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An Illustration

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January 1976

The Rand Paper Series

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Santa Monica, California 90406

THE IMPACT OF ENERGY PRICE INCREASES
ON HOUSEHOLDS: An Illustration

James P. Stucker^{*}

The distributional impacts of energy policy options are among the more elusive elements of energy policy analysis, but they also should be considered among the more important. Which groups would gain income or some other form of satisfaction from a specific policy action? And which groups would lose? Are specific price increases or taxes borne more by the rich than the poor? Will a general energy tax be less regressive than individual taxes on specific fuels? This paper makes a first attempt at answering these questions for energy policies--taxes, tariffs, or supply restrictions--that would affect the price of fuel.

We estimate the differential effects of energy price increases on households at different income levels. The household's direct expenditures on energy are taken from household budget studies. The indirect consumption of energy is estimated by applying production coefficients--derived from input-output analysis--to the household's non-energy expenditures. Thus, total energy requirements are obtained and stated as percentages of household income for five types of fuel--coal, crude petroleum, refined petroleum products, electricity, and natural gas. These percentages allow us to estimate the impact of increases in any of the energy prices on the households assuming, as a first approximation, that the price changes result in no substitution among goods in general or energy forms in particular either in production or in consumption. This assumption insures that our methodology will overestimate the true impacts. Thus, all of our estimates should be viewed as upper bounds on national average budget impacts.

^{*}The Rand Corporation. This research was supported by the Federal Energy Administration. The methodological approach of this paper was suggested by Giora Hanoch. I am also indebted to Kent Anderson and Fred Hoffman.

We begin by reviewing the elements of input-output analysis that pertain to the derivation of total input requirement and to the determination of output prices in competitive markets. Then, in Section II, we investigate the composition of consumer expenditures on energy and the pattern of expenditures over income groups. Finally, in Section III, we discuss the implications of our findings for public policy.

I. A SIMPLE THEORY OF PRICE IMPACTS

Our estimates of the budget impacts of energy price increases are based upon traditional methods of input-output analysis. We assume that the output of each industry in the nation is divided into two components: one portion is used as input by the other industries (and also by the own industry); and another portion that is consumed as final product by households. In matrix notation let

$$(1) \quad X = AX + C$$

where X is a column vector of industry outputs, A is an n by n matrix of production coefficients, and C is a column vector of final (consumption) demands. A typical element of the A matrix, a_{ij} , represents the amount of input required from the i^{th} industry to produce one unit of output in the j^{th} industry. Thus, equation (1) says that total industrial production, X , is the sum of the output used in the production of other goods, AX , and the output sold to final consumption, C .

Solving (1) for X we have

$$(2) \quad X = (I-A)^{-1} C = RC$$

where I is an n by n identity matrix and R simply represents $(I-A)^{-1}$. The elements of R are the total input requirement coefficients. They represent both the direct input requirements and the indirect input requirements of producing one unit of output for final demand.

Now, if we have an estimate of R based upon national data on A , X , and C , we can use this estimate to compute estimates of the amounts of the various inputs required to produce the bundle of goods consumed by a typical household. Let the estimate of R be designated as \hat{R} , and the household's consumption vector as c , then our estimate of the production vector required to support (only) this level of consumption is

$$(3) \quad \tilde{X} = \tilde{R}c.$$

Furthermore, if x_e is the element of X representing the output of the "energy industry," then

$$(4) \quad \tilde{x}_e = \tilde{R}^e c$$

where \tilde{R}^e represents the e^{th} row of \tilde{R} .

To investigate the impact of an increase in an energy price consider the formation of commodity prices where price is composed of the cost of material inputs plus value added, which includes the return to both capital and labor. That is, for the i^{th} industry

$$(5) \quad p_i = v_i + \sum_j p_j a_{ji}$$

and, in general

$$(6) \quad P' = V' + P'A$$

where the prime transposes a column vector into a row vector.

Then

$$(7) \quad P' = V' (I - A)^{-1} = V'R$$

If taxes are imposed on the various products (6) becomes

$$(6a) \quad P' = V' + P'A + T'$$

where T' is a vector of taxes, and (7) becomes

$$(7a) \quad P' = V'R + T'R.$$

Now, the household's budget expenditures on current consumption can be written as

$$(8) \quad b = P'c$$

where b is a scalar. Assuming that we begin with no taxes and then a tax is imposed on energy,^{*} we have the initial expenditures

$$(9) \quad b_o = P_o'c$$

and the expenditures after the price increase

$$(10) \quad b_1 = P_1'c$$

so that an estimate of the impact of the price increase measured in terms of the change in household expenditures with the consumption vector unchanged is

$$\begin{aligned} (11) \quad \Delta b &= b_1 - b_o \\ &= [(V'R + T'R) - V'R]c \\ &= T'Rc \end{aligned}$$

If the tax is applied to only one product (for example, natural gas) and if the change can be represented as a proportion of the original price of the commodity, then the impact on the budget can be estimated as

$$(12) \quad \Delta b = \alpha_g P_g \hat{R}_g^g c$$

^{*} This assumption is for notational purposes only. Identical results are obtained if we begin with taxes on some or all goods and we *increase* the tax on energy.

or, when it is expressed as a percentage of total consumption expenditures,

$$(13) \quad 100 \left(\frac{\Delta b}{b_o} \right) = 100 \left(\alpha_g \frac{P_g \tilde{x}_g}{b_o} \right).$$

Equation (13) is used to estimate the basic budget impacts of energy price and tax increases. It states that the percentage impact on the household's budget can be estimated as α_g , the relation of the tax to the basic price of the commodity, times $\frac{100 P_g \tilde{x}_g}{b_o}$, the percent of the budget originally expended on the product whose price is being increased.

