation Dummy (Dummy) Fuel oil (PCE28), Electricity (PCE45) and

[16] Devine (1983), Chao (1991) and Janoska (1993) included one or more time trends in their equations. This trend was incorporated in an attempt to capture systematic changes in demand that could not be attributed to price, income, age or demographics.

Natural gas (PCE46). Equaled 1 in all years of regulation (1973, 1974, 1975) and 0 in all others. This variable was an attempt to capture the effects of Natural gas price regulation during the early 1970's

Value of Housing Stock (Stock) Owner-occupied housing (PCE41) and Tenant-occupied housing (PCE42). Cumulative housing stock value adjusted for depreciation (2%). Owner-occupied housing (PCE41) is an imputed component of the NIPA. Our formulation is an attempt to bring this sector into a format similar to that used by the NIPA (Carr 1994).

Labor Force Participation Rate (Labor Parti) Net health insurance (PCE67) and Life insurance (PCE70). Equals the labor force participation rate. This variable is an attempt to capture the effect of increased labor force participation among women. Typically, life insurance is carried on the primary wage-earners in a household. Over time, second incomes have moved from being "extra" income to primary income. Consequently, households will probably purchase two policies (one for each wage-earner) when in the past households would have carried a single policy. We believe that a good proxy for this effect is the labor force participation rate.

Population 85 years and Older (Elderly) Hospitals (PCE66) and Nursing homes (PCE80). Equals population 85 years of age and older. Among the over-65 population, this group tends to use these services more frequently and intensely then those younger than 85 years of age (Harrison 1986; Waldo 1989). Because our equations combine the elderly into a single cohort, our system of weighted-populations cannot capture the "aging-of-the-aged" effect. This variable is an attempt to capture this effect.

Second Time Trend (Second time) Gasoline and oil (PCE27), Intercity railroad (PCE58) and Cleaning and laundering (PCE62). A second time trend beginning in 1982. Some unidentified structural change appears to have occurred in these sectors. This variable is an attempt to account for this change until the reasons for the change can be discovered.

ESTIMATION CRITERIA

Because the PCE equations eventually will be used in LIFT, they must be capable of generating reasonable forecasts as well as satisfying economic theory. We felt that each equation had to meet the following four criteria:

1. Non-Positive Own-Price Elasticity: Economic theory suggests that, except in the case of a Giffen good, quantity demanded of a good should be inversely related to its own price. Since, by assumption, none of the PCE categories are Giffen goods, any estimation that results in a category having a positive estimated own-price elasticity would have to be respecified and reestimated.

2. **The size and magnitude of the coefficient on the ΔC^* must generate stable long-term forecasts**: This coefficient must either be positive or smaller in absolute value than the coefficient on the C^* term. If this did not hold, any long-run increase in income would reduce spending. At the level of dissagregation we use, such a property would lead to unreasonable forecasts. Consequently, if the estimated parameters did not meet this criteria, the system was respecified -- usually by changing the form of the equations.

3. **The effect of time must be "small"**: Time was not allowed to change the absolute value of household consumption by more than 1 percent each year. This was to prevent the time trend from dominating the forecast.

4. **Equation-specific variables must have the "correct" effect**: In other words, the coefficient on these variables had to satisfy our a-priori beliefs on the variable's effect.

As we already mentioned, our first step was to estimate the system without a time trend in the equations. Those equations that fit poorly or did not satisfy the above four conditions were studied to determine if they required an equation-specific variable. For some of the categories that did not meet (1-4), we could find no equation-specific variable. We then estimated the system using alternate equation forms. This was possible because of the new estimation software.

Unfortunately, we were unable to find a set of equations that gave us non-positive own-price elasticities for all 80 PCE categories. Despite our efforts, we were forced to accept results with three categories (Auto repair (PCE53), Brokerage and investment counseling (PCE68), and Life insurance (PCE70)) having positive own-price elasticities. All of these estimated own-price elasticities are close to zero and may reflect inadequacies in the data.[17]

V. RESULTS

Traditionally, the regression statistic used in determining "goodness-of-fit" is the R-squared statistic. Under Ordinary-Least Squares (OLS) regression, the R-squared statistic shows the percentage of variation in the dependent variable that is explained by movements in the independent variables. Our equation is non-linear, and consequently, the R-squared statistic loses some of its meaning because it is no longer bounded between zero and one.[18] While it is true that larger R-squared values indicate a "better" fit, the values become ordinal -- signifying better or worse, but not indicating the magnitude of improvement. The R-squared statistic is but one of many statistics on goodness-of-fit. The statistic we use is the Average Absolute Percentage

[17] See Appendix D for a table of price elasticities.

[18] The calculation of the R-squared coefficient depends on the relationship between total sum of squares (TSS), residual sum of squares(RSS) and explained sum of squares (ESS). Under OLS, TSS = RSS + ESS. In a non-linear estimation, this relationship no longer holds, TSS $\neq$ ESS + RSS.

Error (AAPE), since it gives information on both the direction and magnitude of changes in fit.[19]

It must also be remembered that because we are estimating the equations as a system, the software attempts to minimize the error of the system as a whole. Each category carries the same importance when the software attempts to solve equation **(11)**:

$$\Sigma_i \{[Y_i - F(x_i, B_0) + F^{/}(x_i, B_0)B_0] - F^{/}(x_i, B_0)B\}^2 \qquad (11)$$

For this reason, one must look at the AAPE of the system as a whole to determine whether or not one has obtained a "better" fit. Any improvement in the performance of the system, however, could be concentrated in a few categories while the majority of categories performed worse. Thus, one also must look at the AAPE by PCE category to determine whether the improved overall performance offsets any decline in individual equation performance.

We believe that the behavior of the system improved under the new method. This is true regardless of whether one examines the overall AAPE statistic or whether one looks at the AAPE's by PCE category. The new AAPE of the system is 9.71 percent versus the old AAPE of 9.86 percent -- a 1 percent improvement in performance. Forty-two of the categories had improved AAPE statistics and thirty-four categories had worse AAPE's. We list the improved sectors below with the health related categories in **bold**.

These forty-two categories account for over two-thirds of total PCE. The four health-care related categories -- Drug preparations (PCE31), Dentists and other professionals (PCE65), Hospitals (PCE66) and Nursing homes (PCE80) -- account for nearly three-quarters of health-related PCE. The two categories showing the largest improvement, Hospitals and Nursing homes, are health care related and improved by over one percent. In contrast, none of the commodities for which the AAPE grew saw an increase of over .750 percent.

Sectors with improved AAPE

Title	New AAPE	Old AAPE	Difference
NURSING HOMES	**2.561**	**6.064**	**-3.503**
HOSPITALS	**1.340**	**2.370**	**-1.030**
OWNER OCCUPIED SPACE RENT	1.015	1.377	-0.362
NET PURCHASES OF USED CARS	2.381	2.683	-0.302
OTHER RECREATIONAL SERVICES	3.500	3.757	-0.257
FOOD, OFF PREMISE	1.891	2.110	-0.219
DRUG PREPARATIONS AND SUNDRIES	**2.223**	**2.405**	**-0.182**
EDUCATION	1.965	2.138	-0.173
JEWELRY	3.682	3.851	-0.169
TRUCKS	13.328	13.489	-0.161
FUEL OIL AND COAL	7.727	7.864	-0.137
STATIONERY AND WRITING SUPPLIES	1.993	2.116	-0.123

[19] The average absolute percentage error (AAPE) is calculated as follows: $\sum$\{Absolute Value(Predicted Level of PCE - Actual Level of PCE)/\{Actual Level of PCE\}/(# of observations). For a discussion of alternate measures-of-fit, see Newbold and Bos (1994) or Wilson and Keating (1994).

