# Analyzing Environmental Policies with IGEM, an Intertemporal General Equilibrium Model of U.S. Growth and the Environment

# Part 2

## Appendix B. Measuring industry output and intermediate inputs

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In this appendix we define the measures of industry output and intermediate inputs used in estimating the unknown parameters of the state-space models of producer behavior described in Chapter 3 of Part 2. Our methodology and data sources are described in detail in Chapter 4 of Jorgenson, Ho and Stiroh (2005, henceforward JHS), but we provide a concise summary in section B.1. The industry classification in JHS (2005) was chosen to illuminate the role of the information technology industries. For IGEM we focus on the energy-related sectors. Section B2 describes the data sources and our adjustments to them. The results reported in section B3. Table B1 gives the output and inputs for the 35 market industries, as well as household and government sectors.

## B.1. Methodology

Our methodology for measuring industry output, intermediate inputs, and value added is based on a time series of input-output tables. This gives the flows of all commodities in the economy, as well as payments for capital and labor services, in current and constant prices. We account for the supply of every commodity, whether produced domestically or imported. We also describe the use of every commodity, whether consumed as an intermediate input or allocated to final demand. All payments for capital and labor services are included, so that we account for the gross domestic income (GDI) generated through production of the gross domestic product (GDP).

Although current information on industries uses the North American Industrial Classification System (NAICS), our time series of input-output tables requires detailed historical data that are unavailable in NAICS. Table 1.1 in Chapter 1 provides the list of the 35 market industries in IGEM, together with definitions in the 1987 Standard Industrial Classification (SIC) codes. Two additional sectors employ capital and labor services, namely, Households and General Government. Households correspond to a final demand containing the rental flow of capital services from owner-occupied housing and consumer durables. General Government, excluding government enterprises, employs labor services and public capital.

In the National Income and Product Accounts (NIPAs) Government Enterprises include electric utilities. In IGEM electric utilities, both private and public, are consolidated into a single Electric Utilities industry, while the Government Enterprises sector excludes the electric utilities. The NIPAs also provide separate accounts for government producers. For example, private hospitals and private universities are in Services, while government hospitals and universities are

in General Government. In IGEM the General Government industry is included in Government final demand.

Table B1 provides output, energy and non-energy materials inputs, and value added for all sectors in 2005 and these are discussed in detail below. We refer to the 35 market industries in IGEM as the business sector, since we exclude General Government and Households. The capital services of the Households sector include the service flow from consumer durables, which is excluded from the official definition of GDP. Accordingly, value added for the IGEM industries exceeds the official GDI.

### *B.1.1. Notation*

Models of producer behavior for domestic industries in IGEM are presented in Chapter 1, section 1.1. For convenience we repeat the definitions of key variables that describe the outputs, the inter-industry flows of goods and services, and the flows of capital and labor services. The subscript *i* refers to commodities, while *j* refers to industries. The variables are:

| | |
|---|---|
| $i$ | index for commodity, $i=1,...,M,M+1$ |
| $j$ | index for industry, $j=1,...,M$ |
| $t$ | index for time, $t=1960,1978,...,2005$ |
| $QI_j$ | quantity of gross output of industry $j$ |
| $VQI_j$ | nominal value of gross output of industry $j$ |
| $PO_j$ | price of gross output to producers in industry $j$ |
| $PI_i$ | price of gross output to purchasers from industry $j$ |
| $QP_i^j$ | quantity of commodity input $i$ into industry $j$ |
| $PS_i$ | price of commodity $i$ to buyers |
| $KD_j$ | quantity of capital input in industry $j$ |
| $LD_j$ | quantity of labor input in industry $j$ |
| $E_j$ | index of energy intermediate input into $j$ |
| $M_j$ | index of total non-energy intermediate input into $j$ |
| $P_{E,j}$ | price of energy intermediate input into $j$ |
| $P_{M,j}$ | price of total non-energy intermediate input into $j$ |

$PKD_j$ price of total capital input to industry *j*

$PLD_j$ price of total labor input to industry *j*

$QC_i$ quantity of domestically produced commodity *i*

$PC_i$ price of domestically produced commodity *i*

$M_i$ quantity of comparable imports of commodity *i*

$PM_i$ price of imported commodity *i*

$QS_i$ quantity of total supply of commodity *i*

$M_{j,i}$ MAKE matrix; value of commodity *i* made by industry *j*

*B.1.2. Output and Intermediate Inputs*

Our industry models of production are based on production functions with industry outputs expressed as functions of capital, labor, and intermediate inputs. Technology is indexed by time. Each industry, indexed by *j*, has its own production function and purchases *M* distinct intermediate inputs and one imported, *non-comparable* input, for a total of *M+1* intermediate inputs. The non-comparable imports, denoted *nci*, are distinct from comparable or competitive imports included in the *M* intermediate inputs. The official input-output tables classify imports as non-comparable if they are judged to have no close domestic substitutes. The classic example is coffee beans as an intermediate input into the Food industry.

We group intermediate inputs into energy and non-energy aggregates. Production functions are assumed to be separable in these groups and may be written:

$$QI_j = f(KD_j, LD_j, E_j, M_j, t); \qquad E_j = E(QP_3^j ...); \qquad M_j = M(QP_1^j, ...) \tag{B.1}$$

where *KD* is capital services, *LD* is labor services, *E* is an index of energy intermediate inputs – Coal Mining, Oil and Gas Mining, Petroleum Refining, Electric Utilities and Gas Utilities – and *M* is an index of non-energy materials inputs, comprising the 30 non-energy commodities and non-comparable imports.

The production model (B.1) is used for the 35 market industries. The remaining two industries, – Households and General Government, have no intermediate inputs. The simpler production functions for these industries are described at the end of this section. The *M*

commodity inputs correspond to the primary products of the 35 market industries, the concepts of primary and secondary products are explained in section 1.1.4.

Under the assumptions of constant returns to scale and competitive markets, the value of output is equal to the value of all inputs:

$$\text{(B.2)} \qquad PO_{jt}QI_{jt} = VQI_{jt} = PKD_{jt}KD_{jt} + PLD_{jt}LD_{jt} + P_{Ejt}E_{jt} + P_{Mjt}M_{jt}$$

$$P_{Ejt}E_{jt} = PS_{3t}QP_{3t}^{j} + PS_{4t}QP_{4t}^{j} + .. + PS_{31t}QP_{31t}^{j}$$

$$P_{Mjt}M_{jt} = PS_{1t}QP_{1t}^{j} + PS_{2t}QP_{2t}^{j} + .. + PS_{NCI,t}QP_{NCI,t}^{j}$$

where $PO_j$ denotes the price of output, $PS_i$ denotes the price of each commodity and the time subscript has been dropped for brevity. The price of industry capital services, $PKD_j$, is defined as a residual, so that (B.2) holds as an accounting identity.[1] The price of labor services $PLD_j$ is discussed in Appendix C.

We assume that the price of the *i*th intermediate input $PS_i$ is the same for all purchasing sectors. Each of the IGEM industries is an aggregate with many components. Therefore, each input $QP_i^j$ is a commodity bundle consisting of these components. Even if the prices of all of the components were the same for all purchasers, differences in the composition of inputs among industries would generate a different input price $PS_i$ for each purchasing industry. Our assumption averages out the price differences that would be observed with greater industry detail.

Our aggregation over industries is based on the Tornqvist quantity index, which provides a close approximation to the Fisher-ideal index currently employed in the NIPAs. The Tornqvist quantity index is an exact index number that replicates the translog model used in IGEM.[2] The energy index for industry j is:

$$\text{(B.3)} \qquad \Delta \ln E_{jt} = \sum_{i=3,4,16,30,31} \overline{v}_{ijt} \Delta \ln QP_{it}^{j}$$

where $\Delta \ln X_t \equiv \ln X_t - \ln X_{t-1}$ is the growth rate. The weights are shares of the component in the total value of the industry's energy inputs defined as[3]:

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[1]More detail is given in Appendix D.

[2] See Diewert (1976).

[3]The same subscript *i* is used in the numerator and denominator of Equation (B4) to avoid a proliferation of symbols.

$$(B.4) \quad v_{ijt} = \frac{PS_{it} QP_{it}^{j}}{\sum_{i=3,4,16,30,31} PS_{it} QP_{it}^{j}}$$

The two-period average value share is:

$$(B.5) \quad \overline{v}_{ijt} = \tfrac{1}{2}\left(v_{ijt} + v_{ijt-1}\right).$$

The *price index of aggregate energy input, $P_{Ej}$,* is defined implicitly to make the following value identity hold:

$$(B.6) \quad P_{Ej} E_j = \sum_{i=3,4,16,30,31} PS_i \, QP_i^j$$

We construct a similar set of index numbers for non-energy input defined over the set $I_{Mat} = \{1, 2, 5, ...35, nci\}$:

$$(B.7) \quad \Delta \ln M_{jt} = \sum_{i=I_{Mat}} \overline{v}_{ijt} \Delta \ln QP_{it}^{j}$$

$$P_{Mj} M_j = \sum_{i=I_{Mat}} PS_i \, QP_i^j$$

Equations (B3) and (B7) represent growth rates of energy and non-energy inputs, so that we normalize prices at unity in the base year,

$$P_{Ej,t=base} = P_{Mj,t=base} = 1.0.$$

We emphasize that the prices of energy and non-energy inputs are specific to each industry, even though prices of the component inputs are the same for all industries. This reflects differences in the shares of intermediate inputs in the value of output among industries.

The input-output accounts and our model distinguish between purchasers' and producers' prices; the value to the purchaser is the value of output to the producer, plus output taxes paid on *j*'s output $T_j$:

$$(B.8) \quad VQI_j = PI_j QI_j = PO_j QI_j + T_j$$

The purchaser's price *PI* is defined in (1.12).

