Resources and Energy 1 (1978) 267–313. © North-Holland Publishing Company

NET ENERGY ANALYSIS

Handbook for Combining Process and Input–Output Analysis*

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Methods are presented for calculating the energy required, directly and indirectly, to produce all types of goods and services. Procedures for combining process analysis with input–output analysis are described. This enables the analyst to focus data acquisition effects cost-effectively, and to achieve down to some minimum degree a specified accuracy in the results. The report presents sample calculations and provides the tables and charts needed to assess total energy requirements of any technology, including those for producing or conserving energy.

1. Introduction

When we consume anything, we consume energy. It takes energy to manufacture, deliver and sell all types of goods and services. It is possible to add up the energy required at each step of the production process to determine the total 'energy cost' of particular goods and services.

The concept also applies to facilities that produce or conserve energy. It takes energy to construct and operate oil wells and pipelines, and this should be compared to the energy output. Similarly, it takes energy to manufacture insulation for homes and additional capital equipment for industry; these energy costs can also be compared to the energy savings.

Consumers demand energy in two ways; directly and indirectly. Energy is consumed directly in the form of gasoline, electricity, natural gas, or fuel oil. It is consumed indirectly as energy used elsewhere in the economy to

*This work was supported by the US Energy Research and Development Administration. We wish to express our thanks to Donna Amado who was responsible for the computer programming and to Charles R. Mandelbaum of E.R.D.A. for helpful comments on an earlier draft of the manuscript.

produce the other goods and services purchased by consumers. Indirect energy is by no means negligible; the average consumer demands more energy indirectly than directly [Herenden and Tanaka (1975)].

To clarify the concept of energy cost, consider aluminum as an example. A certain amount of energy is consumed directly in the ore reduction process. But energy is also required to mine the bauxite and transport it to the smelter. Additional energy is needed to manufacture the mining and transportation equipment, and to make the inputs to these industries. All these energies have to be summed to determine the total energy cost of aluminum.

The purchase of this report is to provide a practical guide for calculating the energy cost of any item. Two methods are described. One is tedious and involves adding all the energy inputs individually and is subject to error because some inputs are inevitably neglected. The other is a simpler one-step operation that has inaccuracies due to the level of aggregation at which goods and services are defined. We describe both methods, and then show how to combine them to minimize the effort required to obtain a predetermined degree of accuracy in the result. Appendix A gives most of the data needed for any application.

The range of possible applications is quite broad. Energy analyses have been used to determine the overall energy efficiencies of systems as varied as beverage containers [Hannon (1973)] and nuclear power plants [Rotty et al. (1975)]. Published results of energy analyses (particularly net energy analyses) vary for a host of reasons, due to differences in computational techniques, system boundaries, types of fuels and energy, etc. [Bullar and Herendeen (1974), Pilata (1977)]. This report is limited to treating the computational issues involved in such analyses. The methods and results presented are consistent with a forthcoming set of ERDA guidelines for net energy analysis [Perry (1977)].

1.1. Definitions and conventions

The data and methodologies described in this report permit calculation of five types of energy 'embodied' in a particular goods or service. One calculation determines the coal required, directly and indirectly, to produce a unit of aluminum. Parallel calculations yield the total crude oil and gas, refined oil, electricity, and natural gas requirements. All these inputs are useful for certain purposes, but they are not directly additive to obtain a 'total energy requirement'. For example, due to the direct plus indirect nature of the calculations, there would be some double counting of electricity and the coal used to produce electricity.

To obtain a total energy figure, we adopt the convention employed historically by the U.S. Bureau of Mines to combine U.S. fuel and electricity consumption. This convention views coal, crude oil and crude gas as *primary* fossil energy resources, and expresses physical quantities (tons, barrels, cubic feet) in terms of their total enthalpy.[1] Similarly, hydro and nuclear electricity are viewed as primary energy resources, whose enthalpies are evaluated in terms of their fossil fuel equivalents using the prevailing heat rate for fossil electric power plants. These enthalpies are then added to define a total primary requirement, and double-counting is avoided.

Similarly, we define a total primary energy *intensity* as the energy required directly and indirectly to produce a unit of goods or services for final consumption. It is calculated by adding the (direct plus indirect) coal intensity, crude oil and gas intensity, and the fossil fuel equivalent of the hydro and nuclear electric intensity. It is useful to compare the total energy intensities of goods and services for broad-based analyses of conservation options, such as substituting fiberglass for steel in a manufacturing process. In specific instances where options for fuel substitution are limited (e.g., aluminum production), it is more useful to retain the individual fuel intensity detail. In particular, *net* energy analyses often require that the distinction between fuels be maintained, because the object of the analysis is often a facility (e.g., a power plant) for converting one form of energy to another. 'Viewing all energy as equal' obscures the economic purpose of the facility [Bullard (1976), IES report (1975)].

2. Methodology

2.1. General

The energy cost of any economic activity can be measured by either of two general methods: Process analysis or input–output (I–O) analysis. As will be shown, both theoretically require the same data and would yield the same result if a fully disaggregated data base were available. In the real world, each technique is most useful for a particular type of problem. Aggregated, nationwide problems are well suited to I–O analysis because the data base for this analysis is a 368-sector model of the entire U.S. economy. Process analysis is more suited to specific processes, products, or manufacturing chains for which physical flows of goods and services are easy to trace.

2.2. Process analysis

Process analysis begins by identifying one particular product as the object of study. This *target product* may be either a good or a service. One then examines the process which makes the product and asks: 'What goods and

[1] For the types of energy considered here, total enthalpy is approximately equal to Gibbs' free energy. The latter is viewed by many as the 'ultimate' measure of energy consumption because it is truly consumed and cannot be recycled. For practical purposes in these calculations, the two are equal.

services were required directly by this plant to produce the target product?' When the list of such inputs is obtained, it will include some fuels (direct energy) and some non-energy goods and services from other industries. The direct energy use is tallied while each non-energy input is further examined to determine the energy and non-energy inputs required for its production. This process continues, tracing back from the target product through each stage of the production process (fig. 1). Each successive step in the analysis typically identifies smaller and smaller energy inputs, and all these energy inputs are summed to obtain the total energy *intensity* of the target product. The first energy input is called the *direct* energy requirement, the remainder is called the *indirect* energy requirement. It is often the case that certain items appear as both inputs and outputs several places in the production tree, reflecting feedback loops of economic activity.

In stage 2 and beyond, the indirect energy inputs are identified and summed. Note that indirect energy inputs include the energy consumed in energy producing industries.

In fig. 1, there are four inputs to the production of the *target product*. Suppose input A is energy and B, C, and D are non-energy goods and services. The *direct* energy requirement is simply input A. *Indirect* energy inputs to the target product are the sum of energy inputs to all the production processes in stages 2, 3, and beyond.

In practice, a large number of terms is never computed, and the analysis is terminated at a point where the input is believed to add a negligible amount to total energy use. At the second stage only the most significant inputs are considered, and of those, only a subset is further broken down into its components. Unfortunately, diminishing contributions from each stage provide no guarantee that the truncated infinite number of terms actually sum to a negligible quantity.

Performing a process analysis requires extensive data on the production of the target product and similar (but usually less detailed) data on any secondary, tertiary, and other inputs not truncated. For aggregated production sectors, data are obtained from government statistics on economic activity. For individual production processes, information must often be collated directly from manufacturers, trade associations, and consultants. If all flows can be measured in physical units, there is usually no reason to introduce dollar values in the analysis, so the resulting energy intensity is expressed in physical terms (energy/unit of target product).

As an example we shall calculate the energy intensity of cars in a simple 3-sector economy.[2] This hypothetical economy consists only of energy, measured in British Thermal Units (Btu), cars and another aggregate industry

[2]The Batelle/Columbus Labs (1975) and Larry Teasley (1974) provide excellent examples of practical process analysis.

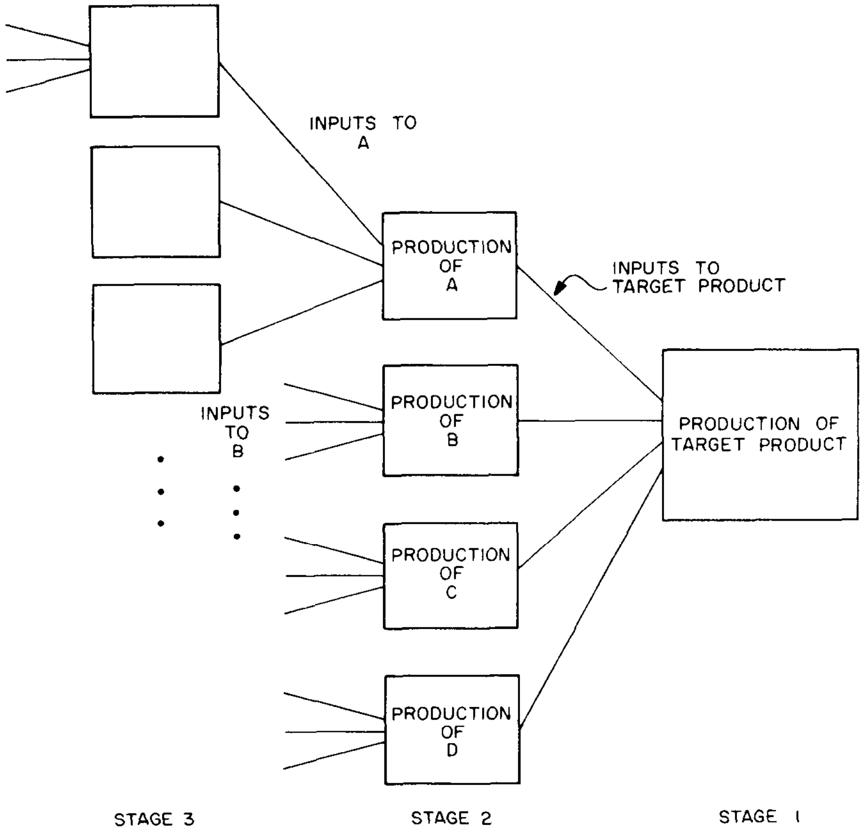

Fig. 1. Successive stages in a process analysis.

composed of all other goods and services. We shall simply label this aggregate industry 'goods' and presume its output is measured in dollars due to the heterogeneity of its output. Assume that census data for all three sectors in this hypothetical economic system identify the inputs for each industry's production process. A typical production facility in the car industry uses 0.6 car, 0.01 Btu energy and $0.25 worth of goods to produce one car. (In this entire example, the numbers are chosen arbitrarily.) The final stage of production is shown in fig. 2.

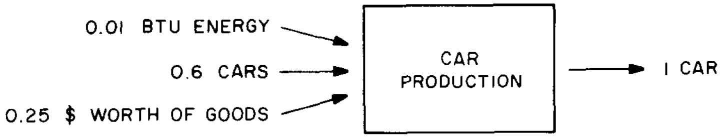

Fig. 2. Production of cars.

Similarly, typical energy and goods production facilities use inputs as shown in figs. 3a and 3b. Energy extracted from the earth does not appear in fig. 3a, only purchased energy inputs are shown.

We now have most of the data necessary to calculate the energy intensity of cars using process analysis. The production 'tree' is shown in fig. 4, where dashed lines denote inputs that are ignored, and represent the truncation points for the analysis. Values for input flows exactly match figs. 2 and 3 in the first production stage where the output is one unit. Outputs at all other stages are less than one unit and their inputs are scaled accordingly. For example, in the second stage, 0.6 cars are produced, so scaling the inputs in fig. 2 gives (0.6)(0.01) Btu, (0.6)(0.6) cars, and (0.6)(0.25) $ goods.

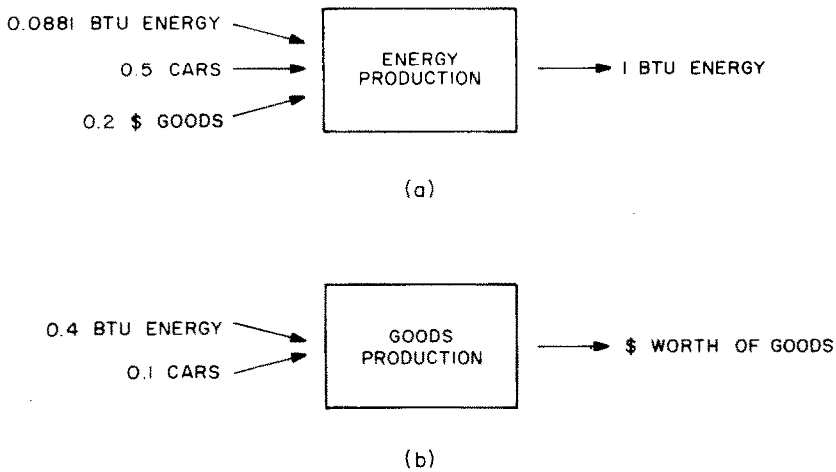

Fig. 3. Production of energy and goods.

In fig. 4, the *direct*[3] energy input to car production is 0.010 Btu/car. There are an infinite number of indirect inputs, all but three of which are neglected. They sum to 0.006+0.100+0.036=0.142 Btu/car. Thus process analysis yields a total (direct plus indirect) energy intensity of 0.152 Btu/car. The truncation error is unknown.

In this simple 3-sector example it is clear that we have sufficient data to carry the process analysis on for an indefinite number of steps. In a real problem, however, a process is truncated to reduce the data acquisition effort. For example, in an economic system with hundreds of sectors, a process analyst may follow only the largest branches on the tree to limit data

[3]Also called 'first round' energy cost.

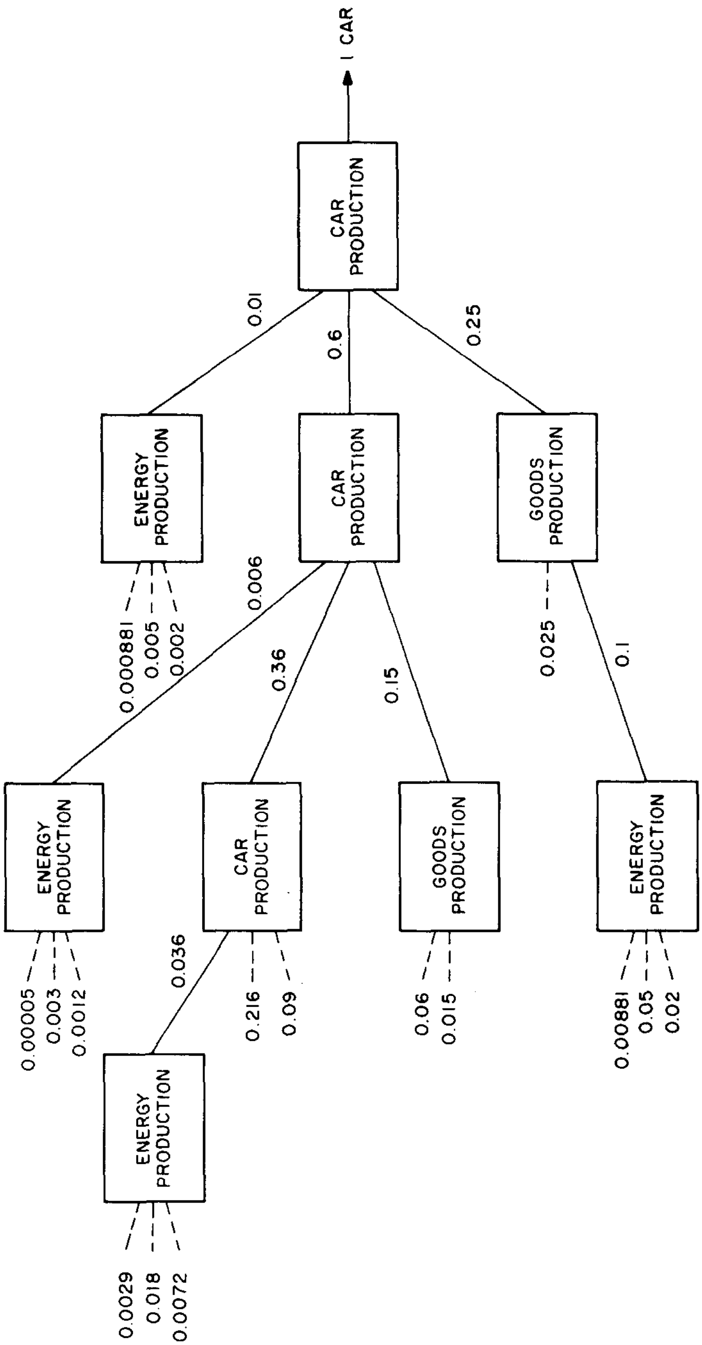

Fig. 4. Hypothetical 3-sector process analysis.

acquisition efforts to those sectors most important to the particular target product.

In table 1, the inputs shown in figs. 2 and 3 are arranged in matrix form, normalized to one unit of output. This matrix is one way to represent the technologies for all goods and services in our hypothetical economy. Note that it shows only *interindustry* flows, not resource flows from Earth to producing industries.

Table 1

Specification of production technologies.