WRITING EQUIPMENT	13.976	14.096	-0.120
NATURAL GAS	1.873	1.986	-0.113
FOOD, ON PREMISE	0.815	0.923	-0.108
BOATS, RECREATIONAL VECH., AND AIRCRAFT	6.434	6.541	-0.108
TENANT OCCUPIED SPACE RENT	1.175	1.257	-0.083
TRAVEL AGENTS AND OTHER TRANSPORTATION S	8.980	9.044	-0.064
ACCESSORIES AND PARTS (AUTO)	4.027	4.091	-0.064
BOOKS AND MAPS	2.892	2.954	-0.062
DURABLE HOUSEFURNISHINGS NEC	2.441	2.503	-0.062
ALCOHOL, OFF PREMISE	2.902	2.956	-0.053
HAND TOOLS	4.563	4.615	-0.052
ALCOHOL, ON PREMISE	2.371	2.421	-0.050
NONDURABLE TOYS AND SPORT SUPPLIES	0.933	0.981	-0.049
MENS CLOTHING	0.726	0.772	-0.046
KITCHEN AND OTHER HOUSEHOLD APPLIANCES	1.538	1.583	-0.044
TAXICABS	6.128	6.170	-0.042
LEGAL SERVICES	2.231	2.271	-0.039
OTHER HOUSING -- EDUCATIONAL HOUSING	1.692	1.728	-0.036
DENTISTS AND OTHER PROFESSIONAL SERVICES	**2.967**	**2.997**	**-0.030**
TELEPHONE AND TELEGRAPH	7.251	7.277	-0.026
TOBACCO	1.029	1.054	-0.026
HOTELS AND MOTELS	2.165	2.188	-0.022
HOUSEHOLD PAPER PRODUCTS	4.139	4.162	-0.022
TIRES AND TUBES	3.235	3.252	-0.016
CLEANING PREPARATIONS	2.369	2.381	-0.012
POSTAGE	1.549	1.557	-0.009
ELECTRICITY	0.579	0.588	-0.009
GASOLINE AND OIL	0.630	0.639	-0.009
WATER AND OTHER SANITARY SERVICES	0.805	0.811	-0.007
TOILET ARTICLES AND PREPARATIONS	0.729	0.733	-0.003

On the next page, we list the thirty-four categories with a larger AAPE (or worse AAPE).

Sectors with worse AAPE

Title	New AAPE	Old AAPE	Difference
OTHER HOUSEHOLD OPERATIONS -- REPAIR	2.139	2.137	0.002
SHOES AND FOOTWEAR	0.959	0.955	0.004
LIGHTING SUPPLIES	2.746	2.742	0.004
RADIO AND TELEVISION REPAIR	5.295	5.291	0.004
HOUSEHOLD INSURANCE	4.960	4.953	0.007
WHEEL GOODS AND DURABLE TOYS	2.052	2.042	0.010
LOCAL PUBLIC TRANSPORT	1.491	1.481	0.010
AUTO INSURANCE	0.808	0.795	0.013
AIRLINES	6.821	6.806	0.015
BARBERSHOPS AND BEAUTY SHOPS	1.972	1.958	0.015
FUNERAL EXPENSES AND OTHER PERSONAL BUSI	0.701	0.682	0.019
FLOWERS, SEEDS, AND POTTED PLANTS	2.241	2.215	0.026
MAGAZINES AND NEWSPAPER	0.944	0.917	0.027
FLOOR COVERINGS	3.585	3.556	0.029
SEMIDURABLE HOUSEFURNISHINGS	1.580	1.551	0.029
AUTO REPAIR	1.396	1.359	0.037
CHINA, GLASSWARE, TABLEWARE, AND UTENSIL	1.560	1.518	0.042
BRIDGE, TOLLS, ETC	4.029	3.981	0.048
LUGGAGE	3.144	3.084	0.060
INTERCITY BUSES	4.633	4.572	0.061
WOMENS CLOTHING	1.817	1.749	0.068
BANK SERVICE CHARGES AND SERVICES W/O PA	2.481	2.402	0.079
MOVIES, LEGITIMATE THEATER, SPECTATOR SP	2.109	2.024	0.085
FURNITURE, MATTRESSES, AND BEDSPRINGS	0.925	0.798	0.127
LIFE INSURANCE	3.307	3.163	0.144
RELIGIOUS AND WELFARE SERVICES	1.296	1.126	0.170
CLEANING, LAUNDERING AND SHOE REPAIR	2.478	2.300	0.177
BROKERAGE AND INVESTMENT COUNSELING	14.166	13.921	0.245
OPHTHALMIC AND ORTHOPEDIC APPLIANCES	**2.893**	**2.643**	**0.251**
INTERCITY RAILROAD	2.903	2.574	0.329
NEW CARS	3.808	3.476	0.332
HEALTH INSURANCE	**1.339**	**0.947**	**0.392**
PHYSICIANS	**2.084**	**1.511**	**0.573**
RADIO, TV, RECORDS, AND MUSICAL INSTRUME	12.064	11.324	0.740

Appendix C, contains the final parameters from the system. Due to the large number of price parameters, we only list the non-price parameters in Appendix A. The implied price and income elasticities from the estimated parameters are listed in Appendix D. Appendix E contains the estimated income and price-elasticities from the old method of modelling Medicare benefits. We present the following example showing how to read the tables in appendices D and E:

Sample Table From Appendix D

GROUP 6: MEDICAL SERVICES

			SHARE	YELAS	OWN	SG #1	SG #2	SG #3	SG #4
64	1	PHYSICIANS	2.37	1.244	-0.319	-0.042	0.083	-0.247	0.153
65	1	DENTISTS AND OTHER PROFESSIONAL SERVICES	1.99	1.128	-0.312	-0.035	0.070	-0.207	0.128
66	2	HOSPITALS	4.16	1.001	-0.604	0.146	-0.417	0.906	-0.374
80	2	NURSING HOMES	0.91	3.029	-0.278	0.032	-0.091	0.198	-0.082
15	3	OPHTHALMIC AND ORTHOPEDIC APPLIANCES	0.28	0.881	-0.255	-0.029	0.061	-0.182	0.041
31	3	DRUG PREPARATIONS AND SUNDRIES	1.21	0.878	-0.858	-0.126	0.264	-0.785	0.177
67	4	HEALTH INSURANCE	0.74	0.399	-0.327	0.048	-0.067	0.108	0.000

1	DENTISTS AND DOCTORS
2	FACILITIES
3	INSURANCE
4	DRUGS AND EQUIPMENT

Looking at the first PCE category, we see that *PCE64, Physicians* is a member of *Group 6: Medical Services* and is part of sub-group 1 *Dentists and Doctors* in Group 6. In 1992, 2.37 percent of total PCE was spent on Physicians. The category has an income elasticity (YELAS) of 1.244.[20] Physicians (PCE64) has an own-price elasticity (OWN) of -0.319. Looking at the values under the headings **SG #**, we see that a 1 percent increase in the cost of Physicians, leads to a -0.042 change in spending on the other categories in sub-group 1. The price increase in PCE64, causes spending in sub-group 2, *Facilities*, to increase 0.083 percent and also causes spending on sub-group 3, *Drugs and Equipment*, to fall -0.247 percent. Finally, the 1 percent increase in the price of PCE64 causes an increase of 0.153 percent on spending on sub-group 4, *Insurance*.