V*alue added, inclusive of taxes,* of industry *j* is the sum of payments for capital, labor, and indirect taxes:

$$(B.9) \quad VA_{jt}^{T} = PKD_{jt} KD_{jt} + PLD_{jt} LD_{jt} + T_{jt}$$

Gross Domestic Product (GDP) in nominal terms is then given by the sum of value added over all sectors, including the government and households:

$$\text{(B.10)}\quad GDP = \sum_j VA_{jt}^T$$

*B.1.3. Input-Output Accounts*

The basic building block for our measures of output and intermediate inputs is a time series of input-output tables. These inter-industry transactions tables describe the industries that produce each product and the industries that use them. This information is summarized in two sets of tables, a Use table allocating the supply of each commodity among the categories of intermediate input and final demand, and a Make table showing how each commodity is supplied or made by the various industries. Each industry produces a primary commodity and, possibly, some secondary commodities. For example, the Hotel industry produces both hotels and restaurants as commodities. Each commodity may be produced by one or many industries. "In-house software", for example, is produced by many industries, each of which develops its own software.

The input-output tables for our industry classification are naturally of dimension 35 x 35. To illustrate the various concepts we reproduce a condensed 3-sector Use table from JHS (2005, Table 4-3) for year 2000 in Table B2. The three industries are IT-producing industry, IT-using industry, and non-IT industry. The final demanders are household consumption (C), general government (G), Investment (I) and Exports (X). The supply from Imports (M) is entered as a negative number.

A key consistency constraint for an input-output system and by extension for IGEM is that the output of a given commodity by all industries and the use of this commodity by all purchasers, industries and final demanders, must be equal. On the input side, the *j*th column of the Use table represents the inputs of that industry. Equations (B2) and (B8) may be combined to express the constraint that the sum of inputs is equal to the value of industry output to the purchaser:

$$\text{(B.11)}\quad PI_j QI_j = \sum_i PS_i QP_i^j + PKD_{jt} KD_{jt} + PLD_{jt} LD_{jt} + T_j$$

On the output side, each industry produces many commodities and the exact composition is given by the Make Table. The *j*th row of the Make Table gives the values of the various commodities produced by industry *j*, and the row total is the industry output:

$$\text{(B.12)}\quad PI_j QI_j = \sum_i M_{j,i}$$

The *i*th column of the Make Table gives the contributions of each industry to the domestic output of the *i*th commodity. Let $QC_i$ denote the quantity of domestically produced commodity *i*, $PC_i$ the price, and $VC_i$ the value. The Make column total is the value of total domestic output of each commodity, summed over all the supplying industries:

$$\text{(B.13)} \quad VC_i = PC_i QC_i = \sum_j M_{j,i}$$

We explain the division of the value into price and quantity later in equation (B20).

The reader can relate the concepts to the illustrative input-output tables in Table B2. The domestic IT-producing industry is represented by the *ITprod* column in the Use table and the *ITprod* row in the Make Table; the IT-producing commodity is in the corresponding row of the Use Table and column of the Make Table. The IT-producing industry output is $PI_{j=ITprod} QI_{j=ITprod} = 742$ billion dollars, and the value of domestically produced ITprod commodity is $PC_{i=ITprod} QC_{i=ITprod} = 804$ billion. The value added of the industry is $VA^T_{j=ITprod} = 366$ billion. The value of "nonIT commodities" intermediate input into the IT-producing industry is $PS_3 QP_3^{j=1} = 78.6$ billion.

The Use Table also includes the familiar breakdown of sales to final demand – consumption, investment, government, export, and import components of GDP. In the summary Use Table in Table B2, these are the columns marked C, I, G, X, and M. The official U.S. Inter-industry Transactions Accounts distinguish between two types of imports – comparable and non-comparable. In the import column (M), commodities 1 through 35 are comparable imports, and we denote them by $M_i$, *i*=1, 2, ... This implies that the commodity is produced domestically and imported from abroad. By contrast imports that are not produced domestically, the non-comparable imports, are in the *nci* row, where $P_j^{NCI} QP_{NCI}^j$ is the value of NCI input into industry *j*. Total imports equal the sum of comparable and non-comparable items.[4]

The sum of all the elements in row *i* of the Use Table equals the value of deliveries of the *i*th commodity to all users – intermediate inputs to other industries and final demand. Thus, the supply-demand balance for domestic commodity *i* in value terms is:

[4]In the official US Inter-Industry Transactions Tables and in our Table B2, the sum of all non-comparable imports is entered in the non-comparable row of the Import column, with a negative sign. This implies that the column sum of Imports is total (negative) imports and the row sum of non-comparable imports is zero.

$$\text{(B.14)}\quad PC_i QC_i = \sum_j PS_i QP_i^j + PS_i\,(c_i + i_i + g_i + x_i) - PM_i M_i$$

The domestic commodity totals are given in the right-most column of Table B2. It is more intuitive, however, to rewrite this as the total supply from domestic suppliers and competitive imports, equal to total demand:

$$\text{(B.15)}\quad PC_i QC_i + PM_i M_i = \sum_j PS_i\, QP_i^j + PS_i\,(c_i + i_i + g_i + x_i)$$

Relating (B.15) to Table B2 we see that in the ITprod row of the Use table the $804.5 billion of the domestic commodity is augmented by imports of $201.1 billion, giving a total supply of $1,005.6 billion Excluding exports of $142.3 billion, the total supply of $863.3 billion to the domestic market is divided among $355.8 billion for intermediate demand, $396 for Investment, and $110.7 for Government. In terms of the notation of Chapter 1, sections 1.1 and 1.5:

$$PC_{i=ITprod} QC_{i=ITprod} = 804.5$$

$$PM_{i=ITprod} M_{i=ITprod} = 201.1$$

The key assumption necessary for Equation (B.15) to hold is that all purchasers, industries and final demand categories, purchase the same commodity bundle of commodity *i* with the same share of the imported variety. Let $QS_i$ denote the quantity of total supply of commodity *i* and $PS_i$ the price. The total value of supply for each commodity is then:

$$\text{(B.16)}\quad PS_i QS_i = VS_i = PC_i QC_i + PM_i M_i$$

The quantity of the total supply of commodity *i* is a Tornqvist index of the domestic and imported varieties:

$$\text{(B.17)}\quad \Delta \ln QS_i = (1 - \overline{v}_m)\Delta \ln QC_i + \overline{v}_m \Delta \ln M_i$$

where the weights are (averaged) value shares:

$$\text{(B.18)}\quad v_{mt} = \frac{PM_{it} M_{it}}{VS_{it}}$$

The price $PS_i$ is defined implicitly from the total supply and the quantity index in (B.17):

$$\text{(B.19)}\quad PS_i = \frac{VS_i}{QS_i}$$

We have now completed the circle in the inter-industry flow of goods. The price $PS_i$ of commodity *i* is the price paid by producers for their input in B.2, which was introduced at the beginning of our description of the input-output system. In other words, the input of commodity *i* bought by industry *j*, denoted by $QP_i^j$ in B2 and B3, is a composite good made up of imports $M_i$ and the domestic variety $QC_i$, which is in turn composed of output from domestic industries via (B13).

Finally, we note that the Bureau of Economic Analysis does not produce an official input-output table in constant dollars. The final demands – C, I, G, X, and M – are based on purchasers' prices, where components of final demand are made up of many input-output commodities.[5] However, purchasers' prices for the components of final demand are not officially linked to the producers' prices. Our accounting system, involving the price indexes *PO*, *PI*, *PC*, and *PS*,, is not used by the BEA in estimating the real GDP.

In our growth accounting methodology and in IGEM, we take the industry output quantities and prices to be primary data. Each commodity is regarded as a Cobb-Douglas aggregate of the quantities produced by the various industries, and its price, $PC_i$, is given by the component industry prices:

$$\text{(B.20)} \quad \ln PC_i = \sum_j \frac{M_{ji}}{VC_i} \ln PI_j$$

With this commodity price, the quantity, $QC_i$, is given by (B.13).

*B.1.4. Non-Business Industries*

Finally, we turn to accounts for the two non-business sectors – Households and General Government – in Table B.1. These sectors do not produce goods and services used as intermediate inputs by other industries. They also do not use intermediate goods, but consume capital and labor services, so that their value added is part of GDP.

The output and input of the Household industry consists of capital service flows from owner-occupied housing and consumers' durable goods. The NIPAs make imputations for the rental-equivalent value of owner-occupied housing, but no imputations are made for the capital

[5] For example, in the GDP accounts for Personal Consumption Expenditures, the item "footwear" consists of the IO commodities rubber products, leather products, scrap, transportation and trade. A bridge table linking the

services other household durable assets like automobiles and computers. By contrast we treat the flow of services from the stock of consumers' durables symmetrically with the services from housing. We regard all assets that do not depreciate within a year as providing an annual flow of services to be estimated and incorporated into output. We include purchases of new durables in investment rather than personal consumption expenditures.[6]

The value of capital services for the Household industry is denoted $PKD_{36}KD_{36}$ to be symmetric with the flow of capital services for the business industries. The output of the Household industry consists solely of capital services, so output is not defined as in (B1) for a business industry, but is equal to input:

$$\text{(B.21)} \quad PI_{36}QI_{36} = PKD_{36}KD_{36}$$

The General Government sector hires a substantial quantity of labor and owns a considerable stock of capital. It is comparable to the larger business industries in size. Table B1 gives the outputs of the various industries for 2005. The output and input values are:

$$\text{(B.22)} \quad PI_jQI_j = PLD_jLD_j + PKD_jKD_j \qquad j=38.$$

There is no market for government output, so that the NIPA records industry value-added as the sum of the compensation of labor and the depreciation of capital. The value of the capital service flow using only depreciation, is much smaller than the corresponding service flow using the price of capital services described in Appendix D. We implement the complete service flow for the government sector and impute the value of capital services and output. Since there are no markets for the output, there are no output prices and quantities. Following the convention in the NIPAs we define the quantity of output as an index of capital and labor quantities, so that there is no growth in productivity. The value added from these non-business industries is given in the value-added row in the final demand columns of the USE matrix in Table B2.