Input ↓ to production of →	Energy	Cars	Goods
Energy	0.0881 Btu/Btu	0.01 Btu/car	0.4 Btu/$
Cars	0.5 Cars/Btu	0.6 Cars/Car	0.1 Cars/$
Goods	0.2 $/Btu	0.25 $/car	0 $/$

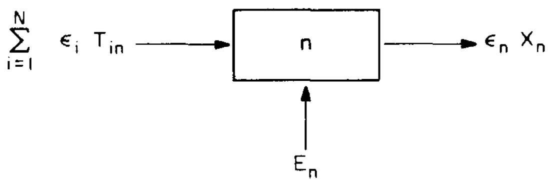

Fig. 5. Energy balance for a producing sector.

Entries on the diagonal show the amount of self-input required to produce 1 unit of output. For example, each Btu of energy output requires 0.0881 Btu of energy input. This representation of the data, as we shall see below, is useful for input–output analysis.

2.3. Input–output analysis

Input–output analysis is a modeling technique used extensively in economic research since its introduction by Leontief (1941). It has been adapted to analyze energy and labor intensities [Herendeen and Bullard (1974)]. The structure of the model, a large linear network, remains the same for any variable. Initially the economy must be disaggregated into N major sectors, each producing a unique good or service and each characterized by a node in the network equations. Examples of these sectors might be primary metals, retail trade or petroleum products. Fig. 5 shows the energy flows entering and leaving each sector.

Energy 'embodied' in outputs from other sectors enters at the left and can be expressed as $\epsilon_i T_{in}$, energy intensity of product i times the input of sector i

to sector n. Energy embodied in the sector's output is shown exiting at the right and is expressed as the product of the energy per unit of sector n output (ε_n) and its output (X_n). If in fig. 5, sector n denotes the energy sector, a non-zero amount E_n is extracted from the earth. The energy balance equation becomes

$$\sum_{i=1}^{N} \varepsilon_i T_{in} + E_n = \varepsilon_n X_n, \tag{1}$$

or, in matrix notation we have

$$\boldsymbol{\varepsilon}\mathrm{T} + \mathbf{E} = \boldsymbol{\varepsilon}\hat{\mathrm{X}}. \tag{2}$$

The above set of N equations can be solved for the N unknowns, $\boldsymbol{\varepsilon}$. $\hat{\mathrm{X}}$ is the diagonal matrix whose elements represent the total output from each sector.

For a typical product, n, the production technology is represented by a vector $\mathbf{A}_n$ where a typical element A_{in} represents the amount of product i needed directly to produce a unit of product n. The $N \times N$ matrix A then provides a linear representation of the technology of producing all goods and services. From this definition of A we have

$$\mathrm{T} = \mathrm{A}\hat{\mathrm{X}}, \tag{3}$$

and eq. (2) becomes

$$\boldsymbol{\varepsilon} = \mathbf{e}(\mathrm{I} - \mathrm{A})^{-1}, \tag{4}$$

where $\mathbf{e}$ is a unit vector which identifies the energy sector row of $(\mathrm{I}-\mathrm{A})^{-1}$ as the *energy intensities*.[4] For a multi-fuel economy, this analysis can be repeated for each type of energy (coal, oil, etc.) and the total primary energy intensities can be calculated [Herendeen and Bullard (1974)].

Though I–O is a simple and elegant technique, it would hardly be useful without large amounts of data. The U.S. Department of Commerce has reported economy-wide data separated into 368 sectors of economic activity for 1963 and 1967. From these data, the A (technological coefficients) and $\hat{\mathrm{X}}$ (total output) matrices are determined. Physical data for the $\mathbf{E}$ (energy) vector are available from a variety of sources and are equal to the output, X_n, of the primary energy-producing sectors. Thus, eq. (4) can be solved for an $\boldsymbol{\varepsilon}$ (energy intensity) vector containing 368 values for the entire economy in the year studied.

[4]This unit vector appears algebraically because $E \equiv X$ for the energy sectors; their output defined to equal what they extract from the earth.

This pure I–O approach implicitly assumes that the target product is *typical* of a certain sector's output. (The same assumption was made for 'cars' in the process-analysis example.) Treatment of atypical products is discussed in section 2.3.2.

2.3.1. A simple I–O example

Now we consider a practical application of input–output analysis. It makes use of a 357-sector description of the U.S. economic system in 1967. It includes detailed information on consumption of five forms of energy by each sector, and is based on data from the U.S. Bureau of Mines and the U.S. Department of Commerce Bureau of Economic Analysis (BEA).

In this example we shall calculate the energy cost of a *typical* large computer. We assume that the price (to the ultimate consumer) was $1,000,000 in 1970. The first step is to determine which of the 357 BEA economic sectors produces computing machines. Reference to the table of the Industry Classification in the 1967 Input–Output study shows that the correct sector is 51.01, 'computing and related machines'. The table also lists the SIC (Standard Industrial Classification) industries included in BEA sector 51.01. Thus for a more detailed description of 51.01, one could check either the results of the Office of Statistucal Standards (1967) or those of the U.S. Department of Commerce (1970) to insure that the correct sector is used.

Having identified the appropriate sector, the corresponding energy intensity can be obtained from table A–4, and it is multiplied by the quantity of computers to obtain the total energy cost. The total primary energy intensity given in the table is 47,116 Btu per 1967 dollar's worth of computers. The Department of Commerce data used to construct the I–O tables in 1967 measured that sector's output in dollars because of the aggregation within the computer industry; that is why the energy intensity is given in those terms. This is true for all non-energy sectors in the U.S. input–output tables; only the five energy sector outputs are expressed in physical units (Btu).

However, due to inflation between 1967 and 1970, there is a difference between one million 1967 dollars' worth of computers and one million 1970 dollars' worth, even though we're talking about exactly the same machine. If we convert the $1 million price tag in 1970 to 1967 prices, we can remove the effects of inflation, and the '1967 dollars' unit of measurement becomes a surrogate for a physical unit of measurement.[5] Using price indices (deflators)

[5]Note that if we were to use purely physical units we could avoid the problems of dollar cost deflation. If physical quantities are known, these can often be energy-costed directly. The energy intensities in table A-4 can be converted to (Btu/physical unit) using the 1967 implied prices of many goods and services. For a few additional materials, energy costs/physical unit are given by Perry (1977).

from table A-1 we calculate the quantity of computers in units of 1967 dollars:

$$\text{Value of a million dollar (1970) computer in 1967 dollars}$$
$$= \$10^6 \frac{(1967 \text{ price index for } 51.01)}{(1970 \text{ price index for } 51.01)} = (10^6)\frac{1.0}{1.015}$$
$$= (10^6)\ 0.99 = \$990.000\ (1967).$$

This figure is multiplied by the total primary energy intensity (ε) for sector 51.01, found in table A-4,

$$\text{Energy cost of computer}$$
$$= \$990{,}000\ (1967) \times 47{,}116\ \text{Btu}/\$1967$$
$$= 46.64 \text{ billion Btu.}$$

This example demonstrates how energy costs can be found quite simply using I–O. However, anyone employing this method should have a good understanding of the limitations and uncertainties inherent in it.

2.3.2. Uncertainty associated with I–O analysis

One source of uncertainty which has been mentioned already is the change in price levels over time. Due to inflation, price levels change while physical quantities (and energy cost) may not. Price level changes can be approximately corrected using deflators as above, though deflators are sometimes inaccurate and may not strictly conform to BEA sector definitions. Measuring quantities in terms of constant (1967) dollars is a surrogate for using physical units. For some products the correspondence between physical units and 1967 dollars is known. The average 1967 price data in table A-5 can be used to express many energy intensities directly in terms of Btu per physical unit.

Another source of uncertainty is change in the structure of the economy, the technology of producing goods and services, as represented by the matrix A. Energy intensities are a function of A alone, and as technological change occurs over time, the uncertainty in ε will increase. Recent studies have identified the parameters in A which are most important for energy analysis and work is now underway to update them to reflect the latest technological advances [Bullard and Sebald (1975)].

Some of the uncertainty in ε is due to sector aggregation. Ideally, each product would be a unique output of a BEA sector, and therefore would have a unique energy coefficient. Because millions of different goods and services are produced by the U.S. economy, it would be infeasible to collect data on N^2 technological coefficients at that level of detail. In practice, many similar products or services with a range of energy costs are grouped in a single sector. The question one wants to ask prior to calculation is: How much of BEA sector X is devoted to making the target product X_1? To answer this question, it is possible to go back to the original Department of Commerce data base and examine the composition of each sector. We have done this and list in table A-5 some common BEA sectors and their major products.[6] To the extent that the target product is typical of the sector's output, the sector energy intensity is a relatively accurate measure of its

Table 2
Energy cost of a computer.

Sector	% of purchase price (table A-3)	Allocated share of total cost ($1970)	Deflator ($1967/$1970) (table A-1)	Energy intensity Btu/$1967 (table A-4)	Primary energy cost (10^9 Btu)
65.01–65.06	0	—	—	—	—
69.01	5	$50,000	0.91	39,636	1.8
69.02	1	$10,000	0.84	39,372	0.3
51.01	94	$940,000	0.99	47,116	43.8
Total		$1,000,000			45.9

energy cost. This table provides a basis for estimating the certainty in an energy intensity, as applied to a particular product. If the target product were a very minor output of a large or diverse sector, there is little the user can do to correct the error using input–output analysis. There is a way to eliminate this problem, and it will be discussed in section 2.4.

A number of economic and accounting conventions also cause problems. Since data are collected from firms rather than consumers, they are based on the firm's value of the product, or producer's price. However, consumers pay not only this price but also the wholesale and retail margins, transportation costs, insurance, etc., required to market the product. In the previous example of the energy cost of the computer, these margins were ignored. Taking them into account, the calculation proceeds as follows:

The total price (to the purchaser) of the computer is $1,000,000 in 1970. Of this, the margins can be obtained from tables A-2 and A-3, and a more

[6]Sectors listed are those producing major inputs to construction and operation of facilities for energy production, processing and transportation.

accurate energy cost can be determined as set forth in table 2. This result compares to 46.64×10^9 Btu in the previous example where the margins were not explicitly accounted for. The favorable comparison is fortuitous in this example because the energy intensity of computers happens to be approximately equal to that of trade. For a more energy-intensive commodity (e.g., steel), the impact of including margins explicitly could be quite significant.

Another economic convention is that purchases of capital goods are counted as net outputs of the economic system, rather than as inputs to production processes. This means that ordinary I–O energy intensities [Bullard and Herendeen (1974)] do not include the energy required to build the factories or machines used by each sector. A correction[7] has been performed using capital requirements data from Fisher and Chilton (1971), so the energy intensities presented in table A-4 include the energy required to make capital equipment.

Finally, there is uncertainty in the results due to errors in collecting and processing the basic data on the technology of producing goods and services. These errors include those due to, more specifically, incomplete census coverage, reporting errors due to misunderstanding, false reports, sampling errors inherent in surveys of firms, transcription or key punching errors, the possibility that forms are lost, classification errors, and the problems of separating companies from establishments in processing returns from surveys or census. Considerable effort has been expended in trying to estimate these stochastic errors, and their effect on the resulting energy intensities. Our investigation considered all the sources of error listed directly above including incomplete reporting. Briefly, results indicate that the energy intensities are approximately normally distributed with more than a 99% likelihood that the actual value falls within the error bounds shown in table A-4 [Bullard (1976)]. It is assumed that these values, computed at the aggregated 90-sector level, can be applied directly to the 357-sector intensities. However, these figures do not include uncertainty due to changes in the technology of producing goods and services since 1967. Where significant process changes have been made, the error bounds should be increased.

Table 3 summarizes the error treatment in energy input–output analysis and points to two errors that are unresolvable using this technique.

The last two items in table 3 result from the fact that the U.S. input–output tables are aggregated to such a level that it is not possible to express each sector's output in terms of a single physical unit, and the data are collected on establishments not directly on processes. Methods for eliminating these problems are discussed by Herendeen and Bullard (1974).

[7] This correction is described by Putnam et al. (1975). Since capital data were only available at the 90-sector level of detail, it was assumed that individual processes within those categories are equally capital-intensive.

Table 3
Limitations of input–output analysis.

Problem	Treatment
1. Price level changes	Use tables A-2 and A-6
2. Technology changes (since base year)	Updated energy intensities not yet available
3. Aggregation: Typical and atypical products	Use table A-6
4. Producer's versus purchaser's prices	Use tables A-3 and A-4
5. Including energy cost of capital	Use table A-5
6. Uncertainty in base year data	Use table A-7
7. Physical flows assumed proportional to dollar values	Use a more disaggregated model
8. Errors due to secondary products and linearity assumptions	None

2.4. Combining process and input–output analyses

As shown above, the energy cost of any good and service can be determined by either process analysis or input–output analysis. In theory, both methods require identical input data and provide identical results.

For most applications, however, the complete set of input–output data (the $N \times N$ matrix A) are not available at the necessary level of detail. It exists only at a more aggregated level of about 368 sectors for the United States economic system, and is much smaller for most other nations.

Because of this lack of data, input–output results give only the *average* energy intensity of a sector's output. Accuracy is limited by the level of aggregation: the energy intensity of aluminum castings would apply to both pressure cookers and aluminum tools because both are included in sector 38.11. Process analysis does provide a framework for determining the energy intensity of atypical products within a sector. The chain of inputs can be traced back to the point where all inputs are sufficiently 'typical' or until the inputs are so small that the aggregation error is tolerable.

The errors associated with truncating a process analysis can be minimized using the results of input–output analysis. The truncation error is replaced by a smaller aggregation error associated with energy-costing the higher indirect order inputs. The combination of these techniques is called 'hybrid analysis' and the procedures are described below.

Theoretically, each step in a process analysis may be viewed as an expansion of the system boundary (around the item being analyzed) into the economic system, tabulating direct energy inputs at each step (see fig. 6). *The results of input–output analysis may be used to estimate the energy embodied in flows crossing the system boundary at any level, by associating each good or service with one of the 368 sectors of the I–O model.* These I–O results are indifferent to the location of the system boundary. Regardless of the number of process analysis steps taken, the boundary looks the same from the I–O side. Thus in theory, it does not matter at which stage of the process analysis you correct for the truncation error. In practice, by carefully choosing the number of stages, hybrid analysis can reduce the error in both techniques and produce the most accurate result possible. The truncation error is eliminated from the process analysis and the aggregation error is minimized in the I–O analysis.

2.4.1. Procedure

To perform a hybrid analysis, begin by doing the first one or two steps in a process analysis. Select the target product and carefully determine the energy and materials required for its production. Some of the input materials may be typical products of I–O sectors; I–O can be used to determine their total energy costs with only a single additional calculation. Thus the only input materials requiring further process analysis are atypical products not easily classified in an I–O sector. The technology for producing these items must be examined to identify their inputs which must in turn be energy-costed with either I–O or further process analysis, depending on whether they are typical or not. Hybrid analysis is best suited for large atypical problems such as determining the energy cost of a power plant, since there is no I–O sector corresponding to power plant construction.

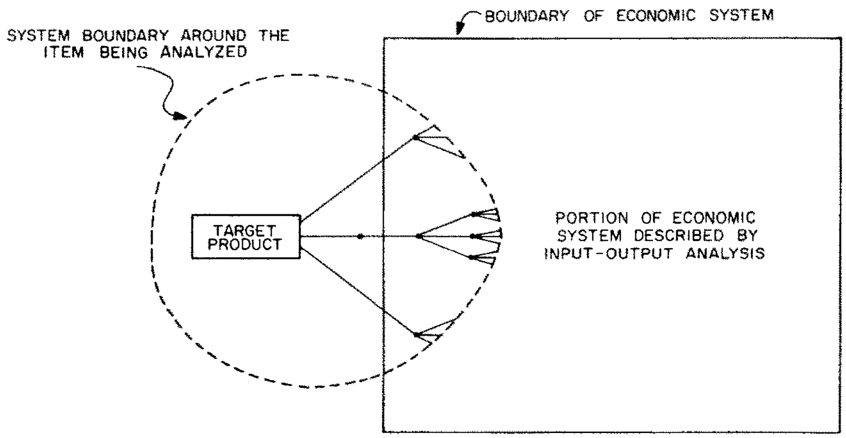

Fig. 6. System boundaries for process and input–output analyses.

2.4.2. *Example*

We will now calculate the energy cost of a large prototype coal-fired power plant [Pilati and Richard (1975)]. Assume that information on this plant is available from either a line-item plant budget or an expert consultant on the project. Our objective is to calculate this energy cost in the easiest manner within an uncertainty of $\pm 10\%$. A sequence of approximations will be used, starting with the simplest assumptions. The sequence can be terminated as soon as the error tolerance is less than 10%.