A casual examination of appendices D and E shows that the estimated elasticities for most of the categories are relatively unchanged. For example, the income elasticity of Tobacco (PCE29) was .267 under the old method, but under the new method it is .266. All of the PCE categories, with the exception of those in *Group 6: Medical Services*, show little change with the adoption of the new method of modelling Medicare benefits. In many ways, this is unsurprising, since our income variable is virtually unchanged and all of the revised price variables are in Group 6. Since we expect price effects between groups to be weak or non-existent, we hardly should be surprised when our empirical work validates our a-priori beliefs.

However, the estimated price elasticities in *Group 6: Medical Services* have changed a great deal. Under the new method, all of these categories are less elastic with respect to their own price. With the exception of categories in sub-group 3, *Drugs and Equipment*, the PCE categories exert less price-effects on categories within sub-group and outside their own sub-group. For example, under the old method, a 1 percent price increase in Hospitals (PCE66) caused a 1.113 percent increase in spending on sub-group 1, *Doctors and Dentists*, and a -0.752 decrease in spending on Nursing homes. Now, the same price increase will cause only a 0.146 increase in spending on sub-group 1, *Doctors and Dentists*, and a -0.457 decrease in spending on Nursing homes. This implies that the substitutability between Physicians and Hospitals and the complementarity between Hospitals and Nursing homes is lower than implied by the old method.

[20] An income elasticity of 1 means that, if income increases by 1 percent, spending increases 1 percent. Similarly, an own-price elasticity of -.5 means that, if the good's own price increased by 1 percent, spending on the good falls by one-half a percent.

VI. CONCLUDING REMARKS

This work is but the first step in modelling Medicare as a price subsidy. Our earlier work (1994b) showed that Medicare is not an income transfer program, but, instead functions as a price subsidy. The earlier work also suggested how one could model Medicare as a price subsidy. The current work has implemented those suggestions and we have obtained a better-fitting system of equations. The next step is to incorporate these equations into LIFT and determine their simulation properties.

One area of particular importance that these equations promise to improve is that the model will no longer treat Medicare as an income transfer. Thus, the effects of increased Medicare benefits will be concentrated in the health services categories of PCE. This should dramatically improve the simulation properties and capabilities of the model.

The current work points to other areas of the model that should be investigated. For example, the current task dealt exclusively with Medicare benefits. Medicaid benefits, an in-kind transfer to the poor (Smeeding and Moon 1980; Janoska 1994c), are still treated as an income transfer despite some evidence that this is an inappropriate treatment of the program (Janoska 1994b). Employer-provided insurance benefits are also treated as income by the model when theory suggests that these benefits be modelled as price subsidies to consumers.

Appendix A
Personal Consumption Categories

DURABLE GOODS

MOTOR VEHICLES AND PARTS

1 New cars
2 Used cars
3 New & used trucks
4 Tires & tubes
5 Auto accessories & parts

FURNITURE & HOUSEHOLD EQUIPMENT

6 Furniture,mattresses,bedsprings
7 Kitchen, household appliances
8 China,glass&tableware,utensils
9 Radio,tv,records,musical instr.
10 Floor coverings
11 Durable housefurnishings, NEC
12 Writing equipment
13 Hand tools

OTHER DURABLES

14 Jewelry
15 Ophthalmic & orthopedic goods
16 Books & maps
17 Wheel goods & durable toys
18 Boats, rec vech., & aircraft

NON-DURABLE GOODS

FOOD AND ALCOHOL

19 Food, off premise
20 Food on premise
21 Alcohol, off premise
22 Alcohol, on premise

CLOTHING

23 Shoes & footwear
24 Women's clothing
25 Men's clothing
26 Luggage

OTHER NON-DURABLES

27 Gasoline & oil
28 Fuel oil & coal
29 Tobacco
31 Drug preparations & sundries
30 Semidurable housefurnishings
32 Toilet articles & preparations
33 Stationery & writing supplies
34 Nondurable toys, sport supplies
35 Flowers, seeds, potted plants
37 Cleaning preparations
36 Lighting supplies
38 Household paper products
39 Magazines & newspaper
40 Other nondurables -- identity

SERVICES

HOUSING

41 Owner occupied space rent
42 Tenant occupied space rent
43 Hotels, motels
44 Other housing

HOUSEHOLD OPERATION

45 Electricity
46 Natural gas
47 Water & other sanitary services
48 Telephone & telegraph
49 Domestic services
50 Household insurance
51 Other household operations:repair
52 Postage

TRANSPORTATION

53 Auto repair
54 Bridge, tolls, etc
55 Auto insurance
56 Taxicabs
57 Local public transport
58 Intercity railroad
59 Intercity buses
60 Airlines
61 Travel agents, other transportation services

MEDICAL SERVICES

64 Physicians
65 Dentists & other professional services
66 Private & government hospitals
67 Health insurance
80 Nursing homes

OTHER SERVICES

76 EDUCATION
62 Laundries & shoe repair
63 Barbershops & beauty shops
68 Brokerage,investment counseling
69 Bank service charges &services w/o pay
70 Life insurance
71 Legal services
72 Funerals, other personal business services
73 Radio & tv repair
74 Movies, theater, spectator sports
75 Other recreational services
77 Religious & welfare services
78 Foreign travel by U.S. residents
79 Travel in U.S. by foreigners