### B.2. Data and Adjustments

Our starting point for constructing the time series of input-output tables is the official benchmark U.S. Inter-Industry Transactions tables produced by the Bureau of Economic Analysis (BEA). These are available on an SIC classification for the years 1977, 1982, 1987,

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two concepts is given for each benchmark year, for 1992 this is Table D in the *Survey of Current Business*, November 1997.

[6] See Appendix D for more detail.

and 1992.[7] The Office of Occupational Statistics and Employment Projections of the Bureau of Labor Statistics (BLS-EMP) uses these benchmark tables to generate a time series of inter-industry transactions tables for 1983-2000 that covers 192 sectors. These data include both Use and Make tables and are structured like the BEA tables. We use earlier versions of the BLS-EMP data that cover the period 1960-95.[8] For the post-2000 period all official data are in NAICS and we turn to the BEA gross output data covering 489 NAICS industries. We bridged these NAICS data to SIC to extend our series to 2005.

*B.2.1. Adjusting the input-output tables to current GDP definitions*

The first step in constructing the BLS-EMP time series of input-output tables is to revise the BEA benchmark tables to conform to a common definition of GDP, including the treatment of software as investment instead of being an intermediate input. There are other differences such as the industry classifications between the various benchmarks and the tables have been revised to conform to the 1992 conventions.

To interpolate the input-output tables between benchmark years, data on industry output are collected by BLS-EMP.[9] The final demand components are taken from the NIPAs. These include the various categories of personal consumption expenditures and investment, as well as trade data by commodities. The BLS-EMP then adjusts the matrices so that the following identities hold: First, the sum of value-added is equal to GDP. Second the sum over commodities of each of the final demand columns is equal to the C, I, G, X, and M aggregates in the NIPAs. Third, the sum of all inputs in each column *j* of the Use Table equals the value of gross output of industry *j*. Fourth, the sum of all commodities in row *j* of the Make Table is equal to the output of the domestic industry. Fifth, the sum of all purchases in row *i* of the Use Table is equal to the sum of column *i* in the Make Table and both are equal to the total value of commodity *i*. This yields a set of consistent input-output tables for all years.

We use the BLS-EMP Use and Make Tables that cover 192 detailed sectors from 1983 to 2000 and have reorganized them to produce the IGEM industry classification in Table B1. The assignments to this industry classification are given in Table B3. The links between the 192

[7]The latest SIC-based tables are described in *Survey of Current Business*, November 1997, p. 36. The benchmark tables for 1997 and 2002 uses another classification system, NAICS, that is not comparable to the older systems.

[8] The data are available on the Office of Occupational Statistics and Employment Projections website at www.bls.gov/emp/.

[9]These data are available at posted at www.bls.gov/emp/ empind2.htm

industries and the 35 IGEM industries are direct, except for the Electric Utilities and Gas Utilities. In the first step, the nominal value tables are consolidated and reorganized. The aggregation process involves reallocating non-business sectors such as scrap and rest of the world. These are reallocated to the 35 IGEM industries and final demand. The owner-occupied housing sector is moved to the consumption column and government electric utilities are merged with private utilities to form the IGEM Electric Utilities industry. The BLS-EMP industry, Combined Utilities is divided between Electric Utilities (10%) and Gas Utilities (90%).

We revise the tables for 1998-2000 to match the GDP given in the *Survey of Current Business* for August 2007. Since the BLS-EMP series are based on a previous revision of the NIPAs, we employ the method of iterative proportional fitting, often called the "RAS method." This approach maintains the original values for industry output of each industry and adjusts all elements of the matrix until the value-added rows and final demand columns match the revised GDP.[10]

*B.2.2. Linking Older and Newer Datasets*

We have linked older versions of the BLS-EMP dataset, covering 1960-85 and 1977-95, to the data set for 1983-2000, thereby extending the series back to 1960. The 1977-95 data set was used in JHS (2005, Chapter 4) and covered 185 industries. The 1960-85 set is used in Jorgenson (1998). These older data are based on earlier benchmarks and differ from the current series in the industrial classification and the definition of investment.

We have consolidated the 185-sector nominal input-output tables to the 35 IGEM sectors the same way as described above for the 1983-2000 data. We take the 1983 Use and Make Tables as initial guesses for the 1982 matrices and use the RAS method to adjust the guess to the new column and row totals given by the BLS-EMP industry output series and the final demands from the *Survey of Current Business* August 2007. The earlier years, 1977 to 1981, are then adjusted in a similar manner, where the initial matrix is a weighted sum of the original and the new 1982 table. We repeat the exercise for the 1960-77 series by using a 1977 table on the new definitions to revise backwards to 1960. This yields an annual time series of nominal input-output tables covering 1960-2000 that conforms to the latest SIC-based estimates of industry output from BLS and the annual update of the NIPAs published by the BEA in 2007.

[10]The RAS method is described in detail in Jorgenson, Gollop and Fraumeni (1987), Chapter 3.

The BLS-EMP followed the conversion from SIC to NAICS by issuing a series of IO tables for 1998-2004 based on 200 NAICS industries. Separately the BEA provides industry output for 489 industries for 1998-2005 based on the NAICS-1997[11]. We first converted the industry output of these 489 NAICS industries to the 35 IGEM industries. In converting the labor data described in Appendix C, we used a NAICS-SIC bridge for 1997 provided by the Census Bureau; however, for output we simply assigned each of the 489 industries to one of the 35 IGEM industries. We calculated growth rates from these BEA output data and applied it to the 2000 values created in section B.2.1 above.

We use the Make matrix from 2000 to derive SIC commodity values from the industry outputs and use the SIC-based industry output and commodity output series as control totals to extrapolate the 2000 Use and Make tables to 2005. One more input is required to do this extrapolation, namely, an initial guess of the final demand columns. This is taken from the BLS-EMP tables at the 200 NAICS commodity level for 1998-2005. The sum of industry value added, and the components of final demand are scaled to the GDP given in the NIPAs from the *Survey of Current Business* for August 2007. At this point we have the value of industry output at purchasers' prices $VQI_{jt}$ and the values of the intermediate inputs, including non-comparable imports, $PS_{it}QP_{it}^{j}$ and $PS_{NCI,t}QP_{NCI,t}^{j}$, for each of the private industries in the period 1960-2005.

*B.2.3. Generating Value-Added Components*

Unfortunately, value added in the BLS-EMP data is not divided among capital and labor compensation and indirect business taxes, as it is in the BEA benchmark tables. We estimate the value-added components from the *GDP by Industry* data produced by the BEA.[12] Our estimates of the value of labor input are described in Appendix C and reflect the sum of the compensation of employees from the NIPAs and the estimated value of self-employed labor compensation. The estimation of the value of capital input is described in Appendix D and includes property compensation, less the imputed value of self-employed labor compensation, plus certain property taxes. After subtracting the value of capital and labor compensation the remainder of GDP equals sales taxes net of subsidies.

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[11] The BEA Gross Output by Industry data may be found at http://www.bea.gov/industry/gdpbyind_data.htm.

[12] These data are described in Lum, Moyer and Yuskavage (2000), and are available at www.bea.gov/bea/dn2/gpo.htm.

A caveat is that the level of the BEA's industry value added is different from the 1992 benchmark input-output data, as explained in BEA (1997). We adjust the *GDP by Industry* data to conform to the rest of the input-output table in the following manner. First, denote the values of capital input, labor input, and sales tax that we derived from the BEA data by $VK_{jt}^{BEA}$, $VL_{jt}^{BEA}$ and $T_{jt}^{BEA}$. Let total value added for industry *j* in the BLS-EMP tables be $VA_{jt}^{BLS}$. Our estimates of the value-added components are derived by scaling the BEA estimates so that they sum to match the total value in the input-output tables. For example, the value of capital services is set as:

$$\text{(B.23)}\quad VK_{jt} = VK_{jt}^{BEA}\frac{VA_{jt}^{BLS}}{VK_{jt}^{BEA}+VL_{jt}^{BEA}+T_{jt}^{BEA}}$$

The quantity of capital input $K_{j,t}$ is the estimate based on *GDP by Industry* and industry investment in Appendix D and the quantity of labor input $L_{j,t}$ is from Appendix C. The prices of industry capital and labor inputs, $PKD_{j,t}$ and $PLD_{j,t}$, are derived from these quantities and the values given in (B23).

*B.2.4. Industry Output Prices and Quantities*

We begin with the value and price data for industry output at the 192-industry level from the BLS-EMP, covering the period 1972-2000, and aggregate them to the 35 business industries from IGEM, using Tornqvist indexes.[13] This yields the price deflators, denoted above as $PI_{j.}$. From the value data described in section B.2.2 and (B.8) we obtain the corresponding industry output quantities $QI_j$. The exceptions to this are Communications Equipment and Computer and Data Processing Services, where we replace the BLS prices with BEA prices that are adjusted for quality change. The BEA prices are given in the *Gross Output by Detailed Industry* dataset.[14]

The behavior of the 35 business industry prices is summarized in Figure B5 where we give the change in industry output prices relative to the overall GDP deflator over the period 1960 to 2005, ranked in order from largest increases to largest declines. The data for this chart are given in the last column of Table B8, which we discuss below. The largest falls in price are

[13]These data are known as the Industry Output and Employment data and are available at www.bls.gov/emp/empind2.htm.

[14]See Lum, Moyer and Yuskavage (2000). Also, see Figure 4.2 in JHS (2005).

in Electrical Machinery, which includes the Electronic Components industry that makes semi-conductors, and Industrial Machinery, which includes Computers. After Tobacco, the three largest rise in prices are in the energy-related industries – Petroleum and Gas Mining, Petroleum Refining, and Gas Utilities. With the complete set of industry output prices and the Make Table, we then calculate domestic commodity prices $PC_i$, using (B.20). We do not use the commodity prices that are implicit in the BLS-EMP data. From the industry output prices, we also subtract the sales tax to give the producers' prices in (B.8).