As a first approximation, we could multiply the dollar cost of the power plant ($88 million[8] at 1970 prices, $\pm 15\%$) by the average intensity for all

[8]This is the cost of all purchased inputs to power plant construction – materials, services, etc. Wages and taxes are excluded to be compatible with the system boundary of the I–O model which corresponds to GNP [see Bullard (1976)]. Using this convention, energy to produce items bought with wages are charged to the wage earner, not the employer.

goods and services in 1970 (68,690 Btu/\$).[9] This coefficient is simply the ratio of total U.S. energy use to gross national product in 1970. When used to approximate the energy intensity of a particular item such as a power plant, this coefficient has an extremely large uncertainty (say a factor of two: $+100\%$, -50%). The total energy cost and error terms are given by the formula

$$(a \pm \Delta a)(\varepsilon \pm \Delta\varepsilon) = a\varepsilon \pm a\Delta\varepsilon \pm \varepsilon\Delta a \pm \Delta\varepsilon\Delta a,$$

where a is the budget figure and ε the energy intensity, and Δa and $\Delta\varepsilon$ represent the uncertainties. Values for Δa and $\Delta\varepsilon$ are obtained by simply multiplying a and ε by their respective percentage errors. This first approximation yields an energy cost of 6.04×10^{12} Btu, while the first-order errors are clearly far outside the desired tolerance interval,

$$+(\varepsilon\Delta a) + (a\Delta\varepsilon) = +6.9 \times 10^{12} \text{ Btu } (+114\%),$$

$$-(\varepsilon\Delta a) - (a\Delta\varepsilon) = -3.9 \times 10^{12} \text{ Btu } (-65\%).$$

For some applications, however, errors such as these may be acceptable, and the analysis could terminate here.

The second approximation begins by identifying the major single expenses in the budget. Assume that an expert consultant provided a list of such purchases shown in column I of table 4. Care must be taken to identify each expense with its appropriate BEA sector, as defined by the U.S. Department of Commerce (1974).[10]

The energy cost calculation for these purchases, including removal of transportation and trade margins and price deflation, is shown in columns II thru VII of table 4. Energy used directly (on-site for construction) should be included in every energy cost calculation, because it may be significant even if it is not a large dollar expense. The energy embodied in the remaining (miscellaneous) inputs to the plant is estimated using the energy/GNP ratio as an average energy intensity as was done in the first approximation.

Column VIII contains the error due to budget uncertainty ($\varepsilon\Delta a$), which is assumed in this example to be 15% for all items. Column IX reflects the uncertainty in the energy intensity ($a\Delta\varepsilon$). The magnitude of the uncertainty in

[9]If the energy/GNP ratio for the appropriate year were not known, construction costs could be deflated to the year for which it is known. A construction cost index is given in table A-2.

[10]For convenience, a 90-sector level of aggregation is used in this example. Generally, more accuracy (less aggregation error) can be achieved with the 368-sector level of detail. Tables in the appendix are 368-order, so the numbers in the example will differ slightly from the figures in those tables.

Table 4

Second-approximation energy cost.

Inputs	(I) 1970 price ($10^3)	(II) BEA sector	(III) $1970 to $1967 deflator	(IV) 1967 price ($10^3)	(V) Price less margins[a] ($10^3 1967)	(VI) Energy intensity (Btu/$)	(VII) Energy (10^9 Btu)	(VIII) Budget uncertainty ($\varepsilon\Delta a$)(10^9 Btu)	(IX) Energy intensity uncertainty[b] ($a\Delta\varepsilon$)(10^9 Btu)
Structural steel	$25,000	40.00	0.90	22,500	18,950	105,582	2001	306	60
Turbines	10,000	43.00	0.87	8,600	7,995	81,114	648	97	19
Construction machinery	2,500	45.00	0.86	2,150	1,957	82,534	162	24	39
Transformers	3,000	53.00	0.92	2,765	2,516	65,401	165	25	5
	5.77×10^{11} Btu	31.01	—	—	—	1.219 Btu/Btu	703	105	21
Energy	7.20×10^{6} Btu	68.01	—	—	—	4.064	< 1	—	—
	9.69×10^{8} Btu	68.02	—	—	—	1.126 Btu/Btu	1	—	—
Miscellaneous	$42,401		0.87	37,594	42,192	73,382	3096	464	+3096 −1548
Total				73,609	73,609		6776		+3583 (+53%) −2052 (−30%)

[a] The margins removed from all sectors are added to miscellaneous expenses.

[b] All inputs assumed typical except those in 45.00 (±24%).

ε is based on table A-6.[11] An examination of table A-6 can indicate whether an input is typical of a particular sector's output. Assume that, based on careful classification and data from the consultant, all inputs except construction machinery (45.00), are believed to be typucal sector outputs. Typical inputs can use the figure from table A-6 for their $\Delta\varepsilon$ terms. To account for the atypical construction machinery, an additional 20% is added to the construction machinery uncertainty from table A-6.

The result of calculating the second approximation is a total energy cost of 6.78×10^{12} Btu with error bounds of +53%, −30%.[12] This is an improvement but it still does not fall within our desired ±10% limits.

In the next approximation fewer inputs are classified as miscellaneous in order to further reduce the error. Assume that we instructed the consultant to write down every significant budgeted expense classified in BEA sectors 36.00, 38.00, 40.00, 42.00, 43.00, 45.00, 46.00, 49.00, 53.00, 62.00, and 75.00. These sectors were chosen because they contain most of the materials commonly used for power plant construction; the amounts appear in column I of table 5. As in table 4, computing the energy cost of these purchases is straightforward and the remaining expenses are costed with the average energy/GNP ratio as before. The error analysis proceeds as in the previous step, and this time the error is +15, −13% for an energy cost of 7.19×10^{12} Btu. This still does not meet our accuracy requirements so the analysis must proceed another step.

From table 5 it appears that two of the largest errors are due to budget uncertainties for sectors 43.00 and 40.00. Assume that we have no way of improving the 15% accuracy of the expenses in sector 43.00, but note that the budget figure in sector 40.00 has an unusually large (±30%) error. Assume that, with a small effort, the consultant could improve the error term on structural steel expenses to ±15%. This reduces the $\varepsilon\Delta a$ error in that sector and reduces the error bound for the entire power plant to +8, −7%. This is within our error specification and the analysis can now be terminated.

To give an idea of how much effort was saved by these approximations, a complete computation from a line-item budget for the plant is shown in table 6. Column I lists all inputs deflated to 1967 dollars with margins already computed and assigned to the appropriate margin sectors. This is why, for example, sector 65.01 (rail transport) shows an expense of $883,154 even though the plant budget may not actually show any money allocated to

[11]These uncertainties apply to the energy intensity of goods in 1967. If we assume the power plant will be built in 1980, the total energy cost will be higher or lower, depending on trends in energy-related technological change throughout the U.S. economy during the 1967–80 period. This correction may be applied after the final result is obtained, and may be approximated by anticipated changes in the aggregate energy/GNP ratio.

[12]Note that for each input, the first-order budget and energy coefficient errors are tabulated. We assume errors on each input item are independent, and therefpre the total error in any approximation is the square root of the sum of the squares of each input error.

Table 5
Third-approximation energy cost.

(I) 1970 price ($10³)	(II) BEA sector	(III) $1970 to $1967 deflator	(IV) 1967 price ($10³)	(V) Price less margins[a] ($10³ 1967)	(VI) Energy intensity (Btu/$)	(VII) Energy (10^9 Btu)	Before improvement: Budget uncertainty[b] ($\varepsilon\Delta a$)(10^9 Btu)	Before improvement: Energy intensity uncertainty[c] ($a\Delta\varepsilon$)(10^9 Btu)	Improved: Budget uncertainty[d] ($\varepsilon\Delta a$)(10^9 Btu)	Improved: Energy intensity uncertainty[c] ($a\Delta\varepsilon$)(10^9 Btu)
2,144	36.00	0.87	1,865	1,343	177,176	238	36	7		
1,746	38.00	0.82	1,431	1,317	158,600	209	31	6		
38,319	40.00	0.90	34,487	28,280	105,583	2986	896	90	448	
2,932	42.00	0.89	2,322	1,881	95,035	179	27	7		
18,562	43.00	0.87	16,149	15,019	81,114	1218	183	37		
3,888	45.00	0.86	3,343	3,042	82,534	251	38	60		
1,497	46.00	0.87	1,302	1,224	69,959	86	13	3		
3,580	49.00	0.88	3,151	2,967	72,460	215	32	4		
4,358	53.00	0.92	4,009	3,648	65,406	239	36	7		
1,850	62.00	0.90	1,665	1,248	54,545	68	10	3		
3,239	75.00	0.86	2,758	2,785	74,525	208	31	23		
5.77×10^{11} Btu	31.01	–	–	–	1.2194	703	105	21		
7.20×10^{6} Btu	68.01	–	–		4.0643	–	–	–		
9.68×10^{8} Btu	68.02	–	–	–	1.116	1	–	–		
1,263	Misc.	0.87	1,090	3,050	73,382	224	34	+224 −112		
Trade margins	69.00	–		7,806	45,824	357	54	36		
Total			73,609	73,609	–	7185		+962(15%) −942(13%)		+568(8%) −554(7%)

[a]Trade margins are listed separately. Remaining margins are assigned to miscellaneous.
[b]Budget uncertainty ±15% on all expenses except 40.00 (±30%).
[c]All inputs assumed typical except 45.00 (±24%).
[d]Budget uncertainty for sector 40.00 reduced from ±30% to ±15%.

Table 6

Sample hybrid analysis

BEA sector	(I) Expenses[a] ($1967)	(II) Energy intensity (Btu/$)	(III) Energy (10^6 Btu)	(IV) Budget uncertainty ($\varepsilon\Delta a$)(10^6 Btu)	(V) Energy intensity uncertainty[b] ($a\Delta\varepsilon$)(10^6 Btu)
3101	5.77×10^{11} Btu	1.2194	703609	105541	21108
6801	7.20×10^{6} Btu	4.0643	29	4	1
6802	9.68×10^{8} Btu	1.1157	1080	162	43
200	6504	77672	505	76	
400	5155	42482	219	33	22
900	16100	117771	1896	284	265
1200	1880	60140	113	17	9
1600	1736	112644	196	29	6
1700	6730	109024	734	110	29
1800	186	61440	11	2	1
1900	100	81326	8	1	0
2000	766938	73312	56226	8434	3374
2200	613	59629	37	5	1
2300	34239	67760	2320	348	70
2400	24114	168994	4075	611	122
2600	242	57880	14	2	0
2700	34507	263170	9081	1362	363
3000	83823	125326	10505	1576	420
3102	11974	576357	6901	1035	897
3103	24445	492584	12041	1806	1686
3200	157109	100306	15759	2364	473
3500	27726	130543	3619	543	181
3600	1342855	177176	237922	35688	7138
3700	549914	233593	128456	19268	3854
3800	1316882	158599	208856	31328	6266
4000	28279568	105583	2985851	447878	89576
4100	4108	98244	404	61	12
4200	1880925	95036	178755	26813	7150
4300	15018830	81113	1218227	182734	36547
4500	3042544	82534	251114	60267	7533
4600	1224037	69959	85633	12845	2569
4900	2961657	72460	214602	32190	4292
5000	3299	60872	201	30	8
5200	642963	75211	48358	7254	1934
5300	3648279	65406	238618	35793	7159
5400	12697	79750	1013	152	30
5500	117535	70393	8274	1241	248
5600	5386	41520	224	34	7
5800	3894	73531	286	43	11
5900	23	78052	2	0	0
6200	1248479	54545	68099	10215	2724
6400	11115	63973	711	107	14
6501	883154	98184	86712	13007	4336
6503	704982	54654	38530	5779	2697
6504	15083	256200	3864	580	309
6505	67575	205114	13861	2079	1386
6506	96	142950	14	2	2

Table 6 (continued)

Sample hybrid analysis.

BEA sector	(I) Expenses[a] ($1967)	(II) Energy intensity (Btu/$)	(III) Energy (10^6 Btu)	(IV) Budget uncertainty ($\varepsilon\Delta a$)(10^6 Btu)	(V) Energy intensity uncertainty[b] ($a\Delta\varepsilon$)(10^6 Btu)
6600	28105	54723	1538	231	215
6803	1215	118619	144	22	14
6900	6087317	45825	278949	41842	27895
7000	40731	28037	1142	171	80
7100	47448	17596	835	125	50
7300	371008	37056	13748	2062	825
7500	2785132	74526	207564	31135	22832
7700	6367	54757	349	52	42
7800	2414	40504	98	15	11
7900	2000	111926	224	34	31
8100	44362	105911	4698	705	658
8200	2394	82546	198	30	20
Total	$73,608,500	–	7357052	518,856 (±7%)	

[a]Budget uncertainty ±15% on all items.
[b]All inputs assumed typical except 45.00 (±24%).

direct purchases of rail transport. This complete I–O analysis eliminated the large errors due to use of the average energy/GNP ratio as an energy intensity. It can be seen that accuracy has been slightly improved by this method; total energy cost is 7.36×10^{12} Btu ± 7%.

If a greater degree of accuracy were desired, it would not have been necessary to perform the arduous task of itemizing all inputs, especially the smallest ones. The effort might have been better spent reducing the budget uncertainty on some of the inputs contributing the largest errors. For example, reviewing design details to reduce the budget uncertainty on inputs from sectors 40.00 and 43.00 to ±5% could have improved the estimate in table 5 to +5%, −3%.

If, in this example, there were significant inputs not typical of their sector, similar reductions in the $\Delta\varepsilon$ errors may have been achieved by performing a one- or two-step process analysis on several of them.

In closing, we return to the question of the unquantified uncertainty due to the fact that the technologies for producing goods and services changed between 1967 (the model base year) and the time construction of the power plant in 1980. This will have the effect of increasing $\Delta\varepsilon$ for all goods and services. Rather than speculating on each production technology individually, it may be easiest to lump the uncertainty in a single factor that attempts to average these effects for all goods and services. The energy/GNP ratio may be used for this purpose since it is essentially a weighted average of the energy intensities of all production technologies. The ratio has been relatively stable, changing by no more than ±5% for about 20 years, so its impact has been negligible in the past. Anticipating a downward trend in response to post-embargo energy prices, one might wish to adjust the $\Delta\varepsilon$ values accordingly. For our purposes we have neglected this effect; for longer range application, it must be considered explicitly.

3. Discussion

The preceding example outlined the basic steps that must be taken to calculate the energy cost of any item. In the trivial case where the item is a typical output of a sector of the economy, its energy cost can be read directly from table A-6. The example considered an atypical item, an electric power plant, and showed how to perform a one-stage process analysis to obtain a ±10% estimate of its energy intensity.

The foregoing example was structured to highlight the payoffs obtained by focusing attention on a few primary inputs – the most significant element in the first stage of the process analysis. It was seen that it is not always necessary to obtain a detailed breakdown of exact quantities of all input materials in order to obtain a reasonable accurate final result. This technique yields considerable cost savings over conventional analyses that rely on a compilation of accurate and detailed lists of input materials and services.

In the interest of simplicity, the example did not include any two-stage process analyses, because the method is identical to that shown for the first-order step. In practice, the presence of large atypical inputs (e.g., the pressure vessel for a nuclear plant) may result in some of the largest uncertainties being associated with the $\Delta\varepsilon$ terms; it may prove more fruitful to perform crude process analyses on these inputs than to seek more accurate data on input quantities.

The methods developed here can be applied to calculating the energy cost of any good or service within a specified degree of accuracy. This report was written to support energy analyses of energy supply and conservation systems in particular, but applications are not restricted to that area. Detailed guidelines for using this method for net energy analysis are presented by Perry (1977).