If we include imports in our analysis the price equation becomes

$$(14) \quad P' = V' + P'A + T' + P'_m M$$

where P'_m is a row vector of import prices--in the general case we have n possible import prices, one pertaining to each industry or product--and $M = [m_{ij}]$ is an n by n matrix of import coefficients representing imports of industrial product i into domestic industry j . Solving for domestic prices yields

$$(15) \quad P' = (V' + T' + P'_m M)R$$

Now, if we are interested in changes in the import prices of crude and refined petroleum, and if these products are imported only into the petroleum refining sector, we can estimate the change in the household's budget brought about by the refining sector as

$$(16) \quad \Delta b = \Delta P'c = \left(\Delta p_{m_c} m_{cr} + \Delta p_{m_r} m_{rr} \right) \tilde{R}^r c \\ = \left(\Delta p_{m_c} \frac{I_c}{x_r} + \Delta p_{m_r} \frac{I_r}{x_r} \right) \tilde{x}_r$$

where I_c and I_r represent the imports of crude and refined products.
If the import price changes are equal equation (16) becomes

$$(16a) \quad \Delta b = \Delta p_m \frac{I_c + I_r}{x_r} \tilde{x}_r$$

where $\Delta p_m = \Delta p_{m_c} = \Delta p_{m_r}$, and we have

$$(17) \quad \frac{\Delta b}{b_o} = \frac{\Delta p_m}{p_r} \frac{I_c + I_r}{x_r} \frac{p_r \tilde{x}_r}{b_o}$$

where $\frac{\Delta p_m}{p_r}$ is the relative size of the price increase, $\frac{I_c + I_r}{x_r}$ is the

proportion of imports, and $\frac{p_r \tilde{x}_r}{b_o}$ is the price change coefficient.

We would also expect market forces to operate in such a manner that an increase in the price of imported crude would induce a corresponding rise in the price of domestic crude. This would impact on the household as

$$(18) \quad \frac{\Delta b}{b_o} = \frac{\Delta v_c \tilde{x}_c}{b_o} = \frac{\Delta v_c}{p_c} \frac{p_c \tilde{x}_c}{b_o}$$

where, Δv_c can be interpreted as an increase in rents to the oil companies (which could be transformed into a tax Δt_c).

II. ESTIMATES OF BUDGET IMPACTS

The budget figures used in this study are from the Consumer Expenditure Survey (CES) conducted for the Bureau of Labor Statistics (BLS) in 1960 and 1961 [Ref. 4], augmented by food and fuel expenditure information (the only information presently available) from the 1972-73 CES [Ref 1], and updated to the beginning of 1975 by the use of BLS survey data gathered for the Consumer Price Index [Ref 3].

The budget studies show the expenditures of households in ten income groups on current consumption items. Natural gas expenditures are a separate item, as are expenditures on electricity, coal petroleum products, gasoline, and motor oil. Expenditures on other budget items do not represent direct expenditures on energy. They do, however, usually have an energy component. For example, some 20 to 30 percent of the household's current consumption expenditures are for food, and the production of most food requires the use of energy somewhere in the production process. The production of food also requires other inputs, such as containers, for example, that themselves require energy inputs. Thus, we have an almost infinite series of energy input requirements for perhaps every item in the family budget. To determine the household's total gas costs we need to sum all of the indirect costs as well as the direct expenditures.

The total requirements matrix of the Bureau of Labor Statistics 1970 input-output study contains the input requirements, in dollar values, of the various forms of energy required to produce one dollar of output for food, and for 128 other products. We combined these factors with the household's expenditures to construct our estimate of the indirect component of total energy expenditures. For example, the average household spent \$1,108 on food, and the output of a dollar's worth of food required the ultimate input of 1.102 cents of output of the gas utility industry. Thus, we estimate that the average household spent over \$12, indirectly, on natural gas through its food purchases.

Our basic estimates of the budget impacts of energy price increases, as specified in equation (13), are based on the summation of all of the direct and indirect expenditures on the energy form being taxed. This

total expenditure figure is then multiplied by the tax, expressed as a ratio to the former price of the energy, to yield our estimate of the relative impact of the tax on the household's total budget.

Our estimates of these figures are shown in tables 1, 2, and 3. Table 1 contains the estimated household energy expenditures for 10 income groups and for the average of all households. The average household spends over \$900 (at December 1974 prices) on annual direct energy expenditures. Just about half of this total is for gasoline, one-quarter for electricity, and the remainder for natural gas and petroleum products other than gasoline. Direct expenditures on coal are insignificant for the average household. The greater the income of a household the more it spends on direct energy purchases. This general statement is true for all specific forms of energy the households purchase except for coal. Average expenditures on coal actually decline for the higher income households.

The estimated indirect or induced expenditures are also shown in this table. These figures need to be interpreted with caution. They represent the total amounts of the several types of energy required in the production of all the items in the household budget, less the direct budget expenditures on these items. For example the consumption budget for the average household requires the production (and use) of about 50 dollars of coal in addition to the \$9 of coal that is purchased and used directly by the household.

The indirect expenditure estimates for the individual forms of energy should not be summed to obtain "total indirect expenditures" as there would be some double counting. We have computed estimates for both raw materials ("crude petroleum and natural gas production") and for products ("petroleum products" and utility "gas"). If we sum the full values of the products and the value of the raw materials we would be overstating the true value of the energy. We have included both levels of energy in the table so that we will be able to estimate the budget impact of a tax levied either on the initial production or on the sale of the products.*

* Furthermore, we are able to estimate the budget impact of a tax simultaneously imposed at both levels by simply summing the budget impact coefficients. This is a slightly different statement, however, than indicating that the sum of the separate induced expenditures can be considered the total induced expenditure.