*B.2.5. Import prices and total supply prices*

The BLS-EMP dataset also includes a parallel set of constant dollar Use and Make Tables. We use only the data for comparable and non-comparable imports, data in the import column and the non-comparable import (NCI) row of the Use table. We employ the competitive import data by 192 commodities, many of which are zero, and generate import prices. The value and price data are then aggregated, using the Tornqvist index to give quantities and prices for 35 competitive imports, denoted $M_i$ and $PM_i$. Non-comparable imports are in the NCI row of the Use Table, used by 35 industries and final demand, and we use the BLS-EMP data from the nominal and constant dollar tables, aggregate them and generate 35+3 sets of prices for $P_{NCI,j}$.

Given the prices of domestic goods and imported goods, we calculate the total supply quantities and prices using (B17) and (B19). These are the prices for intermediate goods, and dividing them into the values from our 35-sector Use tables, we obtain the quantities of intermediates $QP_i^j$. The commodity prices and quantities are used to calculate the quantity of energy and non-energy input aggregates using (B3) and (B7).

*B.2.6. Data issues*

There are a number of data issues with constructing quantity indexes of output and inputs and these are discussed in JHS (2005, Section 4.4), which includes a comparison to other studies that use different data sources. For most industries the growth of output is similar between our estimates, the BLS Office of Productivity accounts, and the BEA *GDP by Industry* accounts. There are large differences for some industries in the 1977-2000 period discussed in JHS (2005 Table 4.4); for the energy sector, the growth rate of our output of Coal Mining is 1.19% per year compared to the BEA's 1.67% and our Gas Utilities grew at -1.52% compared to BEA's 2.04%.

We summarize the data issues here. First, the annual value added data are inconsistent with the benchmark input-output tables.[15] Second, the benchmark input-output tables are not consistent over time. The 1977 and 1982 benchmark tables, for example, are based on the 1972 SIC codes, while 1987 and 1992 tables are based on the 1987 SIC codes. Data for *GDP by Industry* are provided for both classifications in the overlap year of 1987 and we have adjusted the old classifications to the new ones, using the shares of each of the old industries in the new industries for 1987. We have also adjusted the older input-output tables to the new tables. Third, data for 2001 onwards were converted from NAICS to SIC using a fixed bridge. Fourth, unlike studies using detailed survey data, we have to assume that all buyers pay the same price for each commodity, since there is no information about price differences.

### B.3. Input, Output and Prices of Energy Sectors

In the list of industries in the BLS data set given in Table B3 ten of the 192 BLS industries are assigned to the five energy-related IGEM industries:

(3) Coal Mining

(4) Petroleum & Gas Mining

(16) Petroleum Refining and Coal Products

(30) Electric Utilities (private & government)

(31) Gas Utilities

To represent their input structure we present the columns of the 2005 Use table for these IGEM industries in Table B4. In the column for Electric Utilities we see that gross output is $373.0 billion, which is split into $130.2 for intermediate inputs (35%) and $242.8 for value added (65%). The largest intermediate input for Electric Utilities is from Services, $19.9 billion, followed by Petroleum Refining and Coal. Output from Gas Utilities is $77.4 billion and the major inputs are value added $23.0, Petroleum & Gas Mining $29.1, intra-industry purchases $12.6 and Services $4.5 billion. Output from Petroleum Refining was $863.1 billion. This is an industry with a somewhat volatile share of value added, in 2005 it was 68% while in 2000 it was only 14%. The major inputs are the feedstocks from Petroleum and Gas Mining of $107.6 billion and Trade of $18.9 billion. From the output side, the five energy-related industries purchase essentially all the output of Coal Mining and Petroleum Gas Mining, with Chemicals accounting

[15] See BEA (1997). These differences have been eliminated in the most recent version of BEA's industry data.

for most of the remainder.[16] By contrast refined oil, electricity, and gas are used in substantial quantities by all industries and Final Demand.

Turning to the detailed Make table, the total Electric Utilities commodity supplied by U.S. sources is worth $245.8 billion in 2000. Of this total private electric and gas utilities supplied $207.0, Federal government utilities supplied $12.4, and State and Local Government utilities supplied $26.4 billion. The total gas supplied by Gas Utilities is worth $95.4 billion in 2000. Of this total $72.4 billion comes from Gas and Combined utilities, $17.5 comes from Electric Utilities, and $5.4 from S&L government enterprises. It is important not to identify gas supplied with the output of Gas Utilities, since this industry does not provide all of gas supplies.

The prices of the various forms of energy have shown substantial movements in the 1960-2005 period, relative to the prices of other commodities. Figure B.1 shows how the prices of the two industries producing primary fuels – coal, oil and gas – changed relative to the GDP deflator. These graphs are normalized with prices for 1996 equal to unity. The price of Oil and Gas rose from half the 1996 level during the 1960s to twice the 1996 level during the oil shocks of the 1970s. The relatively stable prices of the 1990s gave way to a sharp rise in the mid-2000s. The price of coal also rose substantially in the 1970s, but the decline since then has persisted without a rise in prices in the 2000s.

The secondary energy industries are classified to allow us to distinguish between oil and gas and the prices are given in Figure B2. The prices of Refined Petroleum and Gas Utilities have largely followed the crude oil and gas prices; the rise in refined prices in the 2000s, relative to the GDP deflator, is somewhat larger than the rise in crude prices. The price of delivered electricity showed a very different behavior from the price of coal or oil given that Electric Utilities are highly regulated. After a rise in the 1970s the behavior of electricity prices is essentially the same as the GDP deflator since 1981.

### B.4. Estimates of Output and Intermediate Input by Industry

We now turn to a broader discussion of gross output levels and growth rates for all 35 industries. The data described above are used in the review of the U.S. economy in Tables 3.1-3.3 of Chapter 3. That review includes the industry structure in 2005, as well as on the growth

[16] See Rows three and four of our Use Table.

rates of output and input for the entire 1960-2005 period. Here we provide additional details on the industry characteristics and growth.

### B.4.1 Output, Inputs and Supply Levels in 2005

Table B1 gives the value of output, energy and non-energy intermediate inputs and value added for each industry in year 2005. The largest industry in terms of output is Services ($4,354 billion) followed by FIRE ($2,752 billion). The five energy sectors together produce a gross output of $1,154 billion. This includes substantial intra-industry transactions. In the case of Petroleum and Gas Mining, the output excluding the intra-industry sales is only 86% of industry gross output.

The sum of value added over all sectors is the GDP, $13.6 trillions by our definitions. This is higher than the official $12.5 trillions, due mostly to our imputations of services from consumer durables. In terms of value added Services is the largest business industry with $2,797 billion in 20054, followed by FIRE. The five energy industries have $600 billion worth of value added or 4.4% of GDP in 2005.

In terms of the split of gross output between value added and intermediate inputs, there is a wide range of variation, as shown in Figure B3. Of the three industries with the highest value added to output ratio in 2005, two are energy-related with a large capital input – Petroleum and Gas Mining has a ratio of 71% and Electric Utilities has 65%. At the other end of the scale, the Petroleum Refining and Gas Utilities are heavy intermediate input-using industries with value-added to output ratios of about 30%.

International trade plays a very different role in the different sectors. In Table B7 we give exports and imports for each of the 26 commodities, as well as the shares of domestic output. The overall ratio of imports to GDP in 2005 is 16%, however, for the individual goods, it ranges from 253% in Motor Vehicles to zero for services such as Construction and Government Enterprises. For the energy sectors, the import share for Coal was 2.9%, Petroleum and Gas Mining was 217%, and Petroleum Refining was 177%. The U.S. also exports some coal and the net exports are close to zero over the recent years. There are very small trade flows for Electricity and Gas Utilities. One should note that in 2005 the U.S. was running a substantial trade deficit and a balanced trade configuration would look quite different.

### B.4.2 The growth of industry output and prices, 1960-2005

We have described the industry output growth and the contributions to growth of capital, labor, intermediates, and productivity in Chapter 3. Table B8 gives the growth rates of output, energy and non-energy intermediates, as well as the change in prices relative to the GDP deflator over the period 1960-2005. The growth rate of official GDP over this period was 3.3% per year. Industries with output growth exceeding this rate include Rubber and Plastics, Industrial Machinery, Electrical Equipment, Instruments, Communications, Trade, FIRE, and Services. The industries in relative decline are the primary industries (agriculture and mining), Construction, manufacturing industries facing intense import competition, and Utilities. JHS (2005) point out that this pattern is due to rapid productivity growth in IT, leading to rapid fall in prices, increased import competition in low-skill manufacturing, and the shift in demand towards income-elastic commodities as incomes rise.

Turning to intermediate inputs, of the 35 industries in Table B8, all but six industries showed a slower growth of energy input than output, this is the well known energy conservation in the U.S. economy, especially in the period of the two oil shocks. These are Metal Mining, Construction, Tobacco, Leather, FIRE and Government Enterprises. By energy input here we count all purchases of energy including feedstock, that is, this should not be interpreted as combustion. 15 industries had non-energy intermediate grow slower than output, the other 20 saw intermediate input deepening, most likely the result of increased specialization and outsourcing, although biases in technical change also play a role.

Changes in the output structure comes from three major sources: (i) shifts in supply due to productivity growth, (ii) shifts in final demand due to changes in income, (iii) shifts in intermediate demands due to biases in technical change. Productivity growth in a competitive economy, and in IGEM, manifests itself in lower prices. In the last column of Table B8 we give the change in prices of each commodity, relative to the GDP deflator, over the 1960-2005 period. In Figure B4 the price growth is ranked from the biggest rise relative to the GDP deflator to the biggest fall.