Appendix: Tables for computing indirect energy requirements

TABLE A-I

PRICE INDICES
(1967 = 1.00)

BEA Sectors	1970	1971	1972	1973	1974
(1.01...(1.03)(2.01) (2.03)...(2.07)	1.114	1.127	1.337	2.031	2.059
(3.00)(4.00)	1.206	1.280	1.374	1.467	1.670
(5.00)(6.01)(6.02)	1.685	1.434	1.582	2.388	2.347
(7.00)	1.421	1.460	1.590	1.846	2.579
(8.00)	1.017	1.007	1.104	1.192	1.685
(9.00)(10.00)	0.994	1.169	1.212	1.350	1.729
(11.01)...(11.05) (12.01)(12.02)	1.349	1.473	1.603	1.779	1.984
(13.01)...(13.07)	1.132	1.175	1.209	1.252	1.394
(14.01)...(14.32)	1.123	1.150	1.209	1.449	1.619
(15.01)(15.02)	1.130	1.157	1.191	1.238	1.368
(16.01)...(16.04)	1.040	1.042	1.104	1.237	1.393
(17.01)...(17.10)	1.015	1.017	1.055	1.151	1.299
(18.01...(18.04)	1.122	1.143	1.161	1.208	1.307
(19.01)(19.02)(19.03)	1.027	1.023	1.098	1.143	1.302
(20.01)...(20.09)	1.142	1.292	1.468	1.819	1.877
(21.00)	1.174	1.212	1.300	1.575	1.741
(22.01)...(22.04)	1.116	1.148	1.171	1.227	1.358
(23.01)...(23.07)	1.138	1.164	1.196	1.305	1.542
(24.01)...(24.07)	1.078	1.087	1.115	1.188	1.486
(25.00)	1.079	1.113	1.156	1.246	1.466
(26.01)...(26.08)	1.162	1.212	1.245	1.296	1.376
(27.01)...(27.04)	0.992	1.013	1.025	1.075	1.471
(28.01)...(28.04)	0.969	0.962	0.963	0.983	1.210
(29.01)(29.02)(29.03)	1.037	1.064	1.066	1.080	1.173
(30.00)	1.113	1.148	1.175	1.222	1.570
(31.01)(31.02)(31.03)	1.003	1.059	1.080	1.406	2.125
(32.01)...(32.04)	1.059	1.081	1.104	1.152	1.393
(33.00)	1.089	1.117	1.407	1.591	1.512
(34.01)(34.02)(34.03)	1.110	1.140	1.221	1.299	1.390
(35.01)(35.02)	1.209	1.279	1.316	1.359	1.490
(36.01)...(36.22)	1.128	1.210	1.255	1.304	1.491
(37.01)...(37.04)	1.140	1.225	1.292	1.337	1.695
(38.01)...(38.14)	1.223	1.158	1.161	1.270	1.688
(39.01)(39.02)	1.125	1.218	1.290	1.350	1.652
(40.01)...(40.09)	1.117	1.175	1.214	1.261	1.586
(41.01)(41.02)	1.175	1.216	1.277	1.347	1.630
(42.01)...(42.11)	1.129	1.184	1.226	1.264	1.484
(43.01)(43.02)	1.148	1.200	1.239	1.271	1.431
(44.00)	1.125	1.166	1.211	1.245	1.410
(45.01)(45.02)(45.03)	1.164	1.221	1.267	1.318	1.550
(46.01)...(46.04)	1.147	1.195	1.226	1.264	1.428
(47.01)...(47.04)	1.125	1.157	1.177	1.245	1.439
(48.01)...(48.06)	1.158	1.206	1.236	1.303	1.516
(49.01)...(49.07)	1.139	1.185	1.215	1.260	1.474
(50.01)...(50.05)	1.217	1.296	1.337	1.400	1.611
(51.01)...(51.04)	1.015	1.030	1.038	1.047	1.067

TABLE A-I (continued)

PRICE INDICES (continued)
(1967 = 1.00)

BEA Sectors	1970	1971	1972	1973	1974
(52.01)...(52.05)	1.071	1.114	1.124	1.132	1.232
(53.01)...(53.08)	1.085	1.114	1.120	1.147	1.329
(54.01)...(54.07)	1.057	1.071	1.075	1.084	1.73
(55.01)(55.02)(55.03)	1.106	1.163	1.182	1.213	1.414
(56.01)...(56.04)	1.064	1.106	1.129	1.170	1.180
(57.01)(57.02)(57.03)	0.988	0.989	0.979	0.988	1.064
(58.01)...(58.05)	1.138	1.198	1.221	1.238	1.360
(59.01)(59.02)(59.03)	1.094	1.158	1.195	1.212	1.321
(60.01)...(60.04)	1.132	1.175	1.209	1.252	1.394
(61.01)...(61.07)	1.162	1.207	1.238	1.311	1.481
(62.01)...(62.07)	1.115	1.154	1.170	1.198	1.302
(63.01)(63.02)(63.03)	1.012	1.009	1.012	1.027	1.086
(64.01)...(64.12)	1.084	1.121	1.155	1.200	1.355
(65.01)	1.172	1.359	1.389	1.422	1.517
(65.02)	1.166	1.356	1.555	1.983	2.101
(65.03)	1.122	1.182	1.203	1.155	1.272
(65.04)	0.967	0.930	0.972	0.961	1.051
(65.05)	1.104	1.203	1.266	1.384	1.443
(65.06)	1.069	1.068	1.171	1.232	1.494
(65.07)	1.083	1.173	1.109	1.228	1.275
(66.00)	1.020	1.062	1.107	1.136	1.164
(67.00)	1.119	1.101	1.205	1.271	1.252
(68.01)...(68.03)	1.039	1.095	1.174	1.214	1.475
(69.01)	1.095	1.120	1.163	1.278	1.502
(69.02)	1.197	1.268	1.280	1.327	1.447
(70.01)...(70.03)	1.336	1.297	1.344	1.484	1.647
(70.04)	1.135	1.318	1.381	1.355	1.420
(70.05)	1.115	1.221	1.306	1.285	1.381
(71.01)(71.02)	1.122	1.160	1.201	1.265	1.342
(72.01)	1.138	1.228	1.200	1.271	1.413
(72.02)(72.03)	1.152	1.178	1.218	1.275	1.358
(73.01)(73.02)	1.139	1.192	1.221	1.339	1.374
(73.03)	1.187	1.314	1.353	1.440	1.552
(75.00)	1.160	1.238	1.289	1.307	1.454
(76.01)	1.144	1.165	1.212	1.239	1.381
(76.02)	1.182	1.241	1.282	1.336	1.405
(77.01)(77.02)(77.03)	1.229	1.286	1.341	1.395	1.520
(77.04)	1.215	1.277	1.397	1.529	1.698
(77.05)	1.186	1.307	1.364	1.367	1.454
(78.01)...(78.04)	1.343	1.419	1.623	1.377	1.800
(79.01)...(79.03)	1.187	1.262	1.323	1.402	1.500
(80.01)(80.02)	1.114	1.175	1.256	1.461	2.063
(81.00)(82.00)(83.00)	1.193	1.267	1.319	1.385	1.501
Construction Cost Index	1.277	1.469	1.597	1.769	1.955

Source: Sectors 11.01-12.02: Engineering News Record, 1970.

All others: GNP by Industry Branch, BEA.

Table A-II. MARGINS ON DIRECT ENERGY SOLD TO FINAL DEMAND
(Dollars/Million Btu)

BEA SECTOR NUMBER	RAIL TRANSPORT (65.01)	TRUCK TRANSPORT (65.03)	WATER TRANSPORT (65.04	AIR TRANSPORT (65.05)	PIPELINE TRANSPORT (65.06)	WHOLESALE TRADE (69.01)	RETAIL TRADE (69.02)	INSURANCE (70.04)	TOTAL
7.00	0.0934	0.0186	0.0100	0.0	0.0	0.0048	0.0277	0.0	0.1546
8.00	0.0	0.0025	0.0099	0.0	0.0236	0.0	0.0	0.0	0.0360
31.01	0.0058	0.0195	0.0266	0.0000	0.0201	0.4948	0.3604	0.0	0.9272
68.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
68.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

TABLE A-III. MARGINS ON GOODS AND SERVICES SOLD TO FINAL DEMAND

Percent of Purchase Price Allocated to Margins

BEA SECTOR NUMBER	RAIL TRANSPORT (65.01)	TRUCK TRANSPORT (65.03)	WATER TRANSPORT (65.04)	AIR TRANSPORT (65.05)	PIPELINE TRANSPORT (65.06)	WHOLESALE TRADE (69.01)	RETAIL TRADE (69.02)	INSURANCE (70.04)	TOTAL
1.01	0	0	0	0	0	0	0	0	0
1.02	0	5	0	0	0	7	17	0	29
1.03	0	1	0	2	0	0	11	0	14
2.01	2	4	0	0	0	8	0	0	14
2.02	4	5	1	0	0	9	1	0	20
2.03	4	4	0	0	0	0	0	0	8
2.04	3	9	0	0	0	11	24	0	47
2.05	3	5	0	0	0	8	32	0	48
2.06	2	5	1	0	0	1	0	0	9
2.07	0	3	0	0	0	5	47	0	55
3.00	1	8	2	0	0	12	47	0	70
4.00	0	0	0	0	0	0	0	0	0
5.00	8	3	6	0	0	0	0	0	17
6.01	1	0	0	0	0	0	0	0	1
6.02	4	0	0	0	0	0	0	0	4
9.00	15	9	8	0	0	0	0	0	32
10.00	10	6	3	0	0	0	0	0	19
11.01	0	0	0	0	0	0	0	0	0
11.02	0	0	0	0	0	0	0	0	0
11.03	0	0	0	0	0	0	0	0	0
11.04	0	0	0	0	0	0	0	0	0
11.05	0	0	0	0	0	0	0	0	0
12.01	0	0	0	0	0	0	0	0	0
12.02	0	0	0	0	0	0	0	0	0
13.01	0	0	0	0	0	0	0	0	0
13.02	0	1	0	0	0	0	0	0	1
13.03	2	0	0	0	0	0	0	0	2
13.04	0	0	0	0	0	0	0	0	0
13.05	0	0	0	0	0	10	19	0	29
13.06	1	0	0	0	0	14	8	0	23
13.07	1	4	0	0	0	0	0	0	5
14.01	0	1	0	0	0	5	28	0	34
14.02	0	0	0	0	0	13	23	0	36
14.03	1	1	0	0	0	11	27	0	40

TABLE A-III. MARGINS ON GOODS AND SERVICES SOLD TO FINAL DEMAND (continued)

Percent of Purchase Price Allocated to Margins

BEA SECTOR NUMBER	RAIL TRANSPORT (65.01)	TRUCK TRANSPORT (65.03)	WATER TRANSPORT (65.04)	AIR TRANSPORT (65.05)	PIPELINE TRANSPORT (65.06)	WHOLESALE TRADE (69.01)	RETAIL TRADE (69.02)	INSURANCE (70.04	TOTAL
14.04	1	0	0	0	0	11	16	0	28
14.05	0	0	0	0	0	10	27	0	37
14.06	0	0	0	0	0	7	13	0	20
14.07	2	0	0	0	0	9	27	0	38
14.08	1	1	0	0	0	7	21	0	30
14.09	2	2	0	0	0	7	27	0	38
14.10	3	1	0	0	0	8	26	0	38
14.11	1	0	0	0	0	9	30	0	40
14.12	0	1	0	0	0	13	39	0	53
14.13	3	2	0	0	0	6	27	0	38
14.14	2	1	0	0	0	7	18	0	28
14.15	1	1	0	0	0	5	16	0	23
14.16	2	0	0	0	0	5	13	0	20
14.17	5	1	0	0	0	6	12	0	24
14.18	0	0	0	0	0	10	24	0	34
14.19	2	2	0	0	0	5	16	0	25
14.20	1	1	0	0	0	8	24	0	34
14.21	1	0	0	0	0	17	31	0	49
14.22	0	0	0	0	0	6	22	0	28
14.23	0	1	0	0	0	3	42	0	46
14.24	6	1	0	0	0	10	0	0	17
14.25	3	0	0	0	0	4	0	0	7
14.26	1	1	0	0	0	2	0	0	4
14.27	1	0	0	0	0	4	0	0	5
14.28	0	2	0	0	0	6	24	0	32
14.29	1	1	0	0	0	9	22	0	33
14.30	0	0	1	0	0	7	26	0	34
14.31	0	2	0	0	0	11	22	0	35
14.32	2	1	0	0	0	10	23	0	36
15.01	0	0	0	0	0	27	13	0	40
15.02	0	0	0	0	0	0	0	0	0
16.01	0	0	0	0	0	19	24	0	43
16.02	0	1	0	0	0	14	17	0	32
16.03	0	1	0	0	0	18	33	0	52

TABLE A-III. MARGINS ON GOODS AND SERVICES SOLD TO FINAL DEMAND (continued)

Percent of Purchase Price Allocated to Margins

BEA SECTOR NUMBER	RAIL TRANSPORT (65.01)	TRUCK TRANSPORT (65.03)	WATER TRANSPORT (65.04)	AIR TRANSPORT (65.05)	PIPELINE TRANSPORT (65.06)	WHOLESALE TRADE (69.01)	RETAIL TRADE (69.02)	INSURANCE (70.04)	TOTAL
16.04	0	0	0	0	0	4	37	0	41
17.01	1	1	0	0	0	6	36	0	44
17.02	1	2	0	0	0	9	33	0	45
17.03	0	0	0	0	0	15	25	0	40
17.04	0	0	0	0	0	8	0	0	8
17.05	6	3	0	0	0	9	0	0	18
17.06	0	1	0	0	0	6	0	0	7
17.07	1	3	0	0	0	3	0	0	7
17.08	0	0	0	0	0	0	0	0	0
17.09	1	1	0	0	0	10	21	0	33
17.10	1	1	0	0	0	3	36	0	41
18.01	0	1	0	0	0	4	38	0	43
18.02	0	0	0	0	0	0	0	0	0
18.03	0	0	0	0	0	17	28	0	45
18.04	0	0	0	0	0	4	36	0	40
19.01	0	1	0	0	0	3	50	0	54
19.02	0	0	0	0	0	4	45	0	49
19.03	0	1	0	0	0	8	20	0	29
20.01	4	2	1	0	0	2	0	0	9
20.02	8	1	0	0	0	9	0	0	18
20.03	7	1	0	0	0	7	0	0	15
20.04	8	3	0	0	0	9	0	0	20
20.05	1	0	0	0	0	14	0	0	15
20.06	8	1	0	0	0	10	0	0	19
20.07	0	0	0	0	0	10	0	0	10
20.08	2	2	0	0	0	2	0	0	6
20.09	2	1	0	0	0	6	25	0	34
21.00	3	0	0	0	0	4	0	0	7
22.01	1	1	0	0	0	3	38	0	43
22.02	1	1	0	0	0	3	37	0	42
22.03	1	1	0	0	0	5	35	0	42
22.04	2	1	0	0	0	3	35	0	41
23.01	1	1	0	0	0	8	20	0	30
23.02	1	1	0	0	0	10	18	0	30

TABLE A-III. MARGINS ON GOODS AND SERVICES SOLD TO FINAL DEMAND (continued)

Percent of Purchase Price Allocated to Margins

BEA SECTOR NUMBER	RAIL TRANSPORT (65.01)	TRUCK TRANSPORT (65.03)	WATER TRANSPORT (65.04)	AIR TRANSPORT (65.05)	PIPELINE TRANSPORT (65.06)	WHOLESALE TRADE (69.01)	RETAIL TRADE (69.02)	INSURANCE (70.04)	TOTAL
23.03	1	2	0	0	0	11	4	0	18
23.04	0	1	0	0	0	9	0	0	10
23.05	1	1	0	0	0	9	0	0	11
23.06	1	0	0	0	0	6	43	0	50
23.07	6	4	0	0	0	12	0	0	22
24.01	5	0	0	0	0	2	0	0	7
24.02	3	2	0	0	0	6	4	0	15
24.03	5	2	0	0	0	3	0	0	10
24.04	0	2	0	0	0	16	6	0	24
24.05	3	0	0	0	0	12	26	0	41
24.06	5	5	0	0	0	27	0	0	37
24.07	1	1	0	0	0	9	28	0	39
25.00	0	1	0	0	0	5	19	0	25
26.01	0	1	0	0	0	0	28	0	29
26.02	1	4	0	0	0	13	13	0	31
26.03	0	0	0	1	0	8	13	0	22
26.04	0	2	0	1	0	9	21	0	33
26.05	0	3	0	0	0	8	13	0	24
26.06	0	1	0	0	0	10	30	0	41
26.07	0	2	0	0	0	5	37	0	44
26.08	0	2	0	0	0	1	24	0	27
27.01	2	1	0	0	0	3	2	0	8
27.02	6	3	0	0	0	4	5	0	18
23.03	1	1	0	0	0	9	1	0	12
27.04	3	2	0	0	0	4	8	0	17
28.01	2	2	0	0	0	3	2	0	9
28.02	2	1	0	0	0	2	0	0	5
28.03	0	0	0	0	0	2	0	0	2
28.04	0	0	0	0	0	2	0	0	2
29.01	0	1	0	0	0	5	35	0	41
29.02	1	2	0	0	0	8	21	0	32
29.03	0	0	0	0	0	8	33	0	41
30.00	0	2	0	0	0	9	22	0	33
31.02	0	1	0	0	0	2	0	0	3

TABLE A-III. MARGINS ON GOODS AND SERVICES SOLD TO FINAL DEMAND (continued)

Percent of Purchase Price Allocated to Margins

BEA SECTOR NUMBER	RAIL TRANSPORT (65.01)	TRUCK TRANSPORT (65.03)	WATER TRANSPORT (65.04)	AIR TRANSPORT (65.05)	PIPELINE TRANSPORT (65.06)	WHOLESALE TRADE (69.01)	RETAIL TRADE (69.02)	INSURANCE (70.04)	TOTAL
31.03	3	4	0	0	0	13	0	0	20
32.01	1	1	0	0	0	8	35	0	45
32.02	1	1	0	0	0	8	37	0	47
32.03	0	1	0	0	0	8	11	0	20
32.04	1	2	0	0	0	6	17	0	26
33.00	0	0	0	0	0	4	0	0	4
34.01	0	1	0	0	0	22	20	0	43
34.02	0	0	0	0	0	6	36	0	42
34.03	0	1	0	0	0	3	39	0	43
35.01	0	1	0	0	0	5	31	0	37
35.02	2	10	0	0	0	6	15	0	33
36.01	5	5	1	0	0	4	0	0	15
36.02	5	5	0	0	0	7	0	0	17
36.03	0	2	0	0	0	10	0	0	12
36.04	3	6	0	0	0	3	0	0	12
36.05	0	21	0	0	0	13	0	0	34
36.06	0	5	0	0	0	21	0	0	26
36.07	1	1	0	0	0	14	38	0	54
36.08	1	1	0	0	0	1	0	0	3
36.09	0	0	0	0	0	13	45	0	58
36.10	0	4	0	0	0	19	0	0	23
36.11	0	0	0	0	0	7	2	0	9
36.12	0	0	0	0	0	0	0	0	0
36.13	10	2	0	0	0	10	0	0	22
36.14	11	8	0	0	0	11	0	0	30
36.15	0	3	0	0	0	8	42	0	53
36.16	0	1	0	0	0	10	21	0	32
36.17	9	2	0	0	0	11	2	0	24
36.18	8	0	0	0	0	5	2	0	15
36.19	7	2	0	0	0	12	0	0	21
36.20	10	3	0	0	0	11	0	0	24
36.21	7	1	0	0	0	3	0	0	11
36.22	6	0	0	0	0	11	24	0	41
37.01	2	2	0	0	0	3	0	0	7