Appendix B
List of Customized Equations

NEW CARS	Equation is Y=a0 + a1*C + a2*delC + a3*Interest Rate
NET PURCHASES OF USED CARS	Equation is Y=a0 + a1*C + a2*Interest Rate
TRUCKS	Equation is Y=a0 + a1*C + a2*delC + a3*Interest Rate
TIRES AND TUBES	Equation is Y=a0 + a1*C + a2*delC
ACCESSORIES AND PARTS (AUTO)	Equation is Y=a0 + a1*C + a2*delC
FURNITURE, MATTRESSES, AND BEDSPRINGS	Equation is Y=a0 + a1*C + a2*delC + a3*Construction
KITCHEN AND OTHER HOUSEHOLD APPLIANCES	Equation is Y=a0 + a1*C + a2*Construction
CHINA, GLASSWARE, TABLEWARE, AND UTENSIL	Equation is Y=a0 + a1*C + a2*delC
RADIO, TV, RECORDS, AND MUSICAL INSTRUME	Equation is Y=a0 + a1*C + a2*delC
FLOOR COVERINGS	Equation is Y=a0 + a1*C + a2*delC
DURABLE HOUSEFURNISHINGS NEC	Equation is Y=a0 + a1*C + a2*delC + a3*Construction
WRITING EQUIPMENT	Equation is Y=a0 + a1*C + a2*delC
HAND TOOLS	Equation is Y=a0 + a1*C + a2*delC
JEWELRY	Equation is Y=a0 + a1*C + a2*delC
OPHTHALMIC AND ORTHOPEDIC APPLIANCES	Equation is Y=a0 + a1*C + a2*delC
BOOKS AND MAPS	Equation is Y=a0 + a1*C + a2*delC
WHEEL GOODS AND DURABLE TOYS	Equation is Y=a0 + a1*C + a2*delC
BOATS, RECREATIONAL VECH., AND AIRCRAFT	Equation is Y=a0 + a1*C + a2*delC
FOOD, OFF PREMISE	Equation is Y=a0 + a1*C + a2*delC
FOOD, ON PREMISE	Equation is Y=a0 + a1*C + a2*delC
ALCOHOL, OFF PREMISE	Equation is Y=a0 + a1*C + a2*delC
ALCOHOL, ON PREMISE	Equation is Y=a0 + a1*C + a2*delC
SHOES AND FOOTWEAR	Equation is Y=a0 + a1*C + a2*delC
WOMENS CLOTHING	Equation is Y=a0 + a1*C + a2*delC
MENS CLOTHING	Equation is Y=a0 + a1*C + a2*delC
LUGGAGE	Equation is Y=a0 + a1*C + a2*delC
GASOLINE AND OIL	Equation is Y=a0 + a1*C + a2*delC + a3*Time + a4*Second Time
FUEL OIL AND COAL	Equation is Y=a0 + a1*C + a2*delC + a3*Dummy
TOBACCO	Equation is Y=a0 + a1*C + a2*delC
SEMIDURABLE HOUSEFURNISHINGS	Equation is Y=a0 + a1*C + a2*delC
DRUG PREPARATIONS AND SUNDRIES	Equation is Y=a0 + a1*C + a2*delC
TOILET ARTICLES AND PREPARATIONS	Equation is Y=a0 + a1*C + a2*delC
STATIONERY AND WRITING SUPPLIES	Equation is Y=a0 + a1*C + a2*delC
NONDURABLE TOYS AND SPORT SUPPLIES	Equation is Y=a0 + a1*C + a2*delC
FLOWERS, SEEDS, AND POTTED PLANTS	Equation is Y=a0 + a1*C + a2*delC
CLEANING PREPARATIONS	Equation is Y=a0 + a1*C + a2*delC
LIGHTING SUPPLIES	Equation is Y=a0 + a1*C + a2*delC
HOUSEHOLD PAPER PRODUCTS	Equation is Y=a0 + a1*C + a2*delC
MAGAZINES AND NEWSPAPER	Equation is Y=a0 + a1*C + a2*delC
OTHER NONDURABLES -- IDENTITY	Equation is Y=a0 + a1*C + a2*delC
OWNER OCCUPIED SPACE RENT	Equation is Y=a0 + a1*C + a2*Stock
TENANT OCCUPIED SPACE RENT	Equation is Y=a0 + a1*C + a2*delC + a3*Stock
HOTELS AND MOTELS	Equation is Y=a0 + a1*C + a2*delC
OTHER HOUSING -- EDUCATIONAL HOUSING	Equation is Y=a0 + a1*C + a2*delC + a3*Time
ELECTRICITY	Equation is Y=a0 + a1*C + a2*Time + a3*Dummy
NATURAL GAS	Equation is Y=a0 + a1*C + a2*delC + a3*Dummy
WATER AND OTHER SANITARY SERVICES	Equation is Y=a0 + a1*C + a2*delC + a3*Time
TELEPHONE AND TELEGRAPH	Equation is Y=a0 + a1*C + a2*Time
DOMESTIC SERVICES	Equation is Y=a0 + a1*C + a2*delC
HOUSEHOLD INSURANCE	Equation is Y=a0 + a1*C + a2*delC

Appendix B - Continued

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OTHER HOUSEHOLD OPERATIONS -- REPAIR       Equation is Y=a0 + a1*C + a2*delC
POSTAGE                                    Equation is Y=a0 + a1*C + a2*delC
AUTO REPAIR                                Equation is Y=a0 + a1*C + a2*delC
BRIDGE, TOLLS, ETC                         Equation is Y=a0 + a1*C + a2*delC
AUTO INSURANCE                             Equation is Y=a0 + a1*C + a2*delC

TAXICABS                                   Equation is Y=a0 + a1*C + a2*delC
LOCAL PUBLIC TRANSPORT                     Equation is Y=a0 + a1*C + a2*delC
INTERCITY RAILROAD                         Equation is Y=a0 + a1*C           + a2*Time + a3*Second Time
INTERCITY BUSES                            Equation is Y=a0 + a1*C + a2*delC
AIRLINES                                   Equation is Y=a0 + a1*C + a2*delC

TRAVEL AGENTS AND OTHER TRANSPORTATION S   Equation is Y=a0 + a1*C + a2*delC
CLEANING, LAUNDERING AND SHOE REPAIR       Equation is Y=a0 + a1*C + a2*delC + a3*Time + a4*Second Time
BARBERSHOPS AND BEAUTY SHOPS               Equation is Y=a0 + a1*C + a2*delC
PHYSICIANS                                 Equation is Y=a0 + a1*C + a2*delC
DENTISTS AND OTHER PROFESSIONAL SERVICES   Equation is Y=a0 + a1*C + a2*delC

HOSPITALS                                  Equation is Y=a0 + a1*C                     + a2*Elderly
HEALTH INSURANCE                           Equation is Y=a0 + a1*C                     + a2*Labor Parti.
BROKERAGE AND INVESTMENT COUNSELING        Equation is Y=a0 + a1*C           + a2*Time
BANK SERVICE CHARGES AND SERVICES W/O PA   Equation is Y=a0 + a1*C + a2*delC
LIFE INSURANCE                             Equation is Y=a0 + a1*C                     + a2*Labor Parti

LEGAL SERVICES                             Equation is Y=a0 + a1*C + a2*delC
FUNERAL EXPENSES AND OTHER PERSONAL BUSI   Equation is Y=a0 + a1*C + a2*delC
RADIO AND TELEVISION REPAIR                Equation is Y=a0 + a1*C + a2*delC
MOVIES, LEGITIMATE THEATRE, SPECTATOR SP   Equation is Y=a0 + a1*C + a2*delC
OTHER RECREATIONAL SERVICES                Equation is Y=a0 + a1*C + a2*delC

EDUCATION                                  Equation is Y=a0 + a1*C + a2*delC
RELIGIOUS AND WELFARE SERVICES             Equation is Y=a0 + a1*C + a2*delC
FOREIGN TRAVEL by US                       Equation is Y=a0 + a1*C + a2*delC
US TRAVEL BY FOREIGNERS                    Equation is Y=a0 + a1*C + a2*delC
NURSING HOMES                              Equation is Y=a0 + a1*C                     + a2*Elderly
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Appendix C
Final Estimates With Medicare as a Price Subsidy

1 FOOD, ALCOHOL, AND TOBACCO ITERATION # 6

			CONST	INCOME	DEL Y	TIME	OTHER
19	1	FOOD, OFF PREMISE	56.239	0.714	1.537		
21	2	ALCOHOL, OFF PREMISE	8.389	4.327	3.448		
20	1	FOOD, ON PREMISE	24.777	0.778	-0.031		
22	2	ALCOHOL, ON PREMISE	48.003	0.896	0.035		
29	3	TOBACCO	23.347	0.653	2.054		

2 CLOTHING, ACCESSORIES, & PERSO ITERATION # 6

			CONST	INCOME	DEL Y	TIME	OTHER
24	1	WOMENS CLOTHING	-53.226	1.653	-0.154		
25	1	MENS CLOTHING	-6.642	1.281	0.108		
23	2	SHOES AND FOOTWEAR	-4.589	0.942	-0.312		
26	2	LUGGAGE	2.078	0.158	0.044		
14	2	JEWELRY	5.382	2.168	0.780		
32	3	TOILET ARTICLES AND PREPARATIO	-0.114	0.998	-0.118		
63	3	BARBERSHOPS AND BEAUTY SHOPS	7.766	0.449	0.610		
62	3	CLEANING, LAUNDERING AND SHOE	67.081	0.384	0.170	-0.734	0.685