Of the four largest rise in relative prices, three are energy related; Petroleum and Gas Mining prices rose by 2.0% per year on, followed by Petroleum Refining at 1.9%, and Gas Utilities at 1.8%. The large service industries also had low productivity growth as described in Chapter 3 and had the big rise in relative prices; this includes Services, Construction, Government Enterprises and Printing & Publishing. The relative price of Electricity rose at a

0.58% annual rate. The largest fall in prices were in the Information Technology related industries – Electrical Machinery (-4.2% per year) and Industrial Machinery (-3.4% per year). The other industries with falling relative prices include Textiles (-1.7%), Communications (-1.5%) and Apparel (-1.4%). The price of coal fell at 0.67% per year (i.e. coal at the minemouth).

The sectors with the rapid TFP growth and declines in prices saw the biggest shifts in supply curves and this resulted in high growth rates of output. The services saw little productivity growth and higher relative prices but the income effects shifted out the demand curves and these always saw above average growth rates. Industries that faced sharp international competition such as Textiles and Apparel showed slow or negative growth despite good productivity growth.

The industry performance described above, however, is not uniform over this 1960-2005 period, there is substantial variation in the relative growth rates over subperiods. In Table B9 we give the growth rates for the sub-periods 1960-73, 1973-95 and 1995-2005. Overall official GDP growth decelerated from 4.24% per year during 1960-73 to 2.80% during 1973-95, and then recovered to 3.15% in the Information Technology boom period (1995-2005). However, at the industry level, some industries kept decelerating while others followed the overall economy. At one end are many non-IT manufacturing industries, Coal Mining and Electric Utilities which showed continual slowing growth for all three sub-periods. In the manufacturing group, Stone-Clay-Glass, Primary Metals, Fabricated Metals, Motor Vehicles, and Miscellaneous Manufacturing followed the "sharp deceleration and then small acceleration" pattern of aggregate GDP. The large non-manufacturing sectors, Construction, Trade and Services also followed the aggregate pattern. The IT sectors of Machinery and Electrical Machinery, and Other Transportation Equipment had a big acceleration during the 1995-2005 recovery period.

In the energy group, Coal Mining output was decelerating throughout with a sharp drop during 1995-2005. The Electric Utilities also decelerated throughout this period, in this case from a unusually high growth rate during the electrification period of the 1960s. Petroleum & Gas Mining had negative output growth during 1973-95 but recovered to a small positive growth during 1995-05. Petroleum Refining output also decelerated throughout this period of energy conservation and rising imports.

The complete time series of output for the 5 energy industries are given in Table B10 and plotted in Fig. B5. These are in constant 1996 prices and the nominal values may be derived

from the corresponding price data in Table B11. The biggest sector by dollar value is Electric Utilities which also have the fastest rate of growth over the 1960-2005 period. The next largest sector is Petroleum Refining which is only growing by 0.64% per year during 1995-3005. As noted coal output is rising but at a decelerating rate, and is the smallest sector by value.

**Table B1: IGEM Industry Output and Inputs, 2005 (bil $)**

| | Industry Name | Output | Input | | |
|---|---|---|---|---|---|
| | | | Energy | Material | Value-Added |
| 1 | Agriculture | 424.0 | 18.7 | 221.6 | 183.6 |
| 2 | Metal Mining | 25.0 | 2.5 | 13.3 | 9.3 |
| 3 | Coal Mining | 25.5 | 3.2 | 8.0 | 14.3 |
| 4 | Petroleum and Gas | 259.6 | 19.7 | 56.7 | 183.2 |
| 5 | Nonmetallic Mining | 23.5 | 2.9 | 7.5 | 13.1 |
| 6 | Construction | 1355.7 | 36.5 | 736.2 | 583.0 |
| 7 | Food Products | 595.4 | 10.5 | 390.3 | 194.7 |
| 8 | Tobacco Products | 31.0 | 0.2 | 22.3 | 8.5 |
| 9 | Textile Mill Products | 60.2 | 1.9 | 36.5 | 21.7 |
| 10 | Apparel and Textiles | 36.0 | 0.5 | 20.4 | 15.0 |
| 11 | Lumber and Wood | 129.5 | 3.7 | 77.6 | 48.2 |
| 12 | Furniture and Fixtures | 101.3 | 2.0 | 53.9 | 45.4 |
| 13 | Paper Products | 168.0 | 7.4 | 88.1 | 72.5 |
| 14 | Printing and Publishing | 229.7 | 2.6 | 84.8 | 142.3 |
| 15 | Chemical Products | 521.4 | 25.6 | 263.3 | 232.6 |
| 16 | Petroleum Refining | 418.8 | 214.7 | 67.1 | 137.1 |
| 17 | Rubber and Plastic | 187.9 | 4.6 | 98.6 | 84.6 |
| 18 | Leather Products | 6.3 | 0.2 | 3.9 | 2.3 |
| 19 | Stone, Clay, and Glass | 129.4 | 7.7 | 58.7 | 63.0 |
| 20 | Primary Metals | 251.1 | 12.8 | 161.4 | 77.0 |
| 21 | Fabricated Metals | 296.5 | 6.4 | 161.1 | 128.9 |
| 22 | Industrial Machinery | 424.0 | 5.4 | 234.4 | 184.2 |
| 23 | Electronic & Electric Equip | 330.5 | 4.5 | 172.0 | 154.0 |
| 24 | Motor Vehicles | 442.2 | 3.8 | 352.2 | 86.2 |
| 25 | Other Transportation Equip | 227.5 | 2.9 | 112.3 | 112.3 |
| 26 | Instruments | 207.4 | 2.1 | 85.8 | 119.5 |
| 27 | Miscellaneous Manufacturing | 60.5 | 1.1 | 33.7 | 25.7 |
| 28 | Transport and Warehouse | 667.8 | 87.5 | 268.1 | 312.3 |
| 29 | Communications | 527.9 | 4.0 | 231.6 | 292.3 |
| 30 | Electric Utilities | 373.0 | 52.9 | 77.4 | 242.8 |
| 31 | Gas Utilities | 77.4 | 42.6 | 11.9 | 23.0 |
| 32 | Trade | 2487.9 | 79.1 | 896.5 | 1512.3 |
| 33 | FIRE | 2752.3 | 33.8 | 927.8 | 1790.7 |
| 34 | Services | 4353.6 | 74.2 | 1482.2 | 2797.2 |
| 35 | Goverment Enterprises | 327.5 | 25.5 | 86.1 | 215.9 |
| 36 | Private Households | 1911.1 | | | 1911.1 |
| 38 | General Government | 1572.7 | | | 1572.7 |
| | | | | | 13613 |

Table B.2: 3-sector US Input-Output table 2000 (bil $)

| | Business Sectors | | | Final Demand | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | ITprod | ITuser | nonIT | C | I | G | X | M | Total |
| ITprod | 185.9 | 118.1 | 51.8 | 0.8 | 396.0 | 110.7 | 142.3 | -201.1 | 804.5 |
| ITuser | 98.3 | 1262.9 | 1326.3 | 1447.8 | 637.0 | 266.0 | 423.9 | -271.3 | 5190.8 |
| nonIT | 78.6 | 741.4 | 3139.7 | 3786.6 | 1577.4 | 294.0 | 536.7 | -829.2 | 9325.2 |
| nci | 13.4 | 44.8 | 43.2 | 51.2 | 0.0 | 12.6 | 0.0 | -165.3 | 0.0 |
| K | 111.7 | 965.4 | 1816.5 | 1394.4 | -23.2 | 243.7 | 0.0 | 0.0 | 4508.5 |
| L | 248.5 | 2153.5 | 2801.2 | 0.0 | 0.0 | 904.1 | 0.0 | 0.0 | 6107.4 |
| T | 5.5 | 1.3 | 112.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 119.3 |
| Total | 742.0 | 5287.4 | 9291.2 | 6680.8 | 2587.2 | 1831.1 | 1102.9 | -1466.9 | |

Gross output = 15320.6 GDP= 10735.1

Note: The definition of income and expenditures (GDP) is larger than the official definition due to the treatment of durables and methods of imputing rentals. "C" is consumption of nondurables and services; "I" includes consumer durables.
The shaded area is the inter-industry transactions.

Table B3: Assignment of BLS-EMP IO categories to IGEM 35 Industries

| IGEHM Industries | | BLS 192 Sectors |
|---|---|---|
| 1 Agriculture | 1 | Agricultural production |
| | 2 | Veterinary services |
| | 3 | Landscape and horticultural services |
| | 4 | Agric, forestry and fisheries services, nec |
| | 5 | Forestry, fishing, hunting, & trapping |
| 2 Metal Mining | 6 | Metal mining |
| 3 Coal Mining | 7 | Coal mining |
| 4 Oil and Gas Mining | 8 | Crude petroleum, natural gas, and gas liquids |
| | 9 | Oil and gas field services |
| 5 Nonmetal Mining | 10 | Nonmetallic minerals, except fuels |
| 6 Construction | 11 | Construction |
| 7 Food mfg | 70 | Meat products |
| | 71 | Dairy products |
| | 72 | Preserved fruits and vegetables |
| | 73 | Grain mill products and fats and oils |
| | 74 | Bakery products |
| | 75 | Sugar and confectionery products |
| | 76 | Beverages |
| | 77 | Miscellaneous food and kindred products |
| 8 Tobacco | 78 | Tobacco products |
| 9 Textile | 79 | Weaving, finishing, yarn, and thread mills |
| | 81 | Carpets and rugs |
| | 82 | Miscellaneous textile goods |
| 10 Apparel | 80 | Knitting mills |
| | 83 | Apparel |
| | 84 | Miscellaneous fabricated textile products |
| 11 Lumber and Wood | 12 | Logging |
| | 13 | Sawmills and planing mills |
| | 14 | Millwork, plywood, and structural members |
| 12 Furniture | 15 | Wood containers and misc wood products |
| | 16 | Wood buildings and mobile homes |
| | 17 | Household furniture |
| | 18 | Partitions and fixtures |
| | 19 | Office and misc furniture and fixtures |
| 13 Paper | 85 | Pulp, paper, and paperboard mills |
| | 86 | Paperboard containers and boxes |
| | 87 | Converted paper products except containers |
| 14 Printing and Publishing | 88 | Newspapers |
| | 89 | Periodicals |
| | 90 | Books |
| | 91 | Miscellaneous publishing |
| | 92 | Commercial printing and business forms |
| | 93 | Greeting cards |
| | 94 | Blankbooks and bookbinding |
| | 95 | Service industries for the printing trade |