Table 1

HOUSEHOLD ENERGY CONSUMPTION
(December 1974 Prices)

Income Group	All	I	II	III	IV	V	VI	VII	VIII	IX	X
Percent Distribution of Households	100	4	10	11	12	13	13	15	13	7	2
Average Money Income Before Taxes	\$13,841	\$1,270	\$3,419	\$5,802	\$8,301	\$10,907	\$13,394	\$16,618	\$21,530	\$30,100	\$61,494
Average Consumption Expenditures	\$11,142	\$2,818	\$3,924	\$5,889	\$8,021	\$ 9,769	\$11,416	\$13,517	\$16,372	\$21,028	\$31,427
<u>Direct Energy Expenditures</u>											
Coal	9	13	15	15	11	9	8	9	7	8	6
Petroleum Products	523	150	183	326	441	512	604	743	787	1018	1395
Gasoline	464	112	152	278	382	458	542	650	724	938	1248
Electricity	245	148	146	183	214	240	277	287	339	408	556
Gas	148	66	128	133	148	137	170	182	198	240	324
Total	925	377	472	657	814	898	1059	1221	1331	1674	2281
<u>Indirect Energy Expenditures</u>											
Coal	49	18	22	29	38	44	50	59	70	90	132
Petroleum Products	264	73	101	152	201	238	277	331	388	496	764
Electricity	225	62	79	117	154	190	229	278	339	429	647
Gas	236	84	135	164	197	212	256	293	339	421	607
Crude Oil and Gas Production	413	124	169	261	342	391	461	554	611	782	1116
Total	1187	361	506	723	932	1075	1273	1515	1747	2218	3266

In Table 2 the direct and indirect energy expenditures are expressed as percentages of total budget expenditures. We have chosen to express the estimates as percentages of total consumption rather than as percentages of one of the income measures because we believe the reported income figures are usually quite unstable indicators of the actual life-cycle or "permanent" income of the households. The income profiles of our estimates are much less regressive than if they were presented on an income basis as consumption is usually greater than "income" for the lower income households and substantially less than income for the more affluent households.*

Our figures indicate that direct expenditures on coal, electricity, and utility gas decline steadily when expressed as percentages of total consumption. Direct expenditures on petroleum products in general and on gasoline in particular appear to be higher, relatively, for the middle-income groups than for either the lower-or upper-groups. Total direct expenditures on energy decline, relatively, with income. For the indirect expenditures, coal, gas, and crude production requirements decline with income when expressed as percentages of total consumption. Indirect expenditures on refined petroleum products and on electricity are relatively constant over income groups.

*For example, gasoline expenditures expressed as a percentage of "average money income before taxes" display the following profile:

Income Group	I	II	III	IV	V	VI	VII	VIII	IX	X
Gasoline Expenditure (%)	8.8	4.4	4.8	4.6	4.2	4.0	3.9	3.4	3.1	2.0

A single double-log regression of gasoline expenditures on average money income before taxes yields 0.68 as a crude estimate of the income elasticity of gasoline consumption indicating that the direct impact of a gasoline tax would be substantially regressive. A double-log regression of gasoline expenditures on total consumption expenditure, on the other hand, yields an elasticity estimate of 1.02 indicating that a tax would affect all households proportionately. A comprehensive analysis of the regressiveness of the gasoline tax is given in Ref. 2.

Table 2

ENERGY CONSUMPTION
As Percent of Total Budget Expenditures

Income Group	All	I	II	III	IV	V	VI	VII	VIII	IX	X
<u>Direct Energy Expenditures</u>											
Coal	0.1	0.5	0.4	0.3	0.1	0.1	0.1	0.1	0.0	0.0	0.0
Petroleum Products	4.7	5.3	4.7	5.5	5.5	5.2	5.3	5.5	4.8	4.8	4.4
Gasoline	4.2	4.0	3.9	4.7	4.8	4.7	4.8	4.8	4.4	4.5	4.0
Electricity	2.2	5.2	3.7	3.1	2.7	2.5	2.4	2.1	2.1	1.9	1.8
Gas	1.3	2.4	3.3	2.3	1.8	1.4	1.5	1.4	1.2	1.1	1.0
Total	8.3	13.4	12.0	11.2	10.1	9.2	9.3	9.0	8.1	8.0	7.3
<u>Indirect Energy Expenditures</u>											
Coal	0.4	0.6	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4
Petroleum Products	2.4	2.6	2.6	2.6	2.5	2.4	2.4	2.5	2.4	2.4	2.4
Electricity	2.0	2.2	2.0	2.0	1.9	1.9	2.0	2.1	2.1	2.0	2.0
Gas	2.1	3.0	3.4	2.8	2.5	2.2	2.2	2.2	2.1	2.0	1.9
Crude Oil and Gas	3.7	4.4	4.3	4.4	4.3	4.0	4.0	4.1	3.7	3.7	3.6

Our estimates of the budget impact coefficients are presented in Table 3.* These figures are estimates of the $\frac{P_e}{b_o}$ term in Equation (13).

When combined with information on potential tax rates--expressed as percentages of the current product prices--these figures allow us to estimate the relative budget impact of the taxes. Thus, we would estimate that a new 25 percent electricity tax would impact on the average household as a $(4.2) \cdot (0.25) = 1.05$ percent increase in its budget. That is, the items in the average household's budget will in total cost 1.05 percent more after the tax is instituted than they did before. The table indicates that all of the obvious types of energy taxes would be regressive in their initial impacts. A tax on utility gas would probably be the most regressive, and a tax on refined petroleum products the least.

* These estimates are simply the sum of the direct and indirect expenditure estimates shown in Table 2.

Table 3

BUDGET IMPACT COEFFICIENTS

Income Group	ALL	I	II	III	IV	V	VI	VII	VIII	IX	X
Coal	0.5	1.1	1.0	0.8	0.6	0.5	0.5	0.5	0.5	0.5	0.4
Petroleum Products	7.1	7.9	7.2	8.1	8.0	7.7	7.7	7.9	7.2	7.2	6.9
Electricity	4.2	7.5	5.7	5.1	4.6	4.4	4.4	4.2	4.1	4.0	3.8
Gas	3.4	5.4	6.7	5.0	4.3	3.6	3.7	3.5	3.3	3.2	3.0
Crude oil and gas	3.7	4.4	4.3	4.4	4.3	4.0	4.0	4.1	3.7	3.7	3.4

III. APPLICATION OF THE ESTIMATES

The impacts of energy price increases on the household sector can be estimated directly from Table 3 for a wide variety of cases. We can also estimate the impact of tax increases if we assume that the tax change is immediately reflected as a price change. For example:

A tax on coal would impact on households in the manner shown by the row for coal. That is, its impact on the current consumption budgets of households would be regressive, falling from about an α percent impact for the lowest income households to about a $1/2 \alpha$ percent impact for the wealthiest households. (α is the tax as a proportion of the price of the product.)