3 HOUSEHOLD DURABLES ITERATION # 6

			CONST	INCOME	DEL Y	TIME	OTHER
6	1	FURNITURE, MATTRESSES, AND BED	-3.158	0.744	-0.489		0.036
7	1	KITCHEN AND OTHER HOUSEHOLD AP	-18.376	1.176			0.020
9	1	RADIO, TV, RECORDS, AND MUSICA	-133.495	3.735	-4.940		
8	2	CHINA, GLASSWARE, TABLEWARE, A	2.577	4.119	-2.062		
10	2	FLOOR COVERINGS	5.373	0.365	-0.236		
11	2	DURABLE HOUSEFURNISHINGS NEC	-4.954	0.928	-0.647		0.004
30	2	SEMIDURABLE HOUSEFURNISHINGS	7.060	1.130	-0.355		

4 HOUSEHOLD OPERATION ITERATION # 6

			CONST	INCOME	DEL Y	TIME	OTHER
36	1	CLEANING PREPARATIONS	0.106	0.108	-0.003		
37	1	LIGHTING SUPPLIES	1.880	0.673	-0.369		
38	1	HOUSEHOLD PAPER PRODUCTS	0.993	0.384	-0.303		
50	2	HOUSEHOLD INSURANCE	0.137	0.081	0.060		
51	2	OTHER HOUSEHOLD OPERATIONS --	2.136	0.433	-0.314		
73	2	RADIO AND TELEVISION REPAIR	2.340	0.440	-0.079		
52	3	POSTAGE	0.763	0.213	-0.074		
48	3	TELEPHONE AND TELEGRAPH	0.001	1.213		-0.451	

5 HOUSING AND HOUSEHOLD UTILITIES ITERATION # 6

			CONST	INCOME	DEL Y	TIME	OTHER
41	1	OWNER OCCUPIED SPACE RENT	-109.302	0.759			16.110
42	1	TENANT OCCUPIED SPACE RENT	-60.104	0.472	-0.068		6.380
28	2	FUEL OIL AND COAL	11.093	0.433	26.724		6.174
45	2	ELECTRICITY	-77.896	0.888		0.870	1.015
46	2	NATURAL GAS	7.016	0.503	1.930		-0.781
47	3	WATER AND OTHER SANITARY SERVI	-26.830	0.001	-0.147	0.657	

Appendix C - Continued

6 MEDICAL SERVICES ITERATION # 6

			CONST	INCOME	DEL Y	TIME	OTHER
64	1	PHYSICIANS	-4.890	2.360	-1.800		
65	1	DENTISTS AND OTHER PROFESSIONA	-15.242	2.142	0.001		
66	2	HOSPITALS	-82.015	7.343			0.026
80	2	Nursing Homes	-45.099	3.058			0.014
15	3	OPHTHALMIC AND ORTHOPEDIC APPL	1.199	0.306	0.058		
31	3	DRUG PREPARATIONS AND SUNDRIES	8.572	1.272	-0.283		
67	4	HEALTH INSURANCE	-88.349	0.360			107.396

7 PERSONAL BUSINESS SERVICES ITERATION # 6

			CONST	INCOME	DEL Y	TIME	OTHER
68	1	BROKERAGE AND INVESTMENT COUNS	0.001	4.391		-0.175	
69	3	BANK SERVICE CHARGES AND SERVI	-6.913	10.648	3.464		
70	1	LIFE INSURANCE	-136.203	0.563			169.564
71	2	LEGAL SERVICES	0.887	3.697	-2.026		
72	2	FUNERAL EXPENSES AND OTHER PER	4.385	2.528	-0.012		

8 TRANSPORTATION ITERATION # 6

			CONST	INCOME	DEL Y	TIME	OTHER
1	1	NEW CARS	98.536	0.530	0.979		-4.536
2	1	NET PURCHASES OF USED CARS	11.974	0.257			-1.617
3	1	TRUCKS	-4.370	0.266	0.316		-0.599
4	2	TIRES AND TUBES	-2.416	0.671	0.467		
5	2	ACCESSORIES AND PARTS (AUTO)	-2.437	0.486	-0.264		
53	2	AUTO REPAIR	-2.343	0.918	0.648		
55	2	AUTO INSURANCE	1.507	0.311	-0.059		
54	2	BRIDGE, TOLLS, ETC	0.754	0.026	0.080		
56	3	TAXICABS	0.759	0.208	6.469		
57	3	LOCAL PUBLIC TRANSPORT	3.302	0.389	0.001		
27	4	GASOLINE AND OIL	-60.685	0.567	-0.105	1.128	-2.962

9 RECREATION AND TRAVEL ITERATION # 6

			CONST	INCOME	DEL Y	TIME	OTHER
74	1	MOVIES, LEGITIMATE THEATRE, SP	4.135	0.290	-0.254		
75	1	OTHER RECREATIONAL SERVICES	-7.394	2.349	-0.560		
18	2	BOATS, RECREATIONAL VECH., AND	4.089	0.505	0.597		
17	2	WHEEL GOODS AND DURABLE TOYS	-11.444	1.074	-0.404		
34	2	NONDURABLE TOYS AND SPORT SUPP	-17.077	1.426	-1.029		
35	2	FLOWERS, SEEDS, AND POTTED PLA	-1.635	0.343	-0.247		
13	2	HAND TOOLS	-3.908	0.278	-0.120		
61	3	TRAVEL AGENTS AND OTHER TRANSP	0.325	0.073	0.112		
43	3	HOTELS AND MOTELS	4.632	0.343	0.237		
58	4	INTERCITY RAILROAD	9.398	0.022		-0.115	0.138
59	4	INTERCITY BUSES	2.340	0.049	0.146		
60	4	AIRLINES	1.561	1.304	0.407		

10 READING AND EDUCATION ITERATION # 6

			CONST	INCOME	DEL Y	TIME	OTHER
16	1	BOOKS AND MAPS	-0.380	0.534	0.001		
39	1	MAGAZINES AND NEWSPAPER	5.033	0.721	0.001		
12	1	WRITING EQUIPMENT	1.694	0.028	0.220		
33	1	STATIONERY AND WRITING SUPPLIE	-1.921	0.380	-0.161		
76	2	EDUCATION	3.065	1.557	-0.787		
44	2	OTHER HOUSING -- EDUCATIONAL H	6.152	0.250	0.013	-0.065	
77	3	RELIGIOUS AND WELFARE SERVICES	-15.019	1.069	-0.765		

Appendix D
Estimated Price and Income Elasticities Under New Method

GROUP 1: FOOD, ALCOHOL, AND TOBACCO

			SHARE	YELAS	OWN	SG #1	SG #2	SG #3
19	1	FOOD, OFF PREMISE	8.76	0.436	-0.500	0.584	-0.148	0.113
21	2	ALCOHOL, OFF PREMISE	1.56	0.952	-0.537	-0.026	0.981	0.213
20	1	FOOD, ON PREMISE	3.81	1.113	-0.830	0.254	-0.064	0.049
22	2	ALCOHOL, ON PREMISE	0.58	0.794	-1.153	-0.010	0.365	0.079
29	3	TOBACCO	0.81	0.266	-0.726	0.010	0.110	0.000