TABLE A-III. MARGINS ON GOODS AND SERVICES SOLD TO FINAL DEMAND (continued)

Percent of Purchase Price Allocated to Margins

BEA SECTOR NUMBER	RAIL TRANSPORT (65.01)	TRUCK TRANSPORT (65.03)	WATER TRANSPORT (65.04)	AIR TRANSPORT (65.05)	PIPELINE TRANSPORT (65.06)	WHOLESALE TRADE (69.01)	RETAIL TRADE (69.02)	INSURANCE (70.04)	TOTAL
37.02	0	3	0	0	0	3	0	0	6
37.03	0	1	0	0	0	1	0	0	2
37.04	1	1	0	0	0	14	0	0	16
38.01	1	0	0	0	0	1	0	0	2
38.02	1	0	0	0	0	0	0	0	1
38.03	3	0	0	0	0	2	0	0	5
38.04	1	1	0	0	0	1	0	0	3
38.05	1	2	0	0	0	4	0	0	7
38.06	0	0	0	0	0	0	0	0	0
38.07	1	4	0	0	0	4	0	0	9
38.08	1	1	0	0	0	3	0	0	5
38.09	1	1	0	0	0	2	0	0	4
38.10	1	1	0	0	0	3	1	0	6
38.11	0	0	0	0	0	1	15	0	16
38.12	0	0	0	0	0	1	0	0	1
38.13	0	2	0	0	0	0	0	0	2
38.14	0	1	0	0	0	0	0	0	1
39.01	0	1	0	0	0	1	0	0	2
39.02	3	2	0	0	0	6	0	0	11
40.01	2	3	0	0	0	18	0	0	23
40.02	0	2	0	0	0	19	0	0	21
40.03	1	1	0	0	0	12	19	0	33
40.04	3	2	0	0	0	5	0	0	10
40.05	0	1	0	0	0	8	0	0	9
40.06	1	1	0	0	0	4	0	0	6
40.07	0	1	0	0	0	8	0	0	9
40.08	0	0	0	0	0	1	0	0	1
40.09	0	0	0	0	0	6	9	0	15
41.01	0	1	0	0	0	4	7	0	12
41.02	0	1	0	0	0	1	31	0	33
42.01	0	1	0	0	0	7	34	0	42
42.02	0	1	0	0	0	11	25	0	37
42.03	0	1	0	0	0	5	22	0	28
42.04	0	0	0	0	0	0	0	0	0

TABLE A-III. MARGINS ON GOODS AND SERVICES SOLD TO FINAL DEMAND (continued)

Percent of Purchase Price Allocated to Margins

BEA SECTOR NUMBER	RAIL TRANSPORT (65.01)	TRUCK TRANSPORT (65.03)	WATER TRANSPORT (65.04)	AIR TRANSPORT (65.05)	PIPELINE TRANSPORT (65.06)	WHOLESALE TRADE (69.01)	RETAIL TRADE (69.02)	INSURANCE (70.04)	TOTAL
42.05	1	1	0	0	0	5	23	0	30
42.06	0	4	0	0	0	13	2	0	19
42.07	0	4	0	0	0	4	0	0	8
42.08	0	1	0	0	0	11	0	0	12
42.09	0	0	0	0	0	5	0	0	5
42.10	1	1	0	0	0	2	30	0	34
42.11	1	1	0	0	0	8	16	0	26
43.01	0	0	0	0	0	1	0	0	1
43.02	0	1	0	0	0	6	6	0	13
44.00	1	1	0	0	0	10	13	0	25
45.01	1	1	0	0	0	12	0	0	14
45.02	0	1	0	0	0	5	0	0	6
45.03	0	1	0	0	0	8	0	0	9
46.01	0	1	0	0	0	4	0	0	5
46.02	0	2	0	0	0	5	0	0	7
46.03	0	1	0	0	0	4	0	0	5
46.04	1	2	0	0	0	5	0	0	8
47.01	0	1	0	0	0	4	1	0	6
47.02	0	1	0	0	0	4	0	0	5
47.03	0	0	0	0	0	1	0	0	1
47.04	0	1	0	0	0	7	4	0	12
48.01	0	0	0	0	0	8	0	0	8
48.02	0	1	0	0	0	3	0	0	4
48.03	0	1	0	0	0	10	5	0	16
48.04	0	1	0	0	0	3	0	0	4
48.05	0	0	0	0	0	6	0	0	6
48.06	0	1	0	0	0	4	0	0	5
49.01	1	2	0	0	0	10	0	0	13
49.02	0	1	0	0	0	6	0	0	7
49.03	0	1	0	0	0	7	0	0	8
49.04	0	0	0	0	0	0	0	0	0
49.05	0	1	0	0	0	7	0	0	8
49.06	0	1	0	0	0	7	0	0	8
49.07	0	0	0	0	0	7	0	0	7

TABLE A-III. MARGINS ON GOODS AND SERVICES SOLD TO FINAL DEMAND (continued)

Percent of Purchase Price Allocated to Margins

BEA SECTOR NUMBER	RAIL TRANSPORT (65.01)	TRUCK TRANSPORT (65.03)	WATER TRANSPORT (65.04)	AIR TRANSPORT (65.05)	PIPELINE TRANSPORT (65.06)	WHOLESALE TRADE (69.01)	RETAIL TRADE (69.02)	INSURANCE (70.04)	TOTAL
50.00	1	1	0	0	0	6	1	0	9
51.01	0	0	0	0	0	5	1	0	6
51.02	0	0	0	0	0	18	11	0	29
51.03	0	1	0	0	0	8	8	0	17
51.04	0	1	0	1	0	22	4	0	28
52.01	0	1	0	0	0	14	0	0	15
52.02	0	2	0	0	0	15	0	0	17
52.03	1	1	0	0	0	8	7	0	17
52.04	1	2	0	0	0	21	0	0	24
52.05	0	0	0	0	0	19	5	0	24
53.01	0	0	0	0	0	3	3	0	6
53.02	1	2	0	0	0	2	0	0	5
53.03	0	0	0	0	0	6	1	0	7
53.04	0	1	0	0	0	2	1	0	4
53.05	0	0	0	0	0	5	0	0	5
53.06	0	1	0	0	0	18	0	0	19
53.07	1	1	0	0	0	1	0	0	3
53.08	0	0	0	0	0	3	0	0	3
54.01	1	0	0	0	0	9	21	0	31
54.02	3	1	0	0	0	10	18	0	32
54.03	2	1	0	0	0	9	22	0	34
54.04	0	0	0	0	0	9	22	0	31
54.05	0	1	0	0	0	8	20	0	29
54.06	0	0	0	0	0	13	10	0	23
54.07	1	0	0	0	0	8	25	0	34
55.01	1	0	0	0	0	7	31	0	39
55.02	0	1	0	0	0	7	30	0	38
55.03	0	2	0	0	0	9	0	0	11
56.01	0	0	0	0	0	10	26	0	36
56.02	0	2	0	0	0	13	29	0	44
56.03	0	0	0	0	0	2	0	0	2
56.04	0	0	0	0	0	1	1	0	2
57.01	0	0	0	0	0	5	9	0	14
57.02	0	0	0	0	0	4	0	0	4

TABLE A-III. MARGINS ON GOODS AND SERVICES SOLD TO FINAL DEMAND (continued)

Percent of Purchase Price Allocated to Margins

BEA SECTOR NUMBER	RAIL TRANSPORT (65.01)	TRUCK TRANSPORT (65.03)	WATER TRANSPORT (65.04)	AIR TRANSPORT (65.05)	PIPELINE TRANSPORT (65.06)	WHOLESALE TRADE (69.01)	RETAIL TRADE (69.02)	INSURANCE (70.04)	TOTAL
57.03	0	0	0	0	0	3	8	0	11
58.01	0	2	0	0	0	8	21	0	31
58.02	0	1	0	0	0	7	21	0	29
58.03	0	0	0	0	0	30	0	0	30
58.04	0	0	0	0	0	11	20	0	31
58.05	0	1	0	0	0	3	20	0	25
59.01	0	0	0	0	0	9	0	0	9
59.02	1	7	0	0	0	5	0	0	13
59.03	1	1	0	0	0	3	11	0	16
60.01	0	0	0	0	0	2	0	0	2
60.02	0	0	0	0	0	1	0	0	1
60.03	0	1	0	0	0	0	0	0	1
60.04	0	0	0	0		0	0	0	0
61.01	0	0	0	0		0	0	0	0
61.02	0	1	0	0	0	7	19	0	27
61.03	3	0	0	0	0	2	0	0	5
61.04	1	0	0	0	0	1	0	0	2
61.05	0	1	0	0	0	9	30	0	40
61.06	0	0	0	0	0	0	21	0	21
61.07	0	1	0	0	0	23	16	0	40
62.01	0	0	0	0	0	7	0	0	7
62.02	0	0	0	0	0	7	1	0	8
62.03	0	0	0	0	0	7	0	0	7
62.04	1	0	0	0	0	22	1	0	24
62.05	0	0	0	0	0	19	16	0	35
62.06	0	0	0	0	0	29	0	0	29
62.07	0	0	0	0	0	6	41	0	47
63.01	0	0	0	0	0	11	11	0	22
63.02	0	0	0	0	0	14	54	0	68
63.03	0	0	0	0	0	14	13	0	27
64.01	0	0	0	0	0	6	39	0	45
64.02	0	1	0	0	0	4	34	0	39
64.03	1	0	0	0	0	11	38	0	50
64.04	0	0	0	0	0	9	28	0	37

TABLE A-III. MARGINS ON GOODS AND SERVICES SOLD TO FINAL DEMAND (continued)

Percent of Purchase Price Allocated to Margins

BEA SECTOR NUMBER	RAIL TRANSPORT (65.01)	TRUCK TRANSPORT (65.03)	WATER TRANSPORT (65.04)	AIR TRANSPORT (65.05)	PIPELINE TRANSPORT (65.06)	WHOLESALE TRADE (69.01)	RETAIL TRADE (69.02)	INSURANCE (70.04)	TOTAL
64.05	0	1	0	0	0	12	33	0	46
64.06	0	0	0	0	0	6	42	0	48
64.07	0	0	0	0	0	19	33	0	52
64.08	1	1	0	0	0	15	17	0	34
64.09	2	2	0	0	0	6	37	0	47
64.10	0	1	0	0	0	15	0	0	16
64.11	0	1	0	1	0	17	0	0	19
64.12	0	1	0	0	0	8	19	0	28
65.01	0	0	0	0	0	0	0	0	0
65.02	0	0	0	0	0	0	0	0	0
65.03	0	0	0	0	0	0	0	0	0
65.04	0	0	0	0	0	0	0	0	0
65.05	0	0	0	0	0	0	0	0	0
65.06	0	0	0	0	0	0	0	0	0
65.07	0	0	0	0	0	0	0	0	0
66.00	0	0	0	0	0	0	0	0	0
67.00	0	0	0	0	0	0	0	0	0
68.03	0	0	0	0	0	0	0	0	0
69.01	0	0	0	0	0	0	0	0	0
69.02	0	0	0	0	0	0	0	0	0
70.01	0	0	0	0	0	0	0	0	0
60.02	0	0	0	0	0	0	0	0	0
70.03	0	0	0	0	0	0	0	0	0
70.04	0	0	0	0	0	0	0	0	0
70.05	0	0	0	0	0	0	0	0	0
71.01	0	0	0	0	0	0	0	0	0
71.02	0	0	0	0	0	0	0	0	0
72.01	0	0	0	0	0	0	0	0	0
72.02	0	0	0	0	0	0	0	0	0
72.03	0	0	0	0	0	0	0	0	0
73.01	0	0	0	0	0	0	0	0	0
73.02		0	0	0	0	0	0	0	0
73.03	0	0	0	0	0	0	0	0	0
75.00	0	0	0	0	0	0	0	0	0

TABLE A-III. MARGINS ON GOODS AND SERVICES SOLD TO FINAL DEMAND (continued)

Percent of Purchase Price Allocated to Margins

BEA SECTOR NUMBER	RAIL TRANSPORT (65.01)	TRUCK TRANSPORT (65.03)	WATER TRANSPORT (65.04)	AIR TRANSPORT (64.05)	PIPELINE TRANSPORT (65.06)	WHOLESALE TRADE (69.01)	RETAIL TRADE (69.02)	INSURANCE (70.04)	TOTAL
76.01	0	0	0	0	0	0	0	0	0
76.02	0	0	0	0	0	0	0	0	0
77.01	0	0	0	0	0	0	0	0	0
77.02	0	0	0	0	0	0	0	0	0
77.03	0	0	0	0	0	0	0	0	0
77.04	0	0	0	0	0	0	0	0	0
77.05	0	0	0	0	0	0	0	0	0
78.01	0	0	0	0	0	0	0	0	0
78.04	0	0	0	0	0	0	0	0	0
79.03	0	0	0	0	0	0	0	0	0
81.00	0	0	0	0	0	0	0	0	0
82.00	0	1	0	0	0	11	0	0	12

TABLE A-IV.
1967
ENERGY COST OF GOODS AND SERVICES
(BTU/UNIT FINAL OUTPUT)
CALCULATED WITH DOMESTIC BASE
AND CAPITAL CORRECTIONS

IO SECTOR	INDUSTRY	COAL	CRUDE	REFINED	ELECTRIC	GAS	PRIMARY
700	COAL MINING	1.0035	0.0054	0.0029	0.0006	0.0023	1.0092
800	CRUDE PETRO, GAS	0.0049	1.0546	0.0040	0.0016	0.0246	1.0604
3101	PETRO REFIN PROD	0.0196	1.1991	1.0817	0.0067	0.0868	1.2227
6801	ELECTRIC UTIL	2.0198	1.3543	0.3989	1.1263	0.9208	4.0683
6802	GAS UTILITIES	0.0112	1.1037	0.0106	0.0031	1.0658	1.1166
101	DAIRY	16050	61157	39970	4678	19456	80266
102	POULTRY, EGGS	22614	68491	35711	5596	33013	93561
103	MEAT,ANIMAL PROD	15587	65271	43105	4566	20194	84274
201	COTTON	20049	96877	65265	6052	28198	121727
202	FEED GRAINS	16778	63205	36996	4901	24629	82964
203	TOBACCO	11699	61252	44510	4078	14249	76320
204	FRUITS	11010	39642	23542	3085	15031	52434
205	VEGT,MISC CROPS	9843	40028	24456	2685	14440	51664
206	OIL BEARING CROP	9165	49920	35595	2710	12347	61545
207	FOR,GRHOUSE,NURS	12745	53067	29139	2282	22859	67505
300	FOREST FISH PROD	13669	62755	46507	3070	14669	77622
400	AG FOR,FISH SER	11285	30861	16659	2439	13362	43556
500	IRON ORE MINING	43002	94337	26187	15554	65154	146881
601	COPPER MINING	60222	88714	38950	21397	48236	161908
602	NONFERR MINING	47825	101247	18396	15739	78424	158884
900	STONE CLAY MIN	34990	79586	33874	9260	43097	120219
1000	CHEM MINERAL MIN	37171	165705	21733	15277	139439	212276
1101	NEW CONST RES	17243	42385	20431	4045	20877	62079
1102	NEW CONST NONRES	23563	49554	24146	4553	24152	75728
1103	NEW CONST PUB UT	29188	57651	30376	5136	25754	89704
1104	NEW CONST HIWAYS	23729	105233	75615	4013	25923	132286
1105	NEW CONST OTHER	26228	68879	43904	4028	22726	97651
1201	MAINT CONST RES	13786	40200	22058	3414	17191	55999
1202	MAINT CONST OTHR	14654	47372	29642	2993	16403	63904
1301	GUIDED MISSILES	10745	20306	9803	3759	9998	33344
1302	AMMUNITION	40278	60699	20829	8648	38076	106291
1303	TANKS	49076	56117	19929	8958	34535	110854
1304	FIRE CONTROL EQ	15256	27817	11501	4812	15520	46007
1305	SMALL ARMS	22130	30798	12858	5038	17118	56055
1306	SMALL ARMS AMMUN	41561	53648	20234	7592	30793	99943
1307	OTHER ORDNANCE	30973	40295	13650	7208	25309	75773
1401	MEAT PRODUCTS	16446	61971	37005	4865	23046	81979
1402	BUTTER	18204	72591	36757	5236	33848	94774
1403	CHEESE	19972	64189	34186	5312	28139	87773
1404	CONDENSED MILK	26814	62574	29029	5068	31893	92236
1405	ICE CREAM	20128	50395	25264	5930	23689	74058
1406	FLUID MILK	15417	54263	30999	4801	21632	73043
1407	CANNED SEA FOODS	16859	52725	34700	3562	16299	72028
1408	CANNED SPECIALTY	31469	54291	22370	5324	30543	88115
1409	CANNED FRUIT,VEG	26501	60808	25004	5203	34289	90208
1410	DEHYDRATED PROD	18677	57598	22248	4881	33770	79523
1411	PICKLES,DRESSING	22722	60718	24257	5342	34914	86733
1412	FISH	14811	55285	37290	4109	16148	73123
1413	FROZEN FRUIT,VEG	24767	59441	25285	7477	32587	88586
1414	FLOUR,CEREALS	26028	52681	26776	8943	24404	83656
1415	PREP ANIMAL FEED	24641	70505	32957	6414	35549	99242