| IGEHM Industries | BLS 192 Sectors | |
|---|---|---|
| 15 Chemicals | 96 | Industrial chemicals |
| | 97 | Plastics materials and synthetics |
| | 98 | Drugs |
| | 99 | Soap, cleaners, and toilet goods |
| | 100 | Paints and allied products |
| | 101 | Agricultural chemicals |
| | 102 | Miscellaneous chemical products |
| 16 Petroleum Refining & Coal | 103 | Petroleum refining |
| | 104 | Miscellaneous petroleum and coal products |
| 17 Rubber and Plastics | 105 | Tires and inner tubes |
| | 106 | Rubber products and plastic hose and footwear |
| | 107 | Miscellaneous plastics products, nec |
| 18 Footwear & Leather | 108 | Footwear, except rubber and plastic |
| | 109 | Luggage, handbags, and leather products, nec |
| 19 Stone, clay & glass | 20 | Glass and glass products |
| | 21 | Hydraulic cement |
| | 22 | Stone, clay, and misc mineral products |
| | 23 | Concrete, gypsum, & plaster products |
| 20 Primary Metals | 24 | Blast furnaces and basic steel products |
| | 25 | Iron and steel foundries |
| | 26 | Primary nonferrous smelting & refining |
| | 27 | All other primary metals |
| | 28 | Nonferrous rolling and drawing |
| | 29 | Nonferrous foundries |
| 21 Fabricated Metals | 30 | Metal cans and shipping containers |
| | 31 | Cutlery, hand tools, and hardware |
| | 32 | Plumbing and nonelectric heating equipment |
| | 33 | Fabricated structural metal products |
| | 34 | Screw machine products, bolts, rivets, etc |
| | 35 | Metal forgings and stampings |
| | 36 | Metal coating, engraving, and allied services |
| | 37 | Ordnance and ammunition |
| | 38 | Miscellaneous fabricated metal products |
| 22 Machinery & Computers | 39 | Engines and turbines |
| | 40 | Farm and garden machinery and equipment |
| | 41 | Construction and related machinery |
| | 42 | Metalworking machinery and equipment |
| | 43 | Special industry machinery |
| | 44 | General industrial machinery and equipment |
| | 45 | Computer and office equipment |
| | 46 | Refrigeration and service industry machinery |
| | 47 | Industrial machinery, nec |
| 23 Electrical Machinery | 48 | Electric distribution equipment |
| | 49 | Electrical industrial apparatus |
| | 50 | Household appliances |
| | 51 | Electric lighting and wiring equipment |

| IGEHM Industries | BLS 192 Sectors | |
|---|---|---|
| | 52 | Household audio and video equipment |
| | 53 | Communications equipment |
| | 54 | Electronic components and accessories..... |
| | 55 | Miscellaneous electrical equipment |
| 24 Motor Vehicles | 56 | Motor vehicles and equipment |
| 25 Other Transportation Equip. | 57 | Aerospace |
| | 58 | Ship and boat building and repairing |
| | 59 | Railroad equipment |
| | 60 | Miscellaneous transportation equipment |
| 26 Instruments | 61 | Search and navigation equipment |
| | 62 | Measuring and controlling devices |
| | 63 | Medical equipment, instruments, and supplies |
| | 64 | Ophthalmic goods..... |
| | 65 | Photographic equipment and supplies |
| | 66 | Watches, clocks, and parts |
| 27 Miscellaneous mfg | 67 | Jewelry, silverware, and plated ware |
| | 68 | Toys and sporting goods |
| | 69 | Manufactured products, nec |
| 28 Transportation | 110 | Railroad transportation |
| | 111 | Local and interurban passenger transit |
| | 112 | Trucking and courier services except air |
| | 113 | Warehousing and storage |
| | 114 | Water transportation |
| | 115 | Air transportation |
| | 116 | Pipelines, except natural gas |
| | 117 | Passenger transportation arrangement |
| | 118 | Miscellaneous transportation services |
| 29 Communications | 119 | Telephone and telegraph communications and communications |
| | 120 | Cable and pay television services |
| | 121 | Radio and TV Broadcasting |
| 30 Electric Utilities | 122 | Electric utilities |
| | 124 | Combined Utilities (part of) |
| | 178 | Federal electric utilities |
| | 183 | State and local electric utilities |
| 31 Gas Utilities | 123 | Gas utilities |
| | 124 | Combined Utilities (part of) |
| 32 Trade | 126 | Wholesale trade |
| | 127 | Retail trade exc. eating and drinking places |
| | 128 | Eating and drinking places |
| 33 Finance, insurance, real estate | 129 | Depository institutions |
| | 130 | Nondepository; holding and investment offices |
| | 131 | Security and commodity brokers |
| | 132 | Insurance carriers |
| | 133 | Insurance agents, brokers, and service |
| | 134 | Real estate |
| | 135 | Royalties |

| IGEHM Industries | BLS 192 Sectors | |
|---|---|---|
| 34 Services | 125 | Water and sanitation |
| | 137 | Hotels |
| | 138 | Other lodging places |
| | 139 | Laundry, cleaning, and shoe repair |
| | 140 | Personal services, nec |
| | 141 | Beauty and barber shops |
| | 142 | Funeral service and crematories |
| | 143 | Advertising |
| | 144 | Services to buildings |
| | 145 | Miscellaneous equipment rental and leasing |
| | 146 | Personnel supply services |
| | 147 | Computer and data processing services |
| | 148 | Miscellaneous business services |
| | 149 | Automotive rentals, without drivers |
| | 150 | Automobile parking, repair, and services |
| | 151 | Electrical repair shops |
| | 152 | Watch, jewelry, & furniture repair |
| | 153 | Miscellaneous repair services |
| | 154 | Motion pictures |
| | 155 | Video tape rental |
| | 156 | Producers, orchestras, and entertainers |
| | 157 | Bowling centers |
| | 158 | Commercial sports |
| | 159 | Amusement and recreation services, nec |
| | 160 | Offices of health practitioners |
| | 161 | Nursing and personal care facilities |
| | 162 | Hospitals |
| | 163 | Health services, nec |
| | 164 | Legal services |
| | 165 | Educational services |
| | 166 | Individual and miscellaneous social services |
| | 167 | Job training and related services |
| | 168 | Child day care services |
| | 169 | Residential care |
| | 170 | Museums, botanical, zoological gardens |
| | 171 | Membership organizations |
| | 172 | Engineering and architectural services |
| | 173 | Research and testing services |
| | 174 | Management and public relations |
| | 175 | Accounting, auditing, and other services |
| | 176 | Private households |
| 35 Government Enterprises | 177 | U.S. Postal Service |
| | 179 | Federal government enterprises, nec |
| | 182 | Local government passenger transit |
| | 184 | State and local government enterprises, nec |
| 36 Households | 136 | Owner-occupied dwellings |

| IGEHM Industries | BLS 192 Sectors |
|---|---|
| 38 General Government | |

Note: BLS IO categories are those in the input-output data set from the Office of Employment Projections, U.S. Bureau of Labor Statistics; version released Dec 2001.

Table B4. Input structure of energy sectors and Consumption from the Use table, 2005 (mil $)

| | | Coal Mining | Petro. Mining | Petro. Refining | Electric Utilities | Gas Utilities | Consumption |
|---|---|---|---|---|---|---|---|
| 1 | Agriculture | 21 | 40 | 94 | 171 | 69 | 70931 |
| 2 | Metal Mining | 0 | 0 | 85 | 0 | 0 | 0 |
| 3 | Coal Mining | 1501 | 0 | 11 | 14887 | 21 | 145 |
| 4 | Petroleum and Gas | 0 | 12318 | 107566 | 6962 | 29119 | 0 |
| 5 | Nonmetallic Mining | 8 | 7 | 916 | 29 | 16 | 1 |
| 6 | Construction | 1 | 530 | 702 | 8951 | 78 | 27326 |
| 7 | Food Products | 0 | 0 | 296 | 0 | 0 | 423629 |
| 8 | Tobacco Products | 0 | 0 | 0 | 0 | 0 | 40945 |
| 9 | Textile Mill Products | 61 | 0 | 2 | 35 | 10 | 10342 |
| 10 | Apparel and Textiles | 1 | 0 | 1 | 6 | 2 | 135223 |
| 11 | Lumber and Wood | 42 | 22 | 150 | 1504 | 645 | 784 |
| 12 | Furniture and Fixtures | 0 | 0 | 0 | 4 | 2 | 0 |
| 13 | Paper Products | 8 | 6 | 466 | 201 | 57 | 23006 |
| 14 | Printing and Publishing | 1 | 4 | 15 | 106 | 15 | 33524 |
| 15 | Chemical Products | 227 | 2875 | 7304 | 1953 | 121 | 62935 |
| 16 | Petroleum Refining | 1277 | 4025 | 84671 | 16900 | 649 | 144396 |
| 17 | Rubber and Plastic | 207 | 37 | 1264 | 863 | 188 | 9069 |
| 18 | Leather Products | 0 | 2 | 4 | 4 | 3 | 46631 |
| 19 | Stone, Clay, and Glass | 118 | 1045 | 1568 | 679 | 318 | 1605 |
| 20 | Primary Metals | 95 | 2154 | 114 | 775 | 243 | 60 |
| 21 | Fabricated Metals | 336 | 1195 | 737 | 1816 | 819 | 4308 |
| 22 | Industrial Machinery | 2575 | 3531 | 308 | 2694 | 308 | 318 |
| 23 | Electronic & Electric Equip | 70 | 128 | 105 | 1656 | 375 | 6490 |
| 24 | Motor Vehicles | 52 | 106 | 214 | 3864 | 42 | 0 |
| 25 | Other Transportation Equip | 0 | 0 | 2 | 13 | 7 | 0 |
| 26 | Instruments | 3 | 68 | 60 | 1183 | 36 | 3777 |
| 27 | Miscellaneous Mfg | 2 | 3 | 20 | 100 | 31 | 34799 |
| 28 | Transport and Warehouse | 1017 | 1341 | 10030 | 10262 | 669 | 153357 |
| 29 | Communications | 40 | 450 | 588 | 1664 | 139 | 202180 |
| 30 | Electric Utilities | 402 | 1605 | 4707 | 4612 | 204 | 167552 |
| 31 | Gas Utilities | 17 | 1793 | 17705 | 9502 | 12563 | 60346 |
| 32 | Trade | 914 | 2480 | 18944 | 5948 | 1119 | 1277122 |
| 33 | FIRE | 978 | 31100 | 9223 | 12171 | 1760 | 1028019 |
| 34 | Services | 1166 | 6127 | 11969 | 19875 | 4503 | 1187793 |
| 35 | Goverment Enterprises | 5 | 10 | 216 | 748 | 131 | 58395 |
| | Noncompeting imports | 34 | 3428 | 0 | 98 | 159 | 54846 |
| | Value Added | 14327 | 183150 | 583024 | 242751 | 22971 | 681263 |
| | Gross output | 25507 | 259579 | 863081 | 372987 | 77393 | 5951118 |