A tax on utility gas would be quite regressive. Its impacts would range from over 5α percent for the lower income households down almost to 3α percent for the upper-income households.

The impacts of a tax on gasoline can be estimated as about 0.35 times the estimated impacts of a tax on all refined petroleum products, as gasoline represented just over 35 percent of all refined products in December 1974.

Other situations can be analyzed by setting up specific scenarios. For example, the deregulation of natural gas is sometimes expected to result simply in a rise in the wellhead price of gas. If this is the case, the effects on the household of an x percent increase in the price of natural gas can be computed as equivalent to an $0.17x$ percent increase in the price of "crude petroleum and natural gas," as natural gas currently represents about 17 percent of this category.

The analysis of a tariff on imported petroleum is slightly more complicated. There are two complicating factors. First, the tariff would probably be applied to refined imports as well as crude imports, so there are two effects to work out. Second, the rise in the price of imports may induce an equal rise in the price of domestic production so that only one price prevails in the market. However, if the tariffs on crude and refined products are set equal, the resulting total impact on household expenditures can be estimated as about 0.35 (the ratio of crude and refined imports to the total output of the domestic refineries)

times α_r (the ratio of the tariff to the price of refined products) times the budget impact coefficient for refined products, plus α_c times the budget impact coefficient for crude petroleum times 0.83 (the ratio of crude production to total crude and natural gas production). That is, a tariff that would result in equal initial increases in the prices of imported crude and refined products and, if these changes were 60 percent and 50 percent, respectively, of the original prices of crude and refined products, then the ultimate impact on the household's budget would range from about $(0.35)(0.50)(8.0) + (0.60)(0.83)(4.3) = 3.5$ percent of the household's consumption expenditures for the lower income classes to about $(0.35)(0.50)(7.2) + (0.60)(0.83)(3.7) = 3.1$ percent for the higher income classes.

* Our estimates of budget impacts can also be used to estimate the change of a "cost of living" index if the index is based on the same consumption vector as the budget impact estimates. The index is defined as

$$I_t = P_t' c_o / P_b' c_o$$

where I_t is the value of the index at time t , P_t' is the price vector at time t , P_b' is the price vector in the base period, and c_o is the consumption vector in a (possibly different) base period. The change in the index is

$$\Delta I_t = \Delta P_t' c_o / P_b' c_o,$$

and if we assume that

$$\Delta P_t' = T' R$$

then

$$\begin{aligned} \Delta I_t &= T' R c_o / P_b' c_o \\ &= \frac{\Delta b}{P_b' c_o} \\ &= \left(\frac{\Delta B}{b_t} \right) I_t \end{aligned}$$

That is, the change in the index is equal to our estimated (relative) budget impact multiplied by the current value of the index. This estimate will be an over-estimate of the expected change in the index unless all industries are constant cost producers and marginal cost pricers, in which case the assumption that $\Delta P = T R$ would be true. More probably, however, supplies as well as demands will be price responsive so that some prices rise but others will fall as consumers adjust their actual consumption (c_t not c_o) in response to the initial price changes. If c_o is not greatly dissimilar to c_t this will result in an actual change in the index smaller than our estimated change.

The Consumer Price Index of the Bureau of Labor Statistics is currently based on the consumption quantities of the 1960-61 CES and 1967 prices. Our budget impact estimates are based partially on the 1972-73 CES so they are not strictly comparable with the CPI. They should, however, provide rough approximations of the relative sizes of changes in the CPI to be expected from different levels of energy taxation.

IV. CONCLUSIONS

The validity of the estimates we have presented is limited in a number of ways. First, the original data are for 1960-61 and may not be representative of today's household consumption patterns. The computations should be updated with the 1972-73 Consumer Expenditure Survey when it is released. Second, the analysis is based on the assumption of zero demand elasticities for products and for inputs. That is, input quantities and proportions remain fixed in production and in consumption even in the presence of substantial changes in relative prices. Finally, we assume that increases in prices for inputs are passed directly through the production sectors to the household sector in the form of increased output prices. This assumption may or may not be realistic depending on the degree of competition prevailing in the various industries.

The data and methodology appear sufficiently sound, however, to produce several general conclusions. First, direct energy expenditures are usually regressive in their structure, lower income households spend a greater portion of their consumption budget (and their income) on energy purchases than wealthier families. Second, indirect or induced energy expenditures also appear to be regressive, although less so than the direct expenditures. Third, the indirect energy requirements are definitely important in assessing the impact of price changes. They probably represent over half of all energy transactions, and estimates of price change affects that ignore these transactions, will be substantially understated. Finally, all of the obvious types of energy taxes are probably regressive; utility gas taxes are probably the most regressive, and taxes on refined petroleum products--including gasoline--the least.

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DATA APPENDIX

Information on budget expenditures on consumption commodities by household income class is available from the Survey of Consumer Expenditures conducted for the Bureau of Labor Statistics in 1960 and 1961. [Ref.4] The Bureau also sponsored a survey in 1972-73, but most of those data are still being processed. Some initial figures on fuel and food expenditures have, however, recently been published. [Ref.1] Consequently, we use the 1960-61 data, integrate the 1972-73 food and fuel estimates, and update the resulting consumption vector to reflect relative price changes between 1960 and 1972 and 1975.

1960 Consumer Expenditures

Table A-1 shows the sources and uses of income for the average household in each of the ten groups reported in the survey, and for the average household in the nation. This table shows the relations between money income before taxes, and the total expenditures on current items of consumption. The lower income households typically "dissave"; that is, they spend more for the basic necessities than they are currently earning. Households in the middle and upper income groups usually are able to save a portion of their income.