1 FOOD
2 ALCOHOL
3 TOBACCO

GROUP 2: CLOTHING, ACCESSORIES & PERSON

			SHARE	YELAS	OWN	SG #1	SG #2	SG #3
24	1	WOMENS CLOTHING	5.35	1.337	-0.706	0.746	0.127	0.094
25	1	MENS CLOTHING	2.43	1.365	-1.114	0.339	0.058	0.043
23	2	SHOES AND FOOTWEAR	1.15	1.079	-0.694	0.027	0.188	0.037
26	2	LUGGAGE	0.07	1.754	-0.871	0.002	0.011	0.002
14	2	JEWELRY	0.94	2.466	-0.728	0.022	0.154	0.030
32	3	TOILET ARTICLES AND PREPARATIONS	0.95	1.000	-1.036	0.017	0.031	0.579
63	3	BARBERSHOPS AND BEAUTY SHOPS	0.49	0.638	-1.316	0.009	0.016	0.299
62	3	CLEANING, LAUNDERING AND SHOE REPAIR	0.40	0.701	-1.371	0.007	0.013	0.244

1 CLOTHING
2 ACCESSORIES
3 PERSONAL CARE

GROUP 3: HOUSEHOLD DURABLES

			SHARE	YELAS	OWN	SG #1	SG #2
6	1	FURNITURE, MATTRESSES, AND BEDSPRINGS	1.36	1.609	-0.644	0.061	0.038
7	1	KITCHEN AND OTHER HOUSEHOLD APPLIANCES	1.30	1.084	-0.647	0.058	0.036
9	1	RADIO, TV, RECORDS, AND MUSICAL INSTRUME	5.06	2.013	-0.478	0.227	0.142
8	2	CHINA, GLASSWARE, TABLEWARE, AND UTENSIL	0.56	1.268	-0.514	0.016	0.002
10	2	FLOOR COVERINGS	0.37	1.613	-0.514	0.010	0.002
11	2	DURABLE HOUSEFURNISHINGS NEC	0.93	2.169	-0.512	0.026	0.004
30	2	SEMIDURABLE HOUSEFURNISHINGS	0.66	1.577	-0.513	0.019	0.003

1 MAJOR DURABLES
2 MINOR DURABLES

GROUP 4: HOUSEHOLD OPERATION

			SHARE	YELAS	OWN	SG #1	SG #2	SG #3
36	1	CLEANING PREPARATIONS	0.10	0.980	-0.913	0.054	-0.020	0.007
37	1	LIGHTING SUPPLIES	0.64	0.939	-0.621	0.345	-0.131	0.045
38	1	HOUSEHOLD PAPER PRODUCTS	0.37	0.939	-0.767	0.199	-0.076	0.026
50	2	HOUSEHOLD INSURANCE	0.08	1.085	-0.045	-0.016	-0.016	0.002
51	2	OTHER HOUSEHOLD OPERATIONS -- REPAIR	0.43	0.997	-0.116	-0.088	-0.087	0.012
73	2	RADIO AND TELEVISION REPAIR	0.11	0.400	-0.051	-0.023	-0.022	0.003
52	3	POSTAGE	0.21	1.028	-0.638	0.015	0.006	0.020
48	3	TELEPHONE AND TELEGRAPH	2.44	0.803	-0.424	0.172	0.069	0.234

1 CLEANING AND PAPER PRODUCTS
2 SERVICES AND INSURANCE
3 COMMUNICATION

Appendix D - Continued

GROUP 5: HOUSING & HOUSEHOLD UTILITIES

			SHARE	YELAS	OWN	SG #1	SG #2	SG #3
41	1	OWNER OCCUPIED SPACE RENT	9.61	0.800	-0.752	1.378	-0.139	0.122
42	1	TENANT OCCUPIED SPACE RENT	3.55	0.103	-1.621	0.509	-0.051	0.045
28	2	FUEL OIL AND COAL	0.21	0.162	-0.728	-0.003	0.069	-0.014
45	2	ELECTRICITY	1.60	0.426	-0.272	-0.023	0.526	-0.106
46	2	NATURAL GAS	0.48	0.255	-0.640	-0.007	0.158	-0.032
47	3	WATER AND OTHER SANITARY SERVICES	0.49	0.001	-0.286	0.006	-0.032	0.000

1 HOUSING
2 ENERGY (UTILITIES)
3 SANITATION

GROUP 6: MEDICAL SERVICES

			SHARE	YELAS	OWN	SG #1	SG #2	SG #3	SG #4
64	1	PHYSICIANS	2.37	1.244	-0.319	-0.042	0.083	-0.247	0.153
65	1	DENTISTS AND OTHER PROFESSIONAL SERVICES	1.99	1.128	-0.312	-0.035	0.070	-0.207	0.128
66	2	HOSPITALS	4.16	1.001	-0.604	0.146	-0.417	0.906	-0.374
80	2	NURSING HOMES	0.91	3.029	-0.278	0.032	-0.091	0.198	-0.082
15	3	OPHTHALMIC AND ORTHOPEDIC APPLIANCES	0.28	0.881	-0.255	-0.029	0.061	-0.182	0.041
31	3	DRUG PREPARATIONS AND SUNDRIES	1.21	0.878	-0.858	-0.126	0.264	-0.785	0.177
67	4	HEALTH INSURANCE	0.74	0.399	-0.327	0.048	-0.067	0.108	0.000

1 DENTISTS AND DOCTORS
2 FACILITIES
3 DRUGS AND EQUIPMENT
4 INSURANCE

GROUP 7: PERSONAL BUSINESS SERVICES

			SHARE	YELAS	OWN	SG #1	SG #2	SG #3
68	1	BROKERAGE AND INVESTMENT COUNSELING	0.96	1.584	0.015	0.111	0.020	-0.208
69	3	BANK SERVICE CHARGES AND SERVICES W/O PA	2.34	1.156	-0.017	-0.506	0.384	0.000
70	1	LIFE INSURANCE	1.39	1.131	0.064	0.160	0.029	-0.301
71	2	LEGAL SERVICES	0.81	1.052	-0.346	0.017	-0.565	0.133
72	2	FUNERAL EXPENSES AND OTHER PERSONAL BUSI	0.55	0.942	-0.165	0.011	-0.383	0.090

1 FINANCIAL SERVICES
2 REAL SERVICES
3 IMPUTED

GROUP 8: TRANSPORTATION

			SHARE	YELAS	OWN	SG #1	SG #2	SG #3	SG #4
1	1	NEW CARS	2.74	2.043	-0.075	0.177	-0.308	0.810	-0.022
2	1	NET PURCHASES OF USED CARS	0.69	1.110	-0.208	0.045	-0.078	0.204	-0.006
3	1	TRUCKS	1.37	3.190	-0.164	0.089	-0.154	0.405	-0.011
4	2	TIRES AND TUBES	0.54	0.765	-0.125	-0.061	0.087	-0.075	-0.014
5	2	ACCESSORIES AND PARTS (AUTO)	0.39	0.778	-0.149	-0.044	0.063	-0.054	-0.010
53	2	AUTO REPAIR	1.89	0.946	0.091	-0.213	0.303	-0.264	-0.051
55	2	AUTO INSURANCE	0.57	0.599	-0.120	-0.064	0.091	-0.080	-0.015
54	2	BRIDGE, TOLLS, ETC	0.05	0.759	-0.204	-0.006	0.008	-0.007	-0.001
56	3	TAXICABS	0.07	0.273	-0.459	0.021	-0.010	-0.268	-0.008
57	3	LOCAL PUBLIC TRANSPORT	0.13	0.194	-0.689	0.038	-0.018	-0.498	-0.014
27	4	GASOLINE AND OIL	2.20	0.557	-0.133	-0.018	-0.059	-0.243	0.000