Table B5. The Use of energy commodities, 2005 (mil $)

| | | Coal Mining | Petro. Mining | Petro. Refining | Electric Utilities | Gas Utilities |
|---|---|---|---|---|---|---|
| 1 | Agriculture | 0 | 0 | 14358 | 4121 | 241 |
| 2 | Metal Mining | 16 | 0 | 1224 | 1134 | 77 |
| 3 | Coal Mining | 1501 | 0 | 1277 | 402 | 17 |
| 4 | Petroleum and Gas | 0 | 12318 | 4025 | 1605 | 1793 |
| 5 | Nonmetallic Mining | 47 | 0 | 1839 | 780 | 216 |
| 6 | Construction | 0 | 0 | 33222 | 3261 | 0 |
| 7 | Food Products | 165 | 0 | 4497 | 4507 | 1295 |
| 8 | Tobacco Products | 15 | 0 | 110 | 73 | 8 |
| 9 | Textile Mill Products | 26 | 0 | 621 | 1113 | 183 |
| 10 | Apparel and Textiles | 3 | 0 | 177 | 281 | 60 |
| 11 | Lumber and Wood | 3 | 0 | 2091 | 1501 | 132 |
| 12 | Furniture and Fixtures | 15 | 0 | 1123 | 703 | 117 |
| 13 | Paper Products | 252 | 10 | 2880 | 3515 | 790 |
| 14 | Printing and Publishing | 0 | 0 | 1147 | 1290 | 197 |
| 15 | Chemical Products | 263 | 3045 | 11224 | 8351 | 2695 |
| 16 | Petroleum Refining | 11 | 107566 | 84671 | 4707 | 17705 |
| 17 | Rubber and Plastic | 14 | 0 | 1232 | 3048 | 356 |
| 18 | Leather Products | 1 | 0 | 83 | 75 | 12 |
| 19 | Stone, Clay, and Glass | 437 | 2 | 3027 | 2949 | 1246 |
| 20 | Primary Metals | 1161 | 91 | 2671 | 7510 | 1319 |
| 21 | Fabricated Metals | 8 | 2 | 2062 | 3715 | 662 |
| 22 | Industrial Machinery | 12 | 0 | 1987 | 2928 | 441 |
| 23 | Electronic & Electric Equip | 3 | 1 | 1472 | 2719 | 295 |
| 24 | Motor Vehicles | 34 | 0 | 1397 | 2122 | 270 |
| 25 | Other Transportation Equip | 20 | 0 | 1171 | 1524 | 146 |
| 26 | Instruments | 40 | 0 | 694 | 1213 | 109 |
| 27 | Miscellaneous Mfg | 2 | 0 | 646 | 390 | 77 |
| 28 | Transport and Warehouse | 8 | 47 | 79991 | 7270 | 134 |
| 29 | Communications | 0 | 0 | 1549 | 2365 | 84 |
| 30 | Electric Utilities | 14887 | 6962 | 16900 | 4612 | 9502 |
| 31 | Gas Utilities | 21 | 29119 | 649 | 204 | 12563 |
| 32 | Trade | 21 | 9 | 34267 | 41705 | 3062 |
| 33 | FIRE | 7 | 0 | 7278 | 24837 | 1630 |
| 34 | Services | 21 | 9 | 35473 | 35390 | 3322 |
| 35 | Goverment Enterprises | 0 | 0 | 14770 | 8718 | 2002 |
| | Consumption | 145 | 0 | 144396 | 167552 | 60346 |
| | Investment | 8547 | 82801 | 13884 | 0 | 43 |
| | Government | 115 | -349 | 38183 | 36879 | 2508 |
| | Exports | 1875 | 3442 | 27026 | 6125 | 1541 |
| | Imports | -2891 | -216619 | -176657 | -1565 | 0 |
| | Total domestic commodity | 26804 | 28457 | 418638 | 399627 | 127200 |
| | | | | 0.242562 | 0.417636 | 0.474422 |

Table B7: Exports and Imports, Share of Commodity Output in 2005

| | Industry | Export Share | Import Share | Export ($bil) | Import ($bil) |
|---|---|---|---|---|---|
| 1 | Agriculture | 7.2 | 7.9 | 29.2 | 32.1 |
| 2 | Metal Mining | 8.4 | -13.2 | 2.1 | -3.3 |
| 3 | Coal Mining | 7.0 | 10.8 | 1.9 | 2.9 |
| 4 | Petroleum and Gas | 1.4 | 88.2 | 3.4 | 216.6 |
| 5 | Nonmetallic Mining | 4.3 | 14.1 | 0.9 | 3.0 |
| 6 | Construction | 0.1 | 0.0 | 1.3 | 0.0 |
| 7 | Food Products | 6.5 | 9.2 | 40.9 | 57.5 |
| 8 | Tobacco Products | 6.1 | 5.5 | 3.2 | 2.8 |
| 9 | Textile Mill Products | 16.2 | 29.1 | 10.5 | 18.9 |
| 10 | Apparel and Textiles | 15.3 | 278.9 | 6.4 | 116.2 |
| 11 | Lumber and Wood | 4.1 | 23.7 | 5.4 | 30.8 |
| 12 | Furniture and Fixtures | 5.0 | 41.8 | 5.0 | 41.8 |
| 13 | Paper Products | 9.1 | 15.3 | 15.3 | 25.6 |
| 14 | Printing and Publishing | 4.3 | 4.0 | 5.6 | 5.2 |
| 15 | Chemical Products | 17.0 | 21.6 | 89.5 | 113.4 |
| 16 | Petroleum Refining | 6.4 | 42.1 | 27.0 | 176.7 |
| 17 | Rubber and Plastic | 9.2 | 23.1 | 17.4 | 43.4 |
| 18 | Leather Products | 62.6 | 795.1 | 4.1 | 52.2 |
| 19 | Stone, Clay, and Glass | 5.1 | 18.6 | 6.5 | 23.8 |
| 20 | Primary Metals | 8.3 | 25.6 | 20.5 | 63.0 |
| 21 | Fabricated Metals | 7.3 | 14.8 | 21.7 | 44.2 |
| 22 | Industrial Machinery | 29.7 | 48.4 | 124.7 | 203.3 |
| 23 | Electronic & Electric Equip | 30.2 | 66.0 | 100.2 | 219.4 |
| 24 | Motor Vehicles | 16.5 | 57.8 | 72.5 | 253.2 |
| 25 | Other Transportation Equip | 29.0 | 17.5 | 65.4 | 39.5 |
| 26 | Instruments | 24.5 | 34.9 | 50.9 | 72.4 |
| 27 | Miscellaneous Manufacturing | 21.4 | 126.8 | 12.7 | 75.1 |
| 28 | Transport and Warehouse | 13.1 | -0.5 | 87.3 | -3.3 |
| 29 | Communications | 2.5 | 0.0 | 11.5 | 0.0 |
| 30 | Electric Utilities | 1.5 | 0.4 | 6.1 | 1.6 |
| 31 | Gas Utilities | 1.2 | 0.0 | 1.5 | 0.0 |
| 32 | Trade | 4.3 | | 116.6 | |
| 33 | FIRE | 4.9 | 0.2 | 132.7 | 4.9 |
| 34 | Services | 1.6 | 0.3 | 75.9 | 15.5 |
| 35 | Goverment Enterprises | 0.3 | 0.0 | 0.4 | 0.0 |

| | | | |
|---|---|---|---|
| 7.135525 | 7.018481 | 23.27994 | 24.62649 |
| 7.275883 | -15.0672 | 1.014456 | -1.8257 |
| 7.536351 | 4.610959 | 1.591002 | 1.020475 |
| 1.64927 | 42.95975 | 2.051414 | 93.67891 |
| 5.411826 | 12.62237 | 0.94179 | 2.513917 |
| 0.091346 | 0 | 0.912581 | 0 |
| 7.320778 | 6.698603 | 37.51369 | 36.7899 |
| 10.73684 | 3.760807 | 6.433641 | 2.341582 |
| 12.61667 | 14.0363 | 8.416309 | 10.89218 |
| 16.39212 | 53.64563 | 13.96922 | 98.62353 |
| 5.292758 | 13.83746 | 6.167104 | 18.71273 |
| 5.578297 | 20.83213 | 4.840445 | 22.83329 |
| 9.299607 | 10.93441 | 16.21148 | 21.40146 |
| 4.310444 | 2.8738 | 5.822823 | 3.996977 |
| 17.49317 | 16.17972 | 74.08045 | 81.74419 |
| 6.473413 | 24.17428 | 15.74085 | 77.52327 |
| 9.756745 | 14.23507 | 16.6087 | 28.25405 |
| 28.39125 | 71.62335 | 2.989673 | 26.57864 |
| 5.702008 | 13.35647 | 6.24208 | 16.87551 |
| 10.07913 | 20.60052 | 19.08956 | 49.13982 |
| 7.887623 | 9.367508 | 22.17674 | 29.05974 |
| 28.53461 | 26.77213 | 131.4979 | 168.482 |
| 26.85224 | 30.23394 | 115.8773 | 187.0114 |
| 15.72906 | 30.83665 | 66.65497 | 188.9388 |
| 33.92363 | 16.19224 | 62.60468 | 35.65556 |
| 26.85222 | 21.43201 | 48.2697 | 49.03562 |
| 17.62251 | 50.85141 | 9.125257 | 53.57585 |
| 13.3459 | -0.95174 | 74.50499 | -5.26313 |
| 2.453587 | 0 | 9.346551 | 0 |
| 0.978694 | 1.218138 | 2.405327 | 3.030726 |
| 1.130451 | 0 | 1.078567 | 0 |
| 4.766162 | | 102.9907 | |
| 5.363802 | 0.183538 | 109.9999 | 3.770877 |
| 2.156876 | 0.293044 | 82.11589 | 11.18947 |
| 0.272179 | 0 | 0.333617 | 0 |