IO SECTOR	INDUSTRY	COAL	CRUDE	REFINED	ELECTRIC	GAS	PRIMARY
1416	RICE MILLING	16710	58327	32421	4757	24221	78395
1417	WET CORN MILLING	90178	64047	22458	5608	40135	152213
1418	BAKERY PRODUCTS	15130	39284	16351	4360	21904	57056
1419	SUGAR	38206	101672	31850	3017	67790	141785
1420	CONFECTIONERY	22968	43013	18375	4735	23222	68323
1421	ALCOHOLIC BEV	19326	32659	11736	3394	20157	53485
1422	SOFT DRINKS	20152	49053	17138	4411	30768	71775
1423	FLAVORINGS	16291	41312	15501	3124	24621	59466
1424	COTTONSEED MILLS	33727	99537	54959	13079	41736	141573
1425	SOYBEAN MILLS	23725	63054	37032	4878	24160	89782
1426	VEG OIL MILLS	15638	55695	27318	4427	26756	74497
1427	ANIMAL FATS	29658	96294	40073	6575	52480	130551
1428	COFFEE	11201	25669	11894	2495	13064	38274
1429	COOKING OILS	28409	73002	32904	6521	38210	105340
1430	MANUFACTURED ICE	87158	64355	25484	32316	37352	165948
1431	MACARONI	22048	45227	21106	6361	22754	70749
1432	FOOD PREPARATION	21123	47647	20033	4546	26072	71297
1501	CIGARETTES	9458	23012	12971	2408	9362	33938
1502	TOBACCO STEMMING	10502	52276	37840	3605	12544	65657
1601	BROAD FAB MILLS	41336	66429	27177	11069	37415	114588
1602	NAR FABRIC MILLS	32522	54579	17920	7997	34979	91999
1603	YARN MILLS	44235	65923	26026	12038	38118	117605
1604	THREAD MILLS	39298	59523	24591	11209	33388	105766
1701	FLOOR COVERINGS	35178	65387	25714	9037	37810	106066
1702	FELT GOODS	20246	49928	23870	5462	24875	73578
1703	LACE GOODS	30918	52625	19268	6891	31851	87682
1704	UPHOLSTERY FILL	20459	52511	16784	5106	34032	76161
1705	PROC TEX WASTE	17537	57451	14953	5864	40513	78738
1706	COATED FABRICS	34894	70376	27660	9046	40652	110811
1707	TIRE CORD	73113	86804	20816	14190	62893	168148
1708	SCOURING PLANTS	14351	52155	33449	4639	17860	69504
1709	CORDAGE, TWINE	28767	46761	19259	6594	26067	79481
1710	TEXTILE GOODS	32502	55766	21015	6755	31904	92312
1801	HOSIERY	29031	46173	17076	7569	27747	79837
1802	KNIT APPRL MILLS	26895	43421	16769	6903	25419	74536
1803	KNIT FAB MILLS	46252	71367	26600	10269	42712	123841
1804	APPARL,PURCH MAT	20603	35346	15216	5646	19160	59413
1901	CURTAINS	25771	46931	17726	6903	27844	76952
1902	HOUSEFURNISHINGS	35077	56859	23292	9131	31987	97575
1903	FAB TEXTILE PROD	25372	43795	16922	6267	25572	73019
2001	LOGGING	10395	50990	36536	2270	12693	63226
2002	SAWMILLS	16533	55392	30159	6068	23387	75819
2003	HARDWD FLOORING	17769	43242	21345	5978	20520	64492
2004	SPEC PROD SAWMIL	9833	33700	21059	3351	11583	45705
2005	MILLWORK	15528	36702	17194	4843	18243	55008
2006	VENEER,PLYWOOD	19318	54970	24340	6927	28188	78517
2007	PREFAB WD STRUC	19110	42414	21239	4726	19821	64108
2008	WOOD PRESERVING	24491	88075	31991	6128	53357	116676
2009	WOOD PRODUCTS	22862	55834	20965	7016	32643	82755
2100	WOOD CONTAINERS	15067	40742	19834	4633	19544	58691
2201	WOOD H'HOLD FURN	17279	34073	15979	4988	16969	54432
2202	UPH H'HOLD FURN	18351	34849	16029	4890	17805	56215
2203	MET H'HOLD FURN	43147	56948	18015	8490	37089	105337
2204	MATTRESSES	27609	40137	15956	5240	22974	70968
2301	WOOD OFC FURN	20881	32898	15409	4488	16580	56500
2302	METAL OFC FURN	35007	39889	13354	5366	25327	78341
2303	PUBLIC BLDG FURN	27116	41703	14271	5622	26136	72239
2304	WOOD FIXTURES	17039	34689	13780	4585	19820	54407
2305	MET FIXTURES	44736	46641	15402	6272	29838	95478
2306	BLINDS, SHADES	35502	46816	16033	7204	29408	86813
2307	FURN, FIXTURES	27647	38537	14571	5540	22828	69610
2401	PULP MILLS	45325	166805	74094	14197	88340	220759
2402	PAPER MILLS	81674	130306	53855	15471	72801	221548
2403	PAPERBOARD MILLS	76656	157856	65617	11125	87585	241349
2404	ENVELOPES	31853	60318	25566	7142	32299	96571
2405	SANIT PAPER PROD	38925	69116	30529	8319	36649	113173
2406	BUILDING PAPER	68885	129559	43434	18019	81872	209545
2407	CONV PAPER PROD	36192	73816	31737	8273	39238	115097
2500	PAPERBOARD CONT	40766	88009	37138	7509	47647	133411
2601	NEWSPAPERS	21995	39168	17510	5153	20487	64290
2602	PERIODICALS	19305	39820	18884	4398	19607	61827
2603	BOOK PUBLISHING	16957	34363	15679	4116	17513	53849
2604	MISC PUBLISHING	12518	26866	10216	3077	15746	41285
2605	COMM PRINTING	27579	51853	19651	6733	29941	83542
2606	BUSINESS FORMS	26611	49510	18932	5475	29025	79442
2607	GREETING CARDS	16372	30982	13806	3971	16307	49780
2608	MISC PRINTING	12863	29192	9098	3892	18935	44477
2701	INORG-ORG CHEM	85615	201556	27965	26146	167063	303231
2702	FERTILIZERS	45507	131516	29671	16095	99227	187051
2703	AG CHEMICALS	44393	127829	49296	13153	78235	180411

IO SECTOR	INDUSTRY	COAL	CRUDE	REFINED	ELECTRIC	GAS	PRIMARY
2704	MISC CHEM PROD	44555	146231	51709	10339	63727	197303
2801	PLASTICS	65074	166855	60307	18040	101457	243130
2802	SYN RUBBER	63079	253557	118319	19345	129055	328882
2803	MAN-MADE FIBERS	134099	93210	23966	10781	66129	233443
2804	ORGANIC FIBERS	64847	86259	17842	12762	65283	158840
2901	DRUGS	19113	42736	16811	5232	24661	65055
2902	CLEANING PREP	33119	77812	22413	8564	52088	116207
2903	TOILET PREP	22530	51548	18123	6019	31434	77775
3000	PAINT PRODUCTS	35695	94450	33188	9838	58076	136215
3102	PAVING	52477	521944	429021	7453	79481	578968
3103	ASPHALT	32420	457447	367564	8891	78457	496210
3201	TIRES	37864	61693	21900	9033	38895	101949
3202	RUBBER FOOTWARE	21006	44309	19841	6864	24003	66836
3203	MISC RUBBER PROD	33851	71240	29514	8893	39471	110544
3204	MISC PLASTICS	33382	76401	28218	10252	45900	116079
3300	INDUST LEATHER	18948	40141	17901	3771	20392	61417
3401	FOOTWARE CUT STK	22246	49692	18511	4840	29380	74920
3402	FOOTWARE EXC RUB	14472	29827	13557	3849	15239	46673
3403	MISC LEATHER	16855	34809	13693	4387	19952	54368
3501	GLASS PRODUCTS	23050	84620	13479	7680	68617	112214
3502	GLASS CONTAINERS	27689	132497	25316	10281	104087	166804
3601	CEMENT	251132	249907	37578	27534	203484	517502
3602	BRICKS	61666	298469	36275	10358	251219	367046
3603	CERAMIC TILE	19438	95193	17501	7666	74523	119463
3604	CLAY REFRACT	25775	162746	28517	8215	128770	193862
3605	CLAY PRODUCTS	54311	220814	21412	7592	190487	280166
3606	PLUMBING FIXTURE	20060	74569	15958	5921	56289	98348
3607	FOOD UTENSILS	23647	75602	11010	5545	61869	102732
3608	PORCEL ELEC SUPP	21931	54305	12360	6927	40289	80493
3609	POTTERY PRODUCTS	15601	77660	29044	5785	47088	96921
3610	CONCRETE BLOCKS	47475	100872	36799	7662	62035	153097
3611	CONCRETE PRODUCT	42495	70851	23022	6349	46042	117234
3612	READY-MIX CONCR	69366	119475	45289	9554	71888	194712
3613	LIME	282463	255590	34129	14790	212204	546750
3614	GYPSUM PRODUCTS	34565	130151	38532	10630	88302	171385
3615	STONE PRODUCTS	18633	34347	18363	6581	15619	56981
3616	ABRASIVE PRODUCT	25640	45617	17556	8926	26583	76679
3617	ASBESTOS PRODUCT	29427	84100	40107	9075	42348	119140
3618	GASKETS	25830	61466	30430	6407	29421	91248
3619	TREATED MINERALS	29911	116787	41102	9661	73051	152759
3620	MINERAL WOOL	44339	116686	19837	11663	91387	168242
3621	NONCLAY REFRACT	55123	101700	23525	9016	75110	162366
3622	NONMET MIN PROD	17982	79113	23126	6554	53591	101215
3701	STEEL PROD	164893	108580	30537	14004	75113	282390
3702	IR,STL FOUNDRIES	44811	54252	14696	8756	37853	103755
3703	IR,STL FORGING	85205	90181	29396	9660	58721	180458
3704	PRIMARY MET PROD	43220	104621	18796	19431	82165	157480
3801	PRIMARY COPPER	41229	104661	38609	14640	64727	154408
3802	PRIMARY LEAD	39732	76535	21147	9510	53469	121755
3803	PRIMARY ZINC	120495	168604	22385	24002	138978	303306
3804	PRIM ALUMINUM	168244	207733	39508	83212	160998	428437
3805	PRIM NONFER MET	55178	104158	24785	23369	76348	173590
3806	SEC NONFERR MET	18306	60982	20943	6354	39112	82812
3807	COPPER ROLLING	31782	73991	28435	11853	44816	112783
3808	ALUM ROLLING	99234	141412	28942	47615	107786	270424
3809	NONFER ROLLING	42065	76732	18340	15285	56124	128048
3810	NONFER WIRE	31114	63270	23471	11651	38970	101379
3811	ALUM CASTINGS	50715	88755	18201	22228	67554	153136
3812	BRASS,OTHR CAST	28760	61411	19156	10360	40980	96337
3813	NONFER CASTING	42889	68808	14513	13859	52039	120113
3814	NONFER FORGING	60661	92154	21856	18741	67483	164215
3901	METAL CANS	76553	70359	21651	10356	46650	153477
3902	METAL BARRELS	73406	74521	24108	9121	48315	153551
4001	METAL SANIT WARE	40260	64294	17294	6893	44744	108370
4002	PLUMB FITTINGS	28323	49772	18290	7468	30134	82301
4003	HEATING EQUIP	32581	42193	15217	6233	25954	78488
4004	FAB STRUC STEEL	69149	62262	19621	8384	40952	136902
4005	METAL DOORS	48551	69575	17682	17540	49632	128624
4006	FAB PLATE WORK	55202	55612	17990	7466	36113	115544
4007	SHEET METAL WORK	57995	61364	19448	10134	40238	125682
4008	ARCH METAL WORK	61597	62359	18102	10341	42414	130473
4009	MISC METAL WORK	79388	67762	20238	10274	45584	153938
4101	SCREW MACH PROD	44323	45098	14524	6896	29364	93643
4102	METAL STAMPINGS	61130	54953	17270	8876	36078	121704
4201	CUTLERY	20182	32494	14094	4487	17654	55317
4202	HANDTOOLS	31910	38653	13291	5301	24273	73845
4203	HARDWARE	36331	41475	13370	6706	26806	82005
4204	COAT, ENGRAV SER	20015	62581	16604	7806	42784	86770
4205	FAB WIRE PRODUCT	90405	72645	22224	9385	48236	169489
4206	SAFES, VAULTS	35942	34093	12024	4982	21134	73283

IO SECTOR	INDUSTRY	COAL	CRUDE	REFINED	ELECTRIC	GAS	PRIMARY
4207	STEEL SPRINGS	66313	68602	18047	7746	48321	139906
4208	PIPE	30108	48061	21372	5922	25720	81634
4209	COLLAPSIBLE TUBE	36882	67769	19412	17614	46286	115187
4210	METAL FOIL, LEAF	46321	84620	23665	20372	58124	143094
4211	FAB METAL PROD	54416	54381	17083	8847	35477	114477
4301	STEAM ENGINES	32968	42651	19024	5647	22676	78994
4302	INT COMBUST ENG	27684	38008	13512	6611	23360	69641
4400	FARM MACHINERY	35390	40414	13572	5600	25724	79183
4501	CONST MACHINERY	33481	37971	12624	5745	24272	74932
4502	MINING MACHINERY	35101	39908	13121	5944	25642	78606
4503	OIL FIELD MACH	30365	45949	20031	6016	25041	79664
4601	ELEVATORS	27030	35026	13067	5197	21061	65163
4602	CONVEYORS	32469	36096	12181	5167	22909	71777
4603	HOISTS, CRANES	33000	37406	12474	5804	23863	73996
4604	INDUSTRIAL TRUCK	28544	34632	12385	4713	21320	66033
4701	MET CUTTING TOOL	18533	25260	9546	4053	15071	46251
4702	MET FORMING TOOL	27642	33423	12290	5410	20273	64420
4703	SPECIAL DIE TOOL	25747	32309	10976	5456	20417	61418
4704	MET'WORKING MACH	24545	34722	11567	5642	22153	62669
4801	FOOD PROD MACH	23515	30884	11358	4239	18652	56981
4802	TEXTILE MACH	26204	36397	16496	5539	19076	65949
4803	WOODWORKING MACH	22683	29545	10216	4509	18444	54987
4804	PAPER IND MACH	29652	35571	13234	4947	21348	68299
4805	PRINTING MACH	18282	26756	10281	4081	15693	47481
4806	SPECIAL IND MACH	26471	35744	13028	5635	21701	65641
4901	PUMPS,COMPRESORS	24506	33574	12235	5095	20382	61145
4902	BEARINGS	40811	43890	14809	6846	27885	89025
4903	BLOWERS	27466	38017	13273	5837	23717	68990
4904	INDUST PATTERNS	16032	29457	10834	5181	17846	48499
4905	POWER TRANS EQ	27188	35512	11830	5387	22681	65971
4906	INDUS FURNACES	33896	41944	14845	5458	25994	79178
4907	GENERAL IND MACH	28150	39616	14299	5818	24216	71245
5000	MACH SHOP PROD	24854	33295	11180	5726	21184	61673
5101	COMPUTING MACH	16073	28315	12563	4441	14972	47116
5102	TYPEWRITERS	14617	26132	9541	3728	15707	43016
5103	SCALES	31525	36485	13836	5905	21479	71854
5104	OFC MACHINES	22212	31818	12703	4516	18119	56859
5201	MERCH'DISE MACH	27912	38819	14496	5648	23301	70194
5202	LAUNDRY EQUIP	32839	41579	16704	5881	23904	78095
5203	REFRIG MACH	30504	42988	15377	6716	26383	77610
5204	MEASURING PUMPS	24549	33723	13184	4828	19736	61238
5205	SERVICE IND MACH	29716	41763	15010	5456	25613	74803
5301	ELEC MEAS INSTR	13382	23423	9524	4021	13339	39222
5302	TRANSFORMERS	35795	42310	16039	7258	25095	82671
5303	SWITCHGEAR	19356	29748	11425	5096	17600	52207
5304	MOTORS,GENERATOR	29002	37619	13384	6260	23244	70507
5305	IND CONTROLS	15875	24896	10056	4288	14226	43378
5306	WELDING APPARAT	38922	50580	13739	6793	35142	93686
5307	CARBON PRODUCTS	59267	92364	18731	25479	70008	167435
5308	ELEC IND APPARAT	22490	40240	15450	6031	23666	66313
5401	H'HOLD COOK EQ	36885	48606	16189	6524	30771	89525
5402	H'HOLD REFRIG EQ	35702	45515	15285	7088	28779	85637
5403	H'HOLD LAUNDRY	39804	49156	16145	7508	31506	93668
5404	ELECTRIC H'WARES	29072	45420	16742	7117	27289	78791
5405	H'HOLD VACUUMS	22712	38196	13428	5669	23595	64286
5406	SEWING MACHINES	22336	33622	15797	8094	17264	60941
5407	H'HOLD APPLIANCE	38141	50942	16999	6783	32225	93265
5501	ELECTRIC LAMPS	12913	34590	9747	4462	23753	50113
5502	LIGHT FIXTURES	29220	45694	14781	6932	29587	79174
5503	WIRING DEVICES	34680	42290	14521	6923	26597	81331
5601	RADIO,TV SETS	16613	30936	11941	4738	18056	50432
5602	PHONO RECORDS	16829	47227	19088	5536	26780	67276
5603	PHONE,TELEGR EQ	15931	24472	9000	4098	14684	42934
5604	R-TV COMMUN EQ	13068	22162	9107	4126	12434	37782
5701	ELECTRON TUBES	18208	38670	10947	5945	26374	60509
5702	SEMICONDUCTORS	18851	35431	12284	6851	21935	58526
5703	ELECTRONIC COMP	20186	35098	13491	6066	20590	59025
5801	STORAGE BATTERY	31257	70292	20181	10509	47938	107873
5802	PRIMARY BATTERY	23924	41728	11693	7001	28692	69944
5803	X-RAY EQUIPMENT	13703	24653	11119	3286	13200	40340
5804	ENGINE ELEC EQ	27715	36835	12350	6302	23523	68472
5805	ELECTRICAL EQUIP	21584	46921	17250	6571	28602	72447
5901	TRUCK,BUS BODIES	36763	47682	16415	7102	29860	88717
5902	TRUCK TRAILERS	38535	51894	18766	8952	31687	95799
5903	MOTOR VEH & PART	32525	40439	14462	6244	24809	76773
6001	AIRCRAFT	15464	25207	9318	4972	15171	43712
6002	AIRCRAFT ENGINES	20818	30371	12111	5702	17424	54702
6003	AIRCRAFT PROPELL	26011	41441	15921	6017	24375	71073
6004	AIRCRAFT EQUIP	19014	28553	10016	5733	17680	51100
6101	SHIPBUILDING	30463	37613	14538	6662	22072	72189