In Table A-2 we show the original consumption vectors for the different households. Direct expenditures for coal, petroleum products, electricity, and natural gas are contained in the "gas" row under "Utilities" and "Housing". Direct expenditures for gasoline and motor oil are found under "Transportation." The other figures represent the consumption expenditures for other goods, most of which require some amount of energy in their production.

As a first step in processing these data it was necessary to convert the expenditures from the budget categories into the Standard Industrial Classification (SIC) sectors that are compatible with the input-output matrix. The allocation that we used is shown in Table A-3; and the converted expenditures are shown in Table A-4.

Table A-1
SOURCES AND USES OF INCOME
1960-61

	INCOME GROUP										
	Total	I	II	III	IV	V	VI	VII	VIII	IX	X
Sources of Income											
Money income before taxes	6246	573	1543	2618	3746	4922	6044	7499	9716	13,583	27,750
Other Income											
Other money receipts	81	71	62	71	52	122	87	70	51	101	340
Value of items received without expense	240	223	236	223	225	217	247	244	248	298	322
Income	6567	867	1841	2912	4023	5261	6378	7813	10,015	13,982	28,412
Uses of Income											
Taxes	688	38	24	111	231	410	554	792	1,162	1,859	5,827
Net change in assets & liabilities	199	-722	-212	-182	-194	-4	69	210	532	1,099	5,157
Gifts	280	48	70	131	155	205	265	307	401	628	1,735
Insurance	299	31	40	89	149	236	301	388	503	688	1,178
Value of items received without expense	240	223	236	223	225	217	247	244	248	298	322
Current Consumption Expenditures	5054	1278	1780	2671	3638	4431	5178	6131	7,426	9,538	14,255
Adjustment	-193	-29	-97	-131	-181	-234	-236	-259	-258	-128	-62
TOTAL	6567	867	1841	2912	4023	5261	6378	7813	10,015	13,982	28,412
Percent of Families	100	3.7	10.2	11.1	11.8	13.3	12.7	15.1	13.4	6.8	2.0

Table A-2

EXPENDITURES FOR CURRENT CONSUMPTION
(1960-61 prices)

	INCOME GROUP (Money after taxes)										
	Total	I	II	III	IV	V	VI	VII	VIII	IX	X
Expenditures for Current Consumption	5054	1278	1780	2671	3638	4431	5178	6131	7426	9538	14255
Food	1234	370	532	753	954	1125	1292	1480	1766	2101	2719
Tobacco	91	22	36	60	79	93	103	115	125	121	140
Alcoholic Beverages	78	7	17	29	49	67	76	100	121	173	259
Housing	1468	463	626	849	1092	1276	1512	1761	2053	2597	4253
Shelter	658	225	304	408	504	579	683	788	903	1105	1771
Rental Services	269	131	204	258	318	337	316	251	255	226	240
Owned Dwellings	354	86	94	142	173	224	343	496	594	774	1246
Interest	118	8	8	22	39	68	121	195	233	286	280
Taxes	101	33	34	45	50	63	91	131	165	227	430
Insurance	28	10	10	15	16	19	25	35	43	55	116
Repairs & Replacements	90	27	39	55	59	65	88	106	131	168	348
Other Expenses	17	8	2	6	10	9	17	30	23	37	72
Lodging out of city	35	8	6	9	13	18	25	40	54	106	284
Other Real Estate	6	2	1	1	2	4	5	5	10	16	49
Utilities	249	118	145	174	201	228	263	293	326	381	489
Coal & Coke	10	10	12	13	10	11	11	9	7	8	2
Petroleum Products	47	21	21	29	38	44	49	55	62	79	107
Gas	59	27	37	42	49	56	66	68	77	84	115
Electricity	80	40	47	59	67	74	83	95	103	121	154
Other Utilities	53	20	28	31	37	43	54	66	77	89	111
Household Operations	288	71	105	148	205	239	277	335	406	572	1180
Supplies	67	18	28	41	55	65	76	83	94	96	104
Services	87	14	23	34	51	61	68	90	120	220	653
Telephone & Telegraph	79	24	36	46	60	70	81	96	109	135	196
Other	55	15	18	27	39	43	52	66	83	120	227
Housefurnishings	266	47	72	117	179	225	283	340	407	523	764
Textiles	33	6	9	15	21	26	33	42	52	70	100
Furniture	76	6	16	28	54	62	84	96	126	158	198
Floor Coverings	26	3	6	9	12	18	24	34	42	68	102
Appliances	75	21	23	39	57	75	87	103	107	113	162
Housewares & Misc.	56	11	18	26	35	44	56	65	80	114	202
Clothing	518	80	119	222	328	420	508	641	830	1133	1745
Apparel	445	64	97	184	287	367	443	564	735	1023	1616
Footwear	73	16	22	38	41	53	65	77	95	110	129
Personal Care	145	32	52	86	114	130	155	175	212	256	336
Services	65	13	21	37	49	54	64	77	98	131	194
Supplies	80	19	31	49	65	76	91	98	114	125	142
Medical Care	340	130	156	218	267	293	342	400	469	600	877
Hospitals	46	31	33	40	48	49	43	43	47	63	137
Services	226	64	83	128	161	186	228	278	332	431	617
Drugs & Medicines	68	35	40	50	58	59	71	79	90	106	123
Recreation	200	27	37	73	121	161	190	254	327	471	665
Reading	45	11	16	23	31	37	45	55	65	90	121
Education	53	14	5	10	20	26	39	57	80	182	393
Transportation	770	85	139	294	520	726	827	967	1222	1571	2048
Automotive											
Auto Purchase	299	17	38	84	181	287	325	373	506	659	793
Gasoline	172	22	34	76	128	171	202	233	263	293	268
Oil	12	2	3	6	10	12	15	17	18	20	18
Insurance	73	7	13	27	48	66	79	96	117	151	173
Registration & Fees	31	4	6	13	21	28	32	39	52	67	81
Financing											
Other Transportation	77	18	26	43	54	62	58	75	105	181	458
Other Expenditures	112	37	45	54	63	77	89	126	156	243	699