1 DURABLE PURCHASES
2 MAINTENANCE EXPENSES EXP. GASOLINE
3 PUBLIC TRANSPORTATION
4 GASOLINE

Appendix D - Continued

GROUP 9: RECREATION AND TRAVEL

		SHARE	YELAS	OWN	SG #1	SG #2	SG #3	SG #4
74	1 MOVIES, LEGITIMATE THEATER, SPECTATOR SP	0.39	1.749	-2.008	0.155	0.051	0.142	-0.043
75	1 OTHER RECREATIONAL SERVICES	3.15	2.402	-0.909	1.255	0.416	1.145	-0.346
18	2 BOATS, RECREATIONAL VECH., AND AIRCRAFT	0.45	3.026	-0.664	0.059	-0.013	-0.168	0.052
17	2 WHEEL GOODS AND DURABLE TOYS	0.96	1.554	-0.679	0.127	-0.028	-0.359	0.110
34	2 NONDURABLE TOYS AND SPORT SUPPLIES	1.36	1.294	-0.691	0.180	-0.039	-0.509	0.156
35	2 FLOWERS, SEEDS, AND POTTED PLANTS	0.33	1.091	-0.661	0.044	-0.010	-0.124	0.038
13	2 HAND TOOLS	0.27	1.377	-0.659	0.036	-0.008	-0.101	0.031
61	3 TRAVEL AGENTS AND OTHER TRANSPORTATION S	0.04	1.697	-1.378	0.015	-0.015	0.071	0.038
43	3 HOTELS AND MOTELS	0.22	0.973	-1.059	0.080	-0.082	0.389	0.210
58	4 INTERCITY RAILROAD	0.01	1.010	-1.343	-0.001	0.001	0.010	0.012
59	4 INTERCITY BUSES	0.03	0.774	-1.320	-0.003	0.003	0.029	0.035
60	4 AIRLINES	0.67	1.803	-0.583	-0.074	0.077	0.639	0.772

1 ADMISSIONS
2 RECREATIONAL NONDURABLES AND DUR
3 HOTELS ETC.
4 TRAVEL

GROUP 10: READING AND EDUCATION

		SHARE	YELAS	OWN	SG #1	SG #2	SG #3
16	1 BOOKS AND MAPS	0.38	0.777	-0.771	-0.121	-0.002	0.108
39	1 MAGAZINES AND NEWSPAPER	0.51	0.658	-0.812	-0.162	-0.003	0.145
12	1 WRITING EQUIPMENT	0.03	0.481	-0.659	-0.010	0.000	0.009
33	1 STATIONERY AND WRITING SUPPLIES	0.36	1.104	-0.765	-0.115	-0.002	0.102
76	2 EDUCATION	1.85	1.303	-0.559	-0.011	0.106	0.175
44	2 OTHER HOUSING -- EDUCATIONAL HOUSING	0.16	1.351	-0.655	-0.001	0.009	0.015
77	3 RELIGIOUS AND WELFARE SERVICES	2.70	1.490	-0.853	0.765	0.255	0.000

1 READING
2 EDUCATION
3 RELIGIOUS

Appendix E
Estimated Price and Income Elasticities Under Old Method

GROUP 1: FOOD, ALCOHOL, AND TOBACCO

		SHARE	**YELAS**	**OWN**	**SG #1**	**SG #2**	**SG #3**
19	1 FOOD, OFF PREMISE	8.76	0.443	-0.506	0.673	-0.140	0.117
21	2 ALCOHOL, OFF PREMISE	1.56	0.959	-0.527	-0.025	0.988	0.234
20	1 FOOD, ON PREMISE	3.81	1.123	-0.886	0.293	-0.061	0.051
22	2 ALCOHOL, ON PREMISE	0.58	0.794	-1.147	-0.009	0.367	0.087
29	3 TOBACCO	0.81	0.267	-0.726	0.011	0.122	0.000

1 FOOD
2 ALCOHOL
3 TOBACCO

GROUP 2: CLOTHING, ACCESSORIES & PERSON

		SHARE	**YELAS**	**OWN**	**SG #1**	**SG #2**	**SG #3**
24	1 WOMENS CLOTHING	5.35	1.331	-0.645	0.683	0.138	0.095
25	1 MENS CLOTHING	2.43	1.366	-1.018	0.310	0.063	0.043
23	2 SHOES AND FOOTWEAR	1.15	1.079	-0.692	0.030	0.180	0.054
26	2 LUGGAGE	0.07	1.752	-0.862	0.002	0.011	0.003
14	2 JEWELRY	0.94	2.458	-0.725	0.024	0.147	0.044
32	3 TOILET ARTICLES AND PREPARATIONS	0.95	1.003	-1.044	0.017	0.045	0.591
63	3 BARBERSHOPS AND BEAUTY SHOPS	0.49	0.639	-1.330	0.009	0.023	0.305
62	3 CLEANING, LAUNDERING AND SHOE REPAIR	0.40	0.671	-1.386	0.007	0.019	0.249

1 CLOTHING
2 ACCESSORIES
3 PERSONAL CARE

GROUP 3: HOUSEHOLD DURABLES

		SHARE	**YELAS**	**OWN**	**SG #1**	**SG #2**
6	1 FURNITURE, MATTRESSES, AND BEDSPRINGS	1.36	1.653	-0.583	0.057	0.036
7	1 KITCHEN AND OTHER HOUSEHOLD APPLIANCES	1.30	1.086	-0.586	0.054	0.035
9	1 RADIO, TV, RECORDS, AND MUSICAL INSTRUME	5.06	1.962	-0.429	0.211	0.135
8	2 CHINA, GLASSWARE, TABLEWARE, AND UTENSIL	0.56	1.272	-0.508	0.015	0.015
10	2 FLOOR COVERINGS	0.37	1.617	-0.513	0.010	0.010
11	2 DURABLE HOUSEFURNISHINGS NEC	0.93	2.193	-0.498	0.025	0.025
30	2 SEMIDURABLE HOUSEFURNISHINGS	0.66	1.581	-0.505	0.018	0.017

1 MAJOR DURABLES
2 MINOR DURABLES

GROUP 4: HOUSEHOLD OPERATION

		SHARE	**YELAS**	**OWN**	**SG #1**	**SG #2**	**SG #3**
36	1 CLEANING PREPARATIONS	0.10	0.981	-0.915	0.055	-0.019	0.008
37	1 LIGHTING SUPPLIES	0.64	0.940	-0.618	0.352	-0.124	0.051
38	1 HOUSEHOLD PAPER PRODUCTS	0.37	0.940	-0.767	0.204	-0.072	0.029
50	2 HOUSEHOLD INSURANCE	0.08	1.086	-0.045	-0.015	-0.016	0.003
51	2 OTHER HOUSEHOLD OPERATIONS -- REPAIR	0.43	0.997	-0.114	-0.083	-0.085	0.016
73	2 RADIO AND TELEVISION REPAIR	0.11	0.402	-0.051	-0.021	-0.022	0.004
52	3 POSTAGE	0.21	1.029	-0.634	0.017	0.008	0.022
48	3 TELEPHONE AND TELEGRAPH	2.44	0.806	-0.401	0.194	0.092	0.255