IO SECTOR	INDUSTRY	COAL	CRUDE	REFINED	ELECTRIC	GAS	PRIMARY
6102	BOATBUILDING	22915	45663	17830	6635	26534	72254
6103	LOCOMOTIVES	28297	30443	12554	4622	17124	61691
6104	RR, STREET CARS	58911	59348	19398	9426	38099	124381
6105	MOTOR, BICYCLES	34778	43837	15042	6142	27413	82370
6106	TRAILER COACHES	27548	47620	19024	7643	27216	79561
6107	TRANSPORT EQUIP	49069	54582	18393	8719	34466	109166
6201	SCIEN INSTR	16607	32271	12660	4596	18698	51684
6202	MECH MEAS DEVICE	17562	30875	12405	4686	17616	51320
6203	TEMP CONTROLS	18087	29327	10859	4520	17598	50209
6204	MEDICAL INSTR	30103	38398	13619	5363	23580	71859
6205	SURGICAL SUPPLY	17525	37200	15358	4569	20504	57482
6206	DENTAL EQUIPMENT	21493	33105	11509	5248	20592	57853
6207	WATCHES, CLOCKS	18288	29060	11261	4520	16920	50146
6301	OPTICAL INSTR	16351	28874	10870	4750	17249	48123
6302	OPHTHALMIC GOODS	14253	38765	16086	4682	21836	55956
6303	PHOTOGRAPHIC EQ	16933	36226	12347	5096	22458	56302
6401	JEWELRY	17441	33355	11467	5470	20729	54179
6402	MUSICAL INSTR	22913	38057	16491	4673	20537	63841
6403	GAMES	24611	48019	19827	5985	26682	76296
6404	ATHLETIC EQUIP	24182	42257	16612	6201	24252	70267
6405	PENS AND PENCILS	22163	39502	16504	5364	21797	64967
6406	ARTIFICAL FLOWER	26541	61917	25488	7034	34633	92734
6407	CLOTH FASTENERS	28388	43352	17172	6633	24981	75851
6408	BRUSHES	22912	50013	21922	5610	26728	76337
6409	HARD FLOOR COV	28460	53295	20146	6608	31522	85804
6410	MORTICIAN GOODS	28805	48149	17411	6133	29307	80726
6411	SIGNS, ADS	25470	42537	16592	5171	24708	71182
6412	MISC MFG	23538	39529	15852	5256	22135	66304
6501	RAILROAD	15178	80089	60847	3097	17066	97685
6502	LOCAL TRANSPORT	15335	66015	49307	7126	15246	84307
6503	MOTOR FGT TRANSP	7739	48458	36825	1993	10299	58149
6504	WATER TRANSPORT	26864	242461	192478	6910	39784	281490
6505	AIR TRANSPORT	11146	217038	177026	4081	28783	242174
6506	PIPE LINE TRANSP	41325	73872	32538	22172	49925	116798
6507	TRANSP SERVICES	4576	4776	2084	1074	3232	8730
6600	COMMUNICATIONS	6290	15321	8290	2777	8100	21912
6700	R-TV BROADCAST	11109	25970	10736	4239	14530	39694
6803	WATER,SANIT SER	28458	87263	21888	7740	63165	120483
6901	WHOLSALE TRADE	6877	31244	23812	2221	8517	39636
6902	RETAIL TRADE	8627	28256	14607	4009	13823	39372
7001	BANKING	6531	15039	5854	2538	8805	23026
7002	CREDIT AGENCIES	26704	59072	23129	9616	34454	91177
7003	SEC, COMMOD BROK	3115	10960	6808	849	3817	14648
7004	INSUR CARRIERS	5271	19728	11688	1659	7442	26143
7005	INSURANCE AGENTS	4974	24345	16548	1540	7022	30546
7101	OWNER-OCC DWLNG	1736	5939	3370	481	2395	7971
7102	REAL ESTATE	5726	19291	9302	1807	9480	26120
7201	HOTELS	24104	62395	29964	8388	31089	91299
7202	PERSONAL SERVICE	13157	46573	28626	3495	16455	62055
7203	BARB,BEAUT SHOPS	5967	12844	4109	2267	8534	20039
7301	MISC BUS SERVICE	8905	23648	11089	2288	11890	33902
7302	ADVERTISING	18983	35163	15296	4830	18668	56443
7303	MISC PROF SER	3601	26477	13620	1176	12158	31384
7500	AUTO REPAIR	21569	52219	30548	5001	20175	76733
7601	MOTION PICTURE	11626	30776	14777	4454	15185	45046
7602	AMUSMNT,REC SER	7745	23967	12668	2534	10633	33306
7701	DOCTORS,DENTISTS	2983	15342	10316	942	4909	18953
7702	HOSPITALS	19864	40854	13911	8132	25562	65697
7703	MED, HEALTH SER	13804	43222	12197	5769	29375	60675
7704	EDUCATIONAL SER	22433	46477	20850	6834	24491	72947
7705	NONPROFIT ORG	19571	50050	21702	8573	27069	74978
7801	POST OFFICE	5530	34842	26086	1978	7551	41755
7804	FED GOVT ENTERP	8700	30086	8008	3612	22128	40484
7903	ST,LOC GOVT ENTR	19484	90105	22658	6855	65154	113787
8100	BUSINESS TRAVEL	15592	90951	67126	4552	21599	109025
8200	OFFICE SUPPLIES	26564	51197	20279	6042	28950	81485

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TABLE A-V. MAJOR PRODUCTS OF COMMON BEA SECTORS

BEA Sector*	Source**	Major Products***		1967 Implied Price
9.00	A	1422 Crushed and Broken Limestone	28%	
		1429 Crushed and Broken Stone, n.c.c.	8%	
		1442 Construction Sand and Gravel	27%	
11.02	B	New Construction Industrial Buildings	24%	
		New Construction Office Buildings	14%	
		New Construction Stores, Restaurants	10%	
		New Construction Education Buildings	24%	
		New Construction Hospital Buildings	7%	
		New Construction Other Non-farm	12%	
11.03	B	New Construction Telephone, Telegraph	15%	
		New Construction Electric Utilities	42%	
		New Construction Gas Utilities	14%	
		New Construction Water Supply	12%	
		New Construction Sewers	10%	
11.05	B	New Construction Farm Residential	8%	
		New Construction Farm Service	10%	
		New Construction Oil/Gas Wells	28%	
		New Construction Military	9%	
		New Construction Conservation & Development	29%	
		New Construction Other Non-building	13%	
12.02	B	Maintenance Construction Other Non-farm	42%	
		Maintenance Construction Railroads	6%	
		Maintenance Construction Water Supply	6%	
		Maintenance Construction Military	5%	
		Maintenance Construction Highways	17%	
27.01	C	28151 Cyclic Intermediates	7%	
		28182 Miscellaneous Acyclic Chemicals and Chemical Products	30%	
		28191 Synthetic Ammonia, Nitric Acid and Ammonia Compounds	6%	56.10 $/short ton
		28199 Other Inorganic Chemicals n.e.c.	7%	104.00 $/short ton
27.04	C	28911 Glues, Adhesives, and Sizes	12%	.20 $/lb.
		28921 Explosives (except government owned and contractor-operated plants)	7%	

*Includes sectors providing more than 1% of the capital costs or more than 5% of the non-energy operating costs for any of the six energy facilities in Just, et al., New Energy Technology Coefficients and Dynamic Energy Models.

**See Code at end of table.

***A major product is one accounting for ≥ 5% of the control total for the sector considered unless noted. See code for explanation of control total.

n.e.c. = not elsewhere classified.

n.s.k. = not specified by kind.

TABLE A-V. MAJOR PRODUCTS OF COMMON BEA SECTORS (continued)

BEA Sector	Source	Major Products		1967 Implied Price
		2893 Printing Ink	9%	.54 $/lb.
		2895 Carbon Black	5%	.07 $/lb.
		28993 Essential Oils, Fireworks, and Pyrotechnics and Chemicals and Chemical Preparation	34%	.28 $/lb.
36.01	C	32410 11 Portland Cement	94%	3.20 $/bbls. of 376 lbs.
36.10	C	32710 13 Lightweight Aggregate Structural Block	53%	
		32710 16 Heavyweight Aggregate Structural Block	23%	.20 $/Block
		32710 00,02 Concrete Block and Brick n.s.k.	18%	
36.12	C	32730 11 Ready-mix Concrete	100%	14.40 $/cu.yd.
36.17	C	32922 Asbestos Friction Materials	26%	
		32926 Vinyl Asbestos Floor Tile	27%	1.07 $/sq.yd.
		32927 Asbestos Textile and other Asbestos and Non-asbestos Cement Products	38%	
36.19	C	32950 11 Lightweight Aggregate	9%	
		32950 20 Dead-burned Magnesia or Magnesite	10%	
		32950 31 Crushed Slag	14%	1.78 $/short ton
36.20	C	32961 -- Mineral Wool for Structural Insulation	28%	
		32961 27 3.0 to 4.4 inches thick Building Batts, Blankets and Rolls;	9%	.04 $/sq.ft.
		32961 33 2.0 to 2.9 inches thick Blankets (flexible including Fabricated pieces, rolls, and batts:	5%	.04 $/sq.ft.
		32962 31 Plain	18%	
		32962 36 Faced and Metal Meshed	7%	
		32962 51 Blocks and Boards	17%	.05 $/bd.ft.
		32962 61 Pipe Insulation	8%	.31 $/ln.ft.
		32962 71 Acoustical Pads and Boards	8%	.22 $/sq.ft.
		32962 98 Other Mineral Fibers for Industrial Equipment, and Appliance Insulation such as loose fiber (shipped as such) granulated fiber felts, insulating and finishing cements, etc.	5%	
36.21	C	32970 15 Magnesite and Magnesite-chrome Brick and Shapes	30%	.96 $/9" equiv.
		32970 21 Chrome and Chrome-magnesite Brick and Shapes	6%	.85 $/9" equiv.

TABLE A-V. MAJOR PRODUCTS OF COMMON BEA SECTORS (continued)

BEA Sector	Source	Major Products		1967 Implied Price
		32970 35 Carbon refractories; brick, blocks and shapes, excluding those containing natural graphite	14%	1.62 $/9" equiv.
		32970 65 Basic plastic refractories and ramming mixes, wet and dry types	6%	113 $/short ton
		32970 92 Nonclay gumming mixes	7%	86.30 $/short ton
37.01	C	33121 pt. Coke Oven and Blast Furnace Products, except Ferroalloys	5%	
		33122 Steel Ingot and Semi-finished Shapes	11%	
		33123 Tin Mill Products, Hot-rolled Sheet & Strip	20%	
		33124 Hot-rolled Bars and Barshapes; Plates	19%	
38.10	C	33571 33521 Aluminum and Aluminum-base Alloy Wire and Cable	7%	714 $/short ton
		33572 Copper and Copper-base Alloy wire, including Strand and Cable, Bare and Tinned for Dectrical Transmission	10%	1070 $/short ton
40.04	C	34410 Fabricated Structural Metal n.s.k.	9%	
		34411 Fabricated Structural Metal for Buildings	48%	337 $/short ton
		34412 Fabricated Structural Metal for Bridges	11%	363 $/short ton
		34413 Other Fabricated Structural Metal	19%	438 $/short ton
40.06	C	34431 Heat Exchangers and Steam Condensers	13%	
		34432 Fabricated Steel Plate, including Stack and Weldments	20%	
		34433 Steel Power Boilers, Parts and Attachments (over 15 p.s.i. steam working pressure)	20%	45800 $/unit
		34437 Metal Tanks, Complete at Factory (standard line, non-pressure)	7%	231 $/unit
		34438 Metal Tanks and Vessels, Custom Fabricated at the Factory	18%	
		34439 Metal Tanks and Vessels, Custom Fabricated and Field Erected	7%	273 $/unit
41.01	C	3451- Screw Machine Products	36%	
		34521 Bolts, Nuts, and Other Standard Industrial Fasteners	36%	
		34533 Special Industrial Fasteners	13%	
		34523 Headed Products Other than Industrial Fasteners	6%	

TABLE A-V. MAJOR PRODUCTS OF COMMON BEA SECTORS (continued)

BEA Sector	Source	Major Products		1967 Implied Price
41.02	C	34612 Job Stampings, except Automotive	19%	
		34613 Job Stamping, Automotive	58%	
		34618 Other Stamped and Pressed Metal End Products	6%	
42.08	C	34941 Automatic Regulating and Control Values	9%	
		34942 Valves for Power Transfer (pneumatic and hydraulic)	7%	308 $/unit
		34943 Other Metal Valves for Piping Systems and Equipment (except plumbing and heating valves)	27%	216 $/short ton
		34945 Metal Fittings, Flages, and Union for Piping Systems	15%	
		34980 13 Iron and Steel Fabricated Pipe and Pipe Fittings	12%	
43.01	C	35111,2 Steam, Gas and Hydraulic Turbine and Turbine Generator Set Units and Parts	80%	
43.02	C	35191 Gasoline Engines under 11 h.p. except Aircraft, Auto, Truck, Bus and Tank	10%	50 $/unit
		35192 Gasoline Engines 11 h.p. and Over, except Aircraft, Automobile, Truck, Bus and Tank	6%	
		35193 Diesel Engines (except for trucks and Buses)	33%	2690 $/unit
		35195,7 Outboard Motors and Tank and Converted Internal Combustion Engines	11%	
		35199 Parts and Accessories for Internal Combustion Engines	33%	
45.01	C	35313 Parts and Attachments for Tracklaying-type Tractors, Contractors, Contractors' Off-highway Wheel Tractors, and Tractor Shovel Leaders	13%	
		35314 Power Cranes, Draglines, Shovels, and Parts	15%	
		35317 Tractor Shovel Loaders, Excluding Parts and Attachments	16%	
		35318 Scrapers, Graders, Rollers, and Off-highway Trucks, Trailers and Wagons	10%	
		35319 Other Construction Machinery and Equipment, including Parts	12%	
45.02	C	35321 Underground Mining and Mineral Benefication Machinery and Equipment	19%	
		35322 Crushing, Pulverizing, and Screening Machinery	15%	