Table A-3

ALLOCATION OF BUDGET ITEMS TO PRODUCTION SECTORS

Production Sector	Budget Items
8 Coal Mining	Coal
12 New Residential Construction	(None)
17 Maintenance Construction	Shelter-repairs and replacements
20 Food Products	Food
	Alcoholic Beverages
21 Tobacco Manufacturing	Tobacco
23 Misc. Textile Goods	Housefurnishings-textiles
	Housefurnishings-floor coverings
25 Apparel	Clothing-apparel
29 Household Furniture	Furniture
33 Publishing	Reading
39 Drugs	Medical Care-drugs and medicines
40 Cleaning and Toilet Preparations	Personal Care Supplies
42 Petroleum Products	Automotive-gasoline and oil
	Utilities-petroleum products
45 Leather, Footwear, & Leather Prods.	Footwear
76 Household Appliances	Housefurnishings-appliances
83 Motor Vehicles	Automotive-purchase
92 Misc. Manufacturing	Housefurnishings-housewears
	Household Operations-supplies
93 Railroad Transportation	1/2 of Transportation-other
94 Highway Transportation	1/2 of Transportation-other
99 Communications	Household Ops.-Telephone & Telegraph
101 Electric Utilities	Electricity
102 Gas Utilities	Gas
103 Water and Sanitary Services	Utilities-other
106 Finance	Shelter-interest
	Automotive-financing
107 Insurance	Shelter-insurance
	Automotive-insurance
109 Other Real Estate	Shelter-rental services
	Shelter-other real estate
110 Hotels and Lodging Places	Lodging out of City
111 Other Personal Services	Personal Care-services
	Household Operations-services
115 Automotive Repair	Automotive-service and repairs
117 Other Amusements	Recreation
118 Medical Services	Medical Care-services
119 Hospitals	Medical Care-hospitals
120 Educational Services	Education
125 State and Local Governments	Shelter-taxes
	Automotive-registration and fees
Unallocated	Shelter-other expenses
	Other Expenditures

Table A-4

EXPENDITURES BY PRODUCTION SECTOR
(1960-61 prices)

	INCOME GROUP										
	Total	I	II	III	IV	V	VI	VII	VIII	IX	X
Total Income	6567	867	1841	2912	4023	5261	6378	7813	10,015	13,982	28,412
Production Sector											
8 Coal Mining	10	10	12	13	10	11	11	9	7	8	2
12 New Residential Construction											
17 Maintenance Construction	90	27	39	55	59	65	88	106	131	168	348
20 Food Products	1312	377	549	782	1003	1192	1368	1580	1887	2274	2978
21 Tobacco Manufacturing	91	22	36	60	79	93	103	115	125	121	140
23 Misc. Textile Goods	59	9	15	24	33	44	57	76	94	138	202
25 Apparel	445	64	97	184	287	367	443	564	735	1023	1616
28 Household Furniture	76	6	16	28	54	62	84	96	126	158	198
33 Publishing	45	11	16	23	31	37	45	55	65	90	121
39 Drugs	68	35	40	50	58	59	71	79	90	106	123
40 Cleaning & Toilet Preparations	80	19	31	49	65	76	91	98	114	125	142
42 Petroleum Products	231	45	61	111	176	227	266	305	343	392	393
45 Leather, Footwear & Leather Prods.	73	16	22	38	41	53	65	77	95	110	129
76 Household Appliances	75	21	33	39	57	75	87	103	107	113	162
83 Motor Vehicles	299	17	38	84	181	287	325	373	506	659	793
92 Misc. Manufacturing	123	29	46	67	90	109	132	148	174	210	306
93 Railroad Transportation	38	9	13	21	27	31	29	37	52	90	229
94 Highway Transportation	39	9	13	27	27	31	29	38	53	91	229
99 Communications	79	24	36	46	60	70	81	96	109	135	196
101 Electric Utilities	80	40	47	59	67	74	83	95	103	121	154
102 Gas Utilities	59	27	37	42	49	56	66	68	77	84	115
103 Water & Sanitary Services	53	20	28	31	37	43	54	66	77	89	111
106 Finance	118	8	8	22	39	68	121	195	233	286	280
107 Insurance	101	17	23	42	64	85	104	131	160	206	289
109 Other Real Estate	275	133	205	259	320	341	321	256	265	242	289
110 Hotels & Lodging Places	35	8	6	9	13	18	25	40	54	106	284
111 Other Personal Services	152	27	44	71	100	115	132	167	218	351	847
115 Automotive Repair	105	15	19	45	77	100	115	134	161	200	256
117 Other Amusements	200	27	37	73	121	161	190	254	327	471	665
118 Medical Services	226	64	83	128	161	186	228	278	332	431	617
119 Hospitals	46	31	33	40	48	49	43	43	47	63	137
120 Educational Services	53	14	5	10	20	26	39	57	80	182	393
125 State & Local Governments	132	37	40	58	71	91	123	170	217	294	511
Unallocated	184	60	65	87	112	129	158	222	262	400	998

Updating the Expenditures

Two procedures were performed to update the 1960-61 estimates to reflect the current situation. First, the budget expenditures were adjusted to reflect relative prices prevailing at the beginning of 1975. Then, the fuel and food expenditures from the 1972-73 BLS survey, also updated to reflect the relative prices prevailing at the beginning of 1975, were integrated into the older expenditure data.

Current relative prices were taken from a recent BLS survey taken to adjust the Consumer Price Index to reflect prices at the end of December 1974.^[Ref.3] (The CPI is also still based on the 1960 budget quantities. It is currently being updated with the 1972-73 survey information. The new series is due for release in 1976.) The December 1974 weights are shown in Table A-5. The "adjusted weights" column in Table A-5 is the one we will use. It reflects the allocation of the expenditure items that were originally "unallocated" to all of the industry groups on the basis of their relative expenditures.