1 CLEANING AND PAPER PRODUCTS
2 SERVICES AND INSURANCE
3 COMMUNICATION

Appendix E - Continued

GROUP 5: HOUSING & HOUSEHOLD UTILITIES

			SHARE	YELAS	OWN	SG #1	SG #2	SG #3
41	1	OWNER OCCUPIED SPACE RENT	9.61	0.822	-0.709	1.319	-0.097	0.203
42	1	TENANT OCCUPIED SPACE RENT	3.55	0.105	-1.541	0.487	-0.036	0.075
28	2	FUEL OIL AND COAL	0.21	0.156	-0.771	-0.002	0.071	-0.014
45	2	ELECTRICITY	1.60	0.431	-0.301	-0.016	0.541	-0.107
46	2	NATURAL GAS	0.48	0.255	-0.680	-0.005	0.162	-0.032
47	3	WATER AND OTHER SANITARY SERVICES	0.49	0.001	-0.360	0.010	-0.033	0.000

1 HOUSING
2 ENERGY (UTILITIES)
3 SANITATION

GROUP 6: MEDICAL SERVICES

			SHARE	YELAS	OWN	SG #1	SG #2	SG #3	SG #4
64	1	PHYSICIANS	2.37	1.290	-0.804	-1.067	0.634	0.058	0.183
65	1	DENTISTS AND OTHER PROFESSIONAL SERVICES	1.99	1.166	-0.633	-0.896	0.532	0.049	0.154
66	2	HOSPITALS	4.16	0.834	-1.175	1.113	-0.752	0.111	-0.624
80	2	Nursing Homes	0.91	3.029	-0.588	0.243	-0.164	0.024	-0.137
15	3	OPHTHALMIC AND ORTHOPEDIC APPLIANCES	0.28	0.985	-0.392	0.007	0.008	-0.070	0.078
31	3	DRUG PREPARATIONS AND SUNDRIES	1.21	0.959	-0.626	0.030	0.032	-0.304	0.338
67	4	HEALTH INSURANCE	0.74	0.338	-0.240	0.057	-0.111	0.207	0.000

1 DENTISTS AND DOCTORS
2 FACILITIES
3 DRUGS AND EQUIPMENT
4 INSURANCE

GROUP 7: PERSONAL BUSINESS SERVICES

			SHARE	YELAS	OWN	SG #1	SG #2	SG #3
68	1	BROKERAGE AND INVESTMENT COUNSELING	0.96	1.601	-0.051	0.136	0.033	-0.187
69	3	BANK SERVICE CHARGES AND SERVICES W/O PA	2.34	1.151	-0.022	-0.456	0.373	0.000
70	1	LIFE INSURANCE	1.39	1.135	0.010	0.197	0.047	-0.271
71	2	LEGAL SERVICES	0.81	1.057	-0.313	0.028	-0.586	0.129
72	2	FUNERAL EXPENSES AND OTHER PERSONAL BUSI	0.55	0.943	-0.125	0.019	-0.398	0.088

1 FINANCIAL SERVICES
2 REAL SERVICES
3 IMPUTED

GROUP 8: TRANSPORTATION

			SHARE	YELAS	OWN	SG #1	SG #2	SG #3	SG #4
1	1	NEW CARS	2.74	2.132	-0.119	0.159	-0.272	0.845	0.034
2	1	NET PURCHASES OF USED CARS	0.69	1.125	-0.238	0.040	-0.068	0.213	0.009
3	1	TRUCKS	1.37	3.258	-0.198	0.080	-0.136	0.423	0.017
4	2	TIRES AND TUBES	0.54	0.766	-0.127	-0.054	0.084	-0.081	-0.016
5	2	ACCESSORIES AND PARTS (AUTO)	0.39	0.779	-0.150	-0.039	0.060	-0.058	-0.012
53	2	AUTO REPAIR	1.89	0.947	0.082	-0.187	0.292	-0.283	-0.056
55	2	AUTO INSURANCE	0.57	0.600	-0.122	-0.057	0.088	-0.085	-0.017
54	2	BRIDGE, TOLLS, ETC	0.05	0.760	-0.203	-0.005	0.008	-0.007	-0.001
56	3	TAXICABS	0.07	0.274	-0.448	0.022	-0.010	-0.267	-0.008
57	3	LOCAL PUBLIC TRANSPORT	0.13	0.195	-0.677	0.040	-0.019	-0.496	-0.015
27	4	GASOLINE AND OIL	2.20	0.565	-0.183	0.027	-0.066	-0.245	0.000

1 DURABLE PURCHASES
2 MAINTENANCE EXPENSES EXP. GASOLINE
3 PUBLIC TRANSPORTATION
4 GASOLINE

Appendix E - Continued

GROUP 9: RECREATION AND TRAVEL

			SHARE	YELAS	OWN	SG #1	SG #2	SG #3	SG #4
74	1	MOVIES, LEGITIMATE THEATER, SPECTATOR SP	0.39	1.748	-1.975	0.154	0.053	0.143	-0.041
75	1	OTHER RECREATIONAL SERVICES	3.15	2.401	-0.885	1.244	0.427	1.157	-0.328
18	2	BOATS, RECREATIONAL VECH., AND AIRCRAFT	0.45	3.000	-0.646	0.061	-0.012	-0.165	0.053
17	2	WHEEL GOODS AND DURABLE TOYS	0.96	1.556	-0.660	0.130	-0.026	-0.353	0.113
34	2	NONDURABLE TOYS AND SPORT SUPPLIES	1.36	1.295	-0.671	0.184	-0.037	-0.500	0.160
35	2	FLOWERS, SEEDS, AND POTTED PLANTS	0.33	1.093	-0.642	0.045	-0.009	-0.121	0.039
13	2	HAND TOOLS	0.27	1.377	-0.641	0.037	-0.007	-0.099	0.032
61	3	TRAVEL AGENTS AND OTHER TRANSPORTATION S	0.04	1.691	-1.382	0.015	-0.015	0.073	0.038
43	3	HOTELS AND MOTELS	0.22	0.976	-1.054	0.081	-0.081	0.401	0.208
58	4	INTERCITY RAILROAD	0.01	0.870	-1.348	-0.001	0.001	0.009	0.012
59	4	INTERCITY BUSES	0.03	0.771	-1.325	-0.003	0.004	0.028	0.035
60	4	AIRLINES	0.67	1.797	-0.574	-0.070	0.079	0.635	0.786

1 ADMISSIONS
2 RECREATIONAL NONDURABLES AND DUR
3 HOTELS ETC.
4 TRAVEL

GROUP 10: READING AND EDUCATION

			SHARE	YELAS	OWN	SG #1	SG #2	SG #3
16	1	BOOKS AND MAPS	0.38	0.782	-0.758	-0.104	-0.013	0.114
39	1	MAGAZINES AND NEWSPAPER	0.51	0.662	-0.794	-0.140	-0.017	0.153
12	1	WRITING EQUIPMENT	0.03	0.484	-0.663	-0.008	-0.001	0.009
33	1	STATIONERY AND WRITING SUPPLIES	0.36	1.110	-0.753	-0.099	-0.012	0.108
76	2	EDUCATION	1.85	1.315	-0.544	-0.062	0.170	0.212
44	2	OTHER HOUSING -- EDUCATIONAL HOUSING	0.16	1.383	-0.699	-0.005	0.015	0.018
77	3	RELIGIOUS AND WELFARE SERVICES	2.70	1.500	-0.873	0.808	0.309	0.000

1 READING
2 EDUCATION
3 RELIGIOUS

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September 1994

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