TABLE A-V. MAJOR PRODUCTS OF COMMON BEA SECTORS (continued)

BEA Sector	Source	Major Products		1967 Implied Price
		35323 All Other Mining Machinery and Equipment	10%	
		35324 Parts and Attachments for Mining Machinery and Equipment	49%	
		35320 Mining Machinery n.s.k.	7%	
45.03	C	35331 Rotary Oil and Gas Field Drilling Machinery and Equipment	37%	
		35332 Other Oil and Gas Field Drilling Machinery and Equipment	7%	
		35333 Oil and Gas Field Production Machinery and Equipment (except pumps)	39%	
		35334 Other Oil and Gas Field Machinery and Tools (except pumps) including Water Well	10%	
		35330 Oil Field Machinery n.s.k.	7%	
46.02	C	35351 Conveyors and Conveying Equipment (except hoists and farm elevators)	73%	
		35352 Parts, Attachments, and Accessories for Conveyors and Conveying Systems	18%	
		35350 Conveyors and Conveying Equipment n.s.k.	9%	
46.03	C	35361 Hoists	38%	
		35362 Overhead Traveling Cranes and Monorail Systems	56%	14 million $/unit
		35360 Hoists, Cranes and Monorails n.s.k.	7%	
48.06	C	35591 Chemical Manufacturing Industries Machinery and Equipment and Parts	17%	
		35592 Foundry Machinery, and Equipment, Excluding patterns and molds	9%	
		35593 Plastics-working Machinery and Equipment excluding patterns and molds	15%	20400 $/unit
		35594 Rubber-working Machinery and Equipment excluding the molds	7%	
		35595 Other Special Industry Machinery and Equipment	47%	
		35590 Special Industry Machinery n.s.k.	6%	
49.01	C	35611 Industrial Pumps, except Hydraulic Fluid Power Pumps	26%	
		35612 Hydraulic Fluid Power Pumps and Motors and Vacuum Pumps	13%	91000 $/unit
		35613 Domestic Water Systems and Pumps, Including Pump Jackets and Cylinders	8%	

TABLE A-V. MAJOR PRODUCTS OF COMMON BEA SECTORS (continued)

BEA Sector	Source	Major Products		1967 Implied Price
		35614 Air and Gas Compressors, except Refrigerator Compressor	29%	851000 $/unit
		35615 Pumps and Compressors n.e.c. except Refrigerator Compressor	12%	
		35616 Parts and Attachments for Pumps and Compressors, n.s.k.	22%	
49.03	C	35641 Industrial Fans and Blowers	59%	
		35642 Dust Collection, Air Purification Equipment and Air Washers	37%	
49.05	C	35661 Plain Bearing	9%	
		35662 Speed Changers, Industrial High Speed Drivers, and Gears	39%	
		35663 Other Mechanical Power Transmission Equipment	47%	
49.06	C	35671 Electric Industrial Furnaces and Ovens, Metal Processing	22%	
		35672 Fuel-fired Industrial Furnaces and Ovens, Metal Processing	37%	22 $/unit
		35673 High Frequency Induction and Dielectric Heating Equipment and Parts, Attachments and Components	36%	
49.07		No Subclassifications		
51.01	C	35731 Electronic Computing Equipment, except Parts and Attachments	67%	
		35733 Parts and Attachments for Electronic Computing Equipment	19%	
		35741 Calculating and Accounting Machines, including cash registers, except parts and attachments	10%	
52.05	C	35891 Commercial Cooking and Food Warming Equipment	29%	
		35892 Service Industry Machinery and Parts	57%	
		35890 Service Industry Machines n.e.c., n.s.k.	9%	
53.02	C	36121 Natural-draft Type Transformers (specialty transformers)	18%	3.06 $/unit
		36122 Power and Distribution Transformers, except Parts	70%	447 $/unit
		36123 Power Regulators, Boosters, Reactors, Other Transformers, and Transformer Parts.	11%	

TABLE A-V. MAJOR PRODUCTS OF COMMON BEA SECTORS (continued)

BEA Sector	Source		Major Products		1967 Implied Price
53.03	C	36131	Switchgear, except Ducts and Relays	29%	
		36132	Power Circuit Breakers, All Voltage	13%	
		36133	Low Voltage Panelboards and Distribution Boards and Other Switching the Interrupting Devices, 750 Volts and Under	24%	
		36135	Molded Circuit Breakers, 750 Volts and Under	11%	
		36137	Relays, Control Circuit	12%	
53.04	C	36211	Fractional Horsepower Motors	36%	6600 $/unit
		36212	Integral Horsepower Motors and Generators (except for land xpo equipment	25%	209 $/unit
		36213	Land xpo Motors, Generators, and Control Equipment and Parts	6%	
		36214	Prime Mover Generator Sets, except Steam or Hydraulic Turbine	10%	1590 $/unit
		36215	Motor-Generator Sets and Other Rotating Equipment	15%	3280 $/unit
		36216	Parts and Supplies for Motors Generator Generators, Motor Generator Sets except for Land Transportation Equipment	7%	
53.05			No Subclassifications	100%	
53.06	C	36231	Arc Welding Machines Components, and Accessories, except Electrodes	32%	338 $/unit
		36232	Arc Welding Electrodes, Metal	38%	.22 $/lb.
		36233	Resistance Welders, Components, Accessories and Electrodes	20%	
		36230	Welding Apparatus n.s.k.	9%	
55.03	C	36430	Current Carrying Wiring Devices, Including Lightning Rods	59%	
		36441	Pole Line and Transmission Hardware	10%	
		36442	Electrical Conduit and Conduit Fitting	23%	
		36443	Other Non Current Carrying Wiring Devices and Supplies	7%	.20 $/lb.
62.02	C	38211	Aircraft Engine Instruments Except Flight	9%	
		38212	Integrating Meters, Nonelectric Type	14%	55 $/unit
		38213	Industrial Process Instruments	55%	
		38214	Motor Vehicle Instruments except Electric	5%	
		38216	Other Mechanical Measuring and Controlling Instruments	14%	1600 $/unit

TABLE A-V. MAJOR PRODUCTS OF COMMON BEA SECTORS (continued)

BEA Sector	Source	Major Products		1967 Implied Price
65.01	H	Railway Express	3 %	
		Electric Railways	.2%	
		Pullman Companies	.3%	
		Class I Passenger Service	5 %	
		Other Class I Non-Freight Service (Baggage, Main, Switching, Express, etc.	5 %	
		Incidental Operating Revenue (Dining, Hotel, Rents, Power, Storage, Misc.)	2 %	
		Freight Service	83 %	
68.03		No Subclassification	100 %	
69.01	D	Motor Vehicles, Automotive Equipment	7 %	
		Groceries and Related Products	20 %	
		Farm Products, Raw Materials	8 %	
		Electrical Goods	7 %	
		Machinery, Equipment, Supplies	12 %	
		Metals, Minerals (except petroleum products, scrap)	6 %	
		Beer, Wine Distilled Alcoholic Beverages	5 %	
		Lumber, Construction Materials	5 %	
69.02	E	Groceries and Other Foods	20 %	
		Meals and Snacks	6 %	
		Cosmetics, Drugs, Cleaners	4 %	
		Men's, Boy's Clothing Excluding Footware	3 %	
		Women's, Girl's Clothing Excluding Footware	6 %	
		Major Appliances, Radio, TV, Musical Instrument	3 %	
		Furniture, Sleep Equipment, Floor Coverings	3 %	
		Lumber, Building Material	4 %	
		Automobiles and Trucks	14 %	
		Auto Fuels and Lubricants	6 %	
		Auto Tires, Batteries, and Accessories	3 %	
		All Other Merchanidse	4 %	
		Nonmerchandise Receipts	4 %	
70.04		No Subclassification	100 %	
71.02		No Subclassification	100 %	
73.01	G	734- Services to Dwellings and Other Buildings (window cleaning, pest control, etc.)	10 %	
		7391 Commercial R & D Laboratories	8 %	
		7392 Business and Consulting Services	21 %	
		7394 Leasing, Rental of Heavy Construction and all other equipment	10 %	
		7399 Other Business Services n.e.c.	14 %	

TABLE A-V. MAJOR PRODUCTS OF COMMON BEA SECTORS (continued)

BEA Sector	Source	Major Products		1967 Implied Prices
73.02	G	7311 Advertising Agencies	93%	
73.03		No Subclassification	100%	
75.00	G	751 Car, Truck Rental Leasing, Without Drivers 752 Automobile Parking 7531 Top and Body Repair Shops 7534 Tire Retreading and Repair Shops 7539 Automobile Repair Shops, n.e.c. 754 Automobile Services, except repair	29% 7% 12% 6% 10% 5%	

TABLE A-V. MAJOR PRODUCTS OF COMMON BEA SECTORS (continued)

<u>CODE</u>

A Census of Mineral Industries, reports for SIC sectors comprising BEA sector. Table 5 or 6 depending on aggregation level. Control table is

B Internal C.A.C. documentation. Control total is gross domestic output.

C Census of Manufacturers, reports for SIC sectors comprising BEA sector, Table 5B or 6A depending on aggregation. Control total is value of shipments.

D Census of Business, Vol. 3 Table D: Sales of Merchant Wholesalers, by kind of business.

E Census of Business, Vol. 1, Table 1: Sales of specified Merchandise Lines. NOTE: Major products here are defined as any line representing ≥ 3% of total sales.

F Total Insurance Written in 1967 is control total from <u>Best's Insurance Reports - Life/Health</u> 1975 p. vii and "Best's Insurance News," Property-Liability Edition, Vol. 69, No. 6, p. 38. Percentage breakdowns are made directly for property-liability from the latter reference and are based on "sales" for life from "Best's Insurance News," Life Ed., Vol. 68, No. 2, p. 2.

G Census of Business, Vol. 5, part 1. Table 2: Receipt of All Establishments is control total.

H Based on 1966 statistics from the Interstate Commerce Commission. Control total is total operating revenue for the entire railroad system ($11, 163, 422, 895 from Table 109, Transport Statistics 1966.) Major Products listed is a subjective list of identifiable classes of real service from various tables in <u>Transport Statistics</u>, 1966, Part 1.

TABLE A-VI. ERROR TOLERANCES (% OF MEAN) FOR 90 ENERGY INTENSITIES (1967)

I/O CODE	SECTOR	COAL MINING	CRUDE PETRO	PETRO REFINED	ELECTRIC UTILITIES	GAS UTILITIES	TOTAL PRIMARY	GROSS DOMESTIC OUTPUT
700	Coal Mining	0	17	10	21	28	0	1
800	Crude Petro, Gas	7	0	10	7	5	0	1
3101	Petro Refin Prod	4	3	0	5	4	3	2
6801	Electric Utilities	3	4	5	1	5	2	1
6802	Gas Utilities	7	4	12	8	0	4	1
100	Livestock	11	15	18	12	11	13	4
200	Misc. Ag. Products	7	15	22	8	6	13	3
300	Forest Fish Products	31	23	25	22	18	21	18
400	Ag for. Fish Ser	13	11	13	13	12	10	3
500	Iron Ore Mining	11	6	7	6	6	7	4
600	Nonferr Mining	8	6	7	7	6	6	9
900	Stone Clay Min	28	9	8	11	11	14	2
1000	Chem Mineral Min	23	6	11	8	5	8	3
1100	New Construction	3	9	15	3	3	7	0
1200	Maint. Rep Const	6	9	13	5	5	8	2
1300	Ordnance	3	4	6	5	3	3	1
1400	Food	3	6	10	4	3	5	4
1500	Tobacco	4	10	16	6	5	8	13
1600	Fabric & Mills	4	4	5	5	4	3	7
1700	Textile Goods	5	4	6	8	4	4	6
1800	Apparel	5	5	6	6	5	5	12
1900	Fab Textile Prod	6	5	6	6	6	5	6
2000	Wood Products	7	6	9	10	7	7	1
2100	Wood Containers	6	7	8	8	8	6	2
2200	H'hold Furniture	3	4	5	5	3	3	2
2300	Furn. Fixtures	4	3	4	7	3	3	1
2400	Paper Products	4	4	7	5	3	3	2
2500	Paperboard Cont	5	5	6	5	4	5	2
2600	Printing, Publ	3	4	5	5	3	3	2
2700	Chem Products	4	5	6	5	4	4	1
2800	Plastics	3	4	8	5	4	3	3
2900	Drugs, Toil Prep	3	4	5	4	4	3	4
3000	Paints	4	4	5	5	4	4	2
3102	Paving	19	15	15	7	8	13	1

TABLE A-VI. ERROR TOLERANCES (% OF MEAN) FOR 90 ENERGY INTENSITIES (continued) (1967)

I/O CODE	SECTOR	COAL MINING	CRUDE PETRO	PETRO REFINED	ELECTRIC UTILITIES	GAS UTILITIES	TOTAL PRIMARY	GROSS DOMESTIC OUTPUT
3103	Asphalt	4	14	16	6	7	14	1
3200	Rubber Prod	3	4	6	4	3	3	2
3300	Leather Products	8	7	10	13	8	6	3
3400	Footwear	4	3	5	5	3	3	3
3500	Glass Products	4	5	6	5	4	5	2
3600	Stone Clay Prod	4	4	5	4	4	3	1
3700	Prim Ir. Stl. Manu	4	4	6	5	4	3	1
3800	Prim Nonfer Met	4	4	4	5	4	3	1
3900	Metal Containers	5	5	7	4	4	4	3
4000	Heating, Plumbing	4	3	4	4	3	3	2
4100	Screw Mach Prod	4	4	5	4	3	3	2
4200	Fab Metal Prod	4	5	6	5	4	4	1
4300	Engines, Turbines	3	4	6	4	3	3	4
4400	Farm Machinery	4	4	6	4	3	3	10
4500	Const. Mining Equip	4	4	5	5	4	3	4
4600	Mat Handling Eq	3	4	5	5	3	3	5
4700	Metalworking Eq	3	4	5	4	3	3	4
4800	Spec Ind Mach	3	4	5	6	4	3	1
4900	Gen Ind Mach	3	3	5	3	2	2	3
5000	Mach Shop Prod	5	5	7	7	5	4	2
5100	Ofc, Comput Mach	4	6	10	4	4	5	2
5200	Service Ind Mach	4	4	6	7	4	4	3
5300	Elec Ind Apparat	3	3	5	3	3	3	1
5400	H'hold Appliance	4	4	4	8	3	3	3
5500	Elec Light Eq	3	3	5	4	3	3	2
5600	R-TV Commun Eq	4	4	6	6	3	3	5
5700	Electronic Comp	3	3	5	3	2	3	2
5800	Electrical Equip	4	5	5	7	5	4	2
5900	Motor Veh & Eq	4	4	5	4	3	4	3
6000	Aircraft & Parts	3	4	7	4	3	3	2
6100	Transport Equip	3	3	4	3	2	2	4
6200	Prof Scient Supp	4	5	5	8	5	4	2
6300	Optical Supplies	3	4	7	3	3	3	3
6400	Misc Manufact	2	3	4	4	4	2	2

TABLE A-VI. EORROR TOLERANCES (% OF MEAN) FOR 90 ENERGY INTENSITIES (continued) (1967)

I/O CODE	SECTOR	COAL MINING	CRUDE PETRO	PETRO REFINED	ELECTRIC UTILITIES	GAS UTILITIES	TOTAL PRIMARY	GROSS DOMESTIC OUTPUT
6501	Railroad	8	5	5	8	8	5	3
6502	Local Transport	15	6	6	7	11	7	6
6503	Motor Fgt Transp	15	7	6	15	11	7	4
6504	Water Transport	28	8	7	18	12	8	6
6505	Air Transport	61	9	7	48	30	10	6
6506	Pipe Line Transp	27	13	22	30	10	15	9
6507	Transp Services	20	25	31	21	23	21	3
6600	Communications	18	15	20	23	16	14	7
6700	R-TV Broadcast	17	15	19	21	16	13	2
6803	Water, Sanit Ser	13	13	12	14	16	10	10
6900	Whole, Retail Tr	15	12	17	19	13	10	2
7000	Finance Insur	9	8	12	12	9	7	7
7100	Real Estate	7	7	9	9	9	6	3
7200	Hotels, Pers Ser	15	46	22	21	102	35	7
7300	Business Service	5	7	10	5	10	6	2
7500	Auto Repair	7	14	19	8	8	11	11
7600	Amusements	12	11	14	13	13	10	5
7700	Med, Educ Ser	18	13	16	23	17	12	4
7800	Fed Govt Enterp	12	12	14	14	18	11	3
7900	St. Local Govt Ent	12	17	15	16	21	14	4
8100	Business, Travel	17	15	16	16	19	14	3
8200	Office Supplies	11	10	11	10	10	10	6

Source: C. W. Bullard, D. L. Amado, D. E. Putnam and A. V. Sebald, "Stochastic Sensitivity Analysis of the CAC Energy Input-Output Model," University of Illinois, Center for Advanced Computation, Urbana, IL. 61801 1976.

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