The figures shown in Table A-6 were computed by applying the 1974 weights to the total consumption expenditures of the "average" household in 1960-61. Then the estimates for the individual income groups were spread according to factors based on the relation of the original income group expenditure for each item with the expenditure of the "average" household.

The second procedure we used to update the budget expenditures was to integrate the recently released food and fuel expenditure figures from the 1972-73 BLS CES into the older budget figures.

In Table A-7 the 1972-73 expenditures for food and fuel are expressed as percentages of "family income before taxes." This is the only income measure available in the new survey release and we use it for conversion purposes. To integrate these figures with our older budget figures it is first necessary to assume that the percentage expenditures for the income classes reported in the newer survey are

Table A-5
DECEMBER 1974 PRICING WEIGHTS

<u>Production Sector</u>	<u>Weight</u>	<u>Adjusted Weight</u>
8 Coal Mining	0.08	0.08
12 New Residential Construction	5.81	5.86
17 Maintenance Construction	3.73	3.76
20 Food Products	27.10	27.34
21 Tobacco	1.94	1.96
23 Misc. Textile Goods	0.91	0.92
25 Apparel	8.19	8.26
29 Household Furniture	1.31	1.32
33 Publishing	1.46	1.47
39 Drugs	0.77	0.78
40 Cleaning and Toilet Preps.	1.29	1.30
42 Petroleum Products	4.34	4.38
45 Leather, Footwear, and Products	1.44	1.45
76 Household Appliances	0.96	0.97
83 Motor Vehicles	3.93	3.96
92 Misc. Manufacturing	2.36	2.38
93 Railroad Transportation	0.63	0.64
94 Highway Transportation	0.63	0.64
99 Communications	-	-
101 Electric Utilities	1.32	1.33
102 Gas Utilities	1.22	1.23
103 Water and Sanitary Services	1.43	1.44
106 Finance	4.84	4.88
107 Insurance	2.01	2.03
109 Other Real Estate	4.57	4.61
110 Hotels and Lodging Places	0.39	0.39
111 Other Personal Services	3.17	3.20
115 Automotive Repair	1.67	1.68
117 Other Amusement	3.45	3.48
118 Medical Services	4.85	4.89
119 Hospitals	0.62	0.63
120 Educational Services	0.31	0.31
125 State and Local Governments	2.41	2.43
Unallocated	0.87	
TOTAL	100.01	100.00

Table A-6

EXPENDITURES BY PRODUCTION SECTOR

(December 1974 Relative Prices)

	INCOME GROUPS											
	1961	12/74										
	ALL	ALL	I	II	III	IV	V	VI	VII	VIII	IX	X
Current Consumption Expenditures	5054	5054	1278	1780	2671	3638	4431	5178	6131	7426	9538	14,255
8 Coal Mining	10	4	4	5	5	4	4	4	4	3	3	1
12 New Residential Construction	-	296	74	104	157	213	260	302	358	435	559	835
17 Maintenance Construction	90	190	57	82	116	125	137	186	224	277	335	735
20 Food Products	1312	1382	429	578	824	1056	1256	1441	1664	1987	2395	3137
21 Tobacco Manufacturing	91	99	24	39	65	86	101	112	125	136	136	152
23 Misc. Textile Goods	59	46	7	12	19	26	34	44	59	73	108	158
25 Apparel	445	417	60	91	172	269	344	415	528	689	959	1514
29 Household Furniture	76	67	5	14	25	48	55	74	85	111	139	175
33 Publishing	45	74	18	26	38	51	61	74	90	107	148	199
39 Drugs	68	39	20	23	29	33	34	41	45	52	61	71
40 Cleaning & Toilet Preparations	80	66	16	26	40	54	63	75	81	94	103	117
42 Petroleum Products	231	221	43	58	106	168	217	255	292	328	375	376
45 Leather, Footwear & Leather Prods.	73	73	16	22	38	41	53	65	77	95	110	129
76 Household Appliances	75	49	14	15	25	37	49	57	67	70	74	106
83 Motor Vehicles	299	200	11	25	56	121	192	217	249	338	441	530
92 Misc. Manufacturing	123	120	28	45	65	88	106	129	144	170	205	299
93 Railroad Transportation	38	32	8	11	18	23	26	24	31	44	76	193
94 Highway Transportation	39	32	7	11	18	22	25	24	31	43	75	188
99 Communications	79	-	-	-	-	-	-	-	-	-	-	-
101 Electric Utilities	80	67	34	39	49	56	62	70	80	87	101	129
102 Gas Utilities	59	62	28	39	44	52	59	69	71	81	88	121
103 Water & Sanitary Services	53	73	28	39	43	51	59	74	91	106	123	153
106 Finance	118	247	17	17	46	82	142	253	408	488	599	586
107 Insurance	101	103	17	23	43	65	87	106	134	163	210	295
109 Other Real Estate	275	233	113	174	219	271	289	272	217	225	205	245
110 Hotels & Lodging Places	35	20	5	3	5	7	10	14	29	31	61	162
111 Other Personal Services	152	162	29	47	76	107	123	141	178	232	374	903
115 Automotive Repair	105	85	12	15	36	62	81	93	108	130	162	207
117 Other Amusements	200	176	24	33	64	106	142	167	224	288	414	585
118 Medical Services	226	247	70	91	140	176	203	249	304	363	471	674
119 Hospitals	46	32	22	23	28	33	34	30	30	33	44	95
120 Educational Services	53	16	4	2	3	6	8	12	17	24	55	119
125 State & Local Governments	132	123	34	37	54	66	85	115	158	202	274	476

Table A-7

**FOOD AND FUEL EXPENDITURES
1972-73 BLS CES**

Table A-7

**FOOD AND FUEL EXPENDITURES
1972-73 BLS CES**

	INCOME GROUPS										
	All	I	II	III	IV	V	VI	VII	VIII	IX	X
Percent of Households	100	10	10	10	10	10	10	10	10	10	10
Average Money Income Before Taxes	10,185	930	2,614	4,218	5,922	7,742	9,597	11,485	13,860	17,146	28,507
Annual Expenditures as Percent of Money Income Before Taxes											
Food	15.87	69.17	35.09	27.26	22.60	19.71	17.34	16.58	14.53	13.27	9.61
Energy											
Coal	0.07	1.11	0.46	0.27	0.13	0.09	0.07	0.06	0.03	0.03	0.01
Petroleum Products	3.79	11.92	4.90	5.67	5.34	4.71	4.54	4.49	3.67	3.40	2.28
Gasoline	3.37	8.95	4.44	4.83	4.63	4.22	4.07	3.93	3.38	3.13	2.04
Electricity	1.77	11.74	4.28	3.16	2.59	2.22	2.09	1.74	1.58	1.36	0.91
Natural Gas	1.08	5.26	3.78	2.29	1.80	1.25	1.28	1.11	0.93	0.80	0.53

applicable to the income classes for the older survey. It is not obvious that this assumption is valid. However, if we look at the distributions of households by income group for the two surveys we see that they are reasonably close except for the higher income groups; and the expenditure figures for these groups are not too unrepresentative of simple extrapolations of the expenditures for the lower income groups. We believe that the timeliness of these data more than makes up for the discrepancies between the income groupings.

Table A-8

DISTRIBUTION OF HOUSEHOLDS BY INCOME GROUP
1960-61 and 1972-73

Income Group	1960-61 Data		1972-73 Data	
	Average Money ₁ Income (\$)	Cumulative Percent of Households (%)	Average Money ₁ Income (\$)	Cumulative Percent of Households (%)
I	573	4	930	10
II	1,543	14	2,614	20
III	2,618	25	4,218	30
IV	3,746	37	5,922	40
V	4,922	50	7,742	50
VI	6,044	63	9,597	60
VII	7,499	78	11,485	70
VIII	9,716	91	13,860	80
IX	13,583	98	17,146	90
X	27,750	100	28,507	100

Our procedure was to apply the new expenditure figures (from Table A-7) for food and fuel to the original estimates of money income before taxes. This expresses the new food and fuel estimates in a manner that is consistent with our other budget figures. Then the other budget expenditures were adjusted (proportionately), if it was necessary, so that the total of all the consumption expenditures remained at its original level.

The final consumption figures, based on relative prices prevailing at the beginning of 1975, and incorporating the latest information on fuel and food expenditures by households in different income groups, are shown in Table A-9.

Updating the Income and Total Consumption Figures.

The only additional data conversions we found necessary were associated with the construction of Table 1. To express price impacts in absolute dollar terms we needed estimates of household income and total household expenditures for current consumption for December 1974 for our 10 income groups. These figures were derived from information taken from the Statistical Abstract.^[Ref.5] We computed the average annual rate of growth in family income between 1960 and 1972 from the information in Table 614 on page 382 as 5.85 percent and used this to estimate the 1974 income levels for all income groups.

We computed average consumption expenditures per household for 1960 and 1974 from the personal consumption estimates of Table 600 on page 374 and the household estimates of Table 52 on page 40. The ratio of the two was then used to estimate the December 1974 consumption levels for all the income groups.

Table A-9

FINAL CONSUMPTION VECTORS
(December 1974 relative prices)

	INCOME GROUPS										
	Total	I	II	III	IV	V	VI	VII	VIII	IX	X
Expenditures for Current Consumption	5054	1278	1780	2671	638	4431	5178	6131	7426	9538	14255
8 Coal Mining	4	6	7	7	5	4	4	4	3	4	3
12 New Residential Construction	315	70	99	155	220	274	318	366	453	574	857
17 Maintenance Construction	202	54	78	114	129	144	196	229	288	365	754
20 Food Products	1108	407	567	758	921	1071	1159	1393	1594	2062	3056
21 Tobacco	105	23	37	64	89	106	118	128	142	136	156
23 Misc. Textile Goods	49	7	11	19	27	36	46	60	76	111	162
25 Apparel	444	57	86	170	278	362	436	540	718	985	1554
29 Household Furniture	71	5	13	25	50	58	78	87	116	143	180
33 Publishing	79	17	25	37	53	64	78	92	111	152	204
39 Drugs	41	19	22	29	34	36	43	46	54	63	73
40 Cleaning Preparations	70	15	25	39	56	66	79	83	98	106	120
42 Petroleum Products	236	68	83	148	200	232	274	337	357	462	633
45 Leather, Footwear, & Products	78	15	21	37	42	56	68	79	99	113	132
76 Household Appliances	52	13	14	25	38	52	60	69	73	76	109
83 Motor Vehicles	213	10	24	55	125	202	228	255	352	453	544
92 Misc. Manufacturing	128	27	43	64	91	112	136	147	177	211	307
93 Railroad Transportation	34	7	10	18	24	27	25	32	46	78	198
94 Highway Transportation	34	7	10	18	23	26	25	32	45	77	193
101 Electric Utilities	111	67	66	83	97	109	126	130	154	185	253
102 Gas Utilities	67	30	58	60	67	62	77	83	90	109	147
103 Water and Sanitary Services	78	26	37	42	53	62	78	93	110	126	157
106 Finance	263	16	16	45	85	150	266	417	508	615	602
107 Insurance	110	16	22	42	67	92	111	137	170	216	303
109 Other Real Estate	248	107	166	216	280	304	286	222	234	211	251
110 Hotels and Lodging Places	21	5	3	5	7	11	15	30	32	63	166
111 Other Personal Services	172	28	45	75	111	130	148	182	242	384	927
115 Automotive Repair	90	11	14	35	64	85	98	110	135	166	212
117 Other Amusements	187	23	31	63	110	150	176	229	300	425	600
118 Medical Services	263	66	87	138	182	214	262	311	378	484	692
119 Hospitals	34	21	22	28	34	36	32	31	34	45	98
120 Educational Services	17	4	2	3	6	8	13	17	25	57	122
125 State and Local Governments	131	32	35	53	68	90	121	162	210	282	489