Table B8: Growth in Output, Inputs, and Prices, 1960-2005 (% per year)

| | | Output | Energy Intermediate | Nonenergy Intermediate | Relative Price |
|---|---|---|---|---|---|
| 1 | Agriculture | 2.00 | 1.39 | 1.31 | -0.85 |
| 2 | Metal Mining | 0.67 | 1.61 | 2.34 | 1.16 |
| 3 | Coal Mining | 2.22 | 1.36 | 3.25 | -0.67 |
| 4 | Petroleum & Gas Mining | 0.40 | -2.78 | 3.82 | 2.02 |
| 5 | Nonmetallic Mining | 1.56 | 0.98 | 2.05 | -0.25 |
| 6 | Construction | 1.60 | 1.71 | 2.87 | 0.84 |
| 7 | Food Products | 2.01 | 1.31 | 1.58 | -0.63 |
| 8 | Tobacco Products | -0.83 | 0.36 | 0.69 | 2.41 |
| 9 | Textile Mill Products | 1.17 | -0.49 | -0.09 | -1.67 |
| 10 | Apparel and Textiles | -0.28 | -1.76 | -0.96 | -1.44 |
| 11 | Lumber and Wood | 2.03 | 1.62 | 2.26 | 0.10 |
| 12 | Furniture and Fixtures | 3.27 | 2.72 | 3.13 | -0.37 |
| 13 | Paper Products | 2.04 | 0.96 | 1.80 | -0.29 |
| 14 | Printing and Publishing | 1.83 | 1.82 | 1.78 | 0.59 |
| 15 | Chemical Products | 2.81 | 1.55 | 2.67 | 0.03 |
| 16 | Petroleum Refining | 1.63 | 1.40 | 2.51 | 1.90 |
| 17 | Rubber and Plastic | 4.21 | 2.49 | 3.48 | -0.87 |
| 18 | Leather Products | -2.36 | -2.01 | -2.29 | -0.31 |
| 19 | Stone, Clay, and Glass | 1.90 | 0.89 | 1.90 | -0.12 |
| 20 | Primary Metals | 0.84 | 0.06 | 1.04 | 0.03 |
| 21 | Fabricated Metals | 1.94 | 1.47 | 2.00 | -0.09 |
| 22 | Industrial Machinery | 5.92 | 1.90 | 4.38 | -3.44 |
| 23 | Electronic & Electric Equip | 6.50 | 1.83 | 3.66 | -4.20 |
| 24 | Motor Vehicles | 3.22 | 1.66 | 3.38 | -0.84 |
| 25 | Other Transportation Equip | 1.91 | 1.82 | 2.28 | -0.05 |
| 26 | Instruments | 4.32 | 2.27 | 4.16 | -1.06 |
| 27 | Miscellaneous Manufacturing | 2.18 | 1.32 | 1.85 | -0.57 |
| 28 | Transport and Warehouse | 3.01 | 2.80 | 2.91 | -0.40 |
| 29 | Communications | 5.65 | 3.07 | 5.40 | -1.53 |
| 30 | Electric Utilities | 2.94 | 1.60 | 3.65 | 0.58 |
| 31 | Gas Utilities | -0.45 | -0.45 | 3.78 | 1.78 |
| 32 | Trade | 3.72 | 2.62 | 3.45 | -0.54 |
| 33 | FIRE | 4.19 | 4.32 | 4.42 | 0.33 |
| 34 | Services | 3.93 | 3.37 | 4.49 | 1.04 |
| 35 | Goverment Enterprises | 2.43 | 3.26 | 2.86 | 1.06 |

Note: Price growth is relative to the GDP deflator.

Table B9: Growth of industry output by subperiod (% per year)

| | | 1960-2005 | 1960-1973 | 1973-1995 | 1995-2005 |
|---|---|---|---|---|---|
| 1 | Agriculture | 2.00 | 1.65 | 1.99 | 2.11 |
| 2 | Metal Mining | 0.67 | 1.19 | 1.32 | -0.48 |
| 3 | Coal Mining | 2.21 | 2.72 | 2.37 | 0.82 |
| 4 | Petroleum & Gas Mining | 0.40 | 2.29 | -0.71 | 0.21 |
| 5 | Nonmetallic Mining | 1.56 | 3.43 | 0.64 | 1.97 |
| 6 | Construction | 1.60 | 2.52 | 0.44 | 2.72 |
| 7 | Food Products | 2.01 | 2.44 | 1.83 | 1.58 |
| 8 | Tobacco Products | -0.83 | 0.57 | -0.33 | -2.63 |
| 9 | Textile Mill Products | 1.17 | 4.19 | 1.24 | -2.78 |
| 10 | Apparel and Textiles | -0.28 | 3.04 | 1.11 | -6.65 |
| 11 | Lumber and Wood | 2.03 | 4.48 | 1.32 | 0.24 |
| 12 | Furniture and Fixtures | 3.27 | 4.80 | 2.01 | 4.27 |
| 13 | Paper Products | 2.04 | 4.57 | 2.05 | -0.58 |
| 14 | Printing and Publishing | 1.83 | 3.15 | 2.06 | -0.12 |
| 15 | Chemical Products | 2.81 | 6.24 | 1.82 | 0.93 |
| 16 | Petroleum Refining | 1.63 | 3.01 | 1.10 | 0.64 |
| 17 | Rubber and Plastic | 4.21 | 7.91 | 3.64 | 1.62 |
| 18 | Leather Products | -2.36 | -0.02 | -2.78 | -4.89 |
| 19 | Stone, Clay, and Glass | 1.90 | 3.62 | 0.62 | 3.07 |
| 20 | Primary Metals | 0.84 | 3.74 | -0.45 | 1.39 |
| 21 | Fabricated Metals | 1.94 | 4.14 | 1.14 | 1.84 |
| 22 | Industrial Machinery | 5.92 | 6.51 | 5.76 | 7.33 |
| 23 | Electronic & Electric Equip | 6.50 | 6.82 | 6.39 | 8.40 |
| 24 | Motor Vehicles | 3.22 | 5.38 | 2.43 | 3.33 |
| 25 | Other Transportation Equip | 1.91 | 2.51 | 1.26 | 3.08 |
| 26 | Instruments | 4.32 | 4.98 | 4.65 | 3.42 |
| 27 | Miscellaneous Manufacturing | 2.18 | 4.54 | 0.88 | 1.91 |
| 28 | Transport and Warehouse | 3.01 | 4.41 | 2.80 | 2.19 |
| 29 | Communications | 5.65 | 7.09 | 4.90 | 5.95 |
| 30 | Electric Utilities | 2.94 | 5.68 | 2.37 | 1.01 |
| 31 | Gas Utilities | -0.45 | 4.46 | -2.97 | -1.69 |
| 32 | Trade | 3.72 | 4.72 | 3.27 | 3.64 |
| 33 | FIRE | 4.19 | 4.22 | 4.18 | 3.99 |
| 34 | Services | 3.93 | 4.51 | 3.66 | 4.02 |
| 35 | Goverment Enterprises | 2.43 | 3.02 | 2.92 | 1.47 |
| | GDP | 3.29 | 4.24 | 2.80 | 3.15 |

Table B10. Output of Energy industries (producer's prices, billion $1996).

| | Coal Mining | Petroleum Mining | Petroleum Refining | Electric Utilities | Gas Utilities |
|---|---|---|---|---|---|
| 1960 | 10.01 | 127.71 | 88.82 | 80.94 | 59.03 |
| 1961 | 9.70 | 130.90 | 89.03 | 84.78 | 61.20 |
| 1962 | 10.19 | 135.44 | 92.30 | 90.62 | 65.35 |
| 1963 | 11.04 | 137.11 | 97.19 | 95.35 | 68.69 |
| 1964 | 10.29 | 141.50 | 103.46 | 100.33 | 73.89 |
| 1965 | 12.33 | 145.20 | 103.73 | 105.55 | 76.18 |
| 1966 | 12.88 | 150.83 | 107.16 | 112.78 | 81.53 |
| 1967 | 13.36 | 157.06 | 114.06 | 119.06 | 85.58 |
| 1968 | 13.16 | 162.94 | 122.52 | 127.66 | 91.63 |
| 1969 | 13.51 | 169.05 | 127.84 | 135.57 | 97.51 |
| 1970 | 14.52 | 172.71 | 127.89 | 143.49 | 102.13 |
| 1971 | 13.29 | 169.90 | 131.40 | 148.36 | 106.19 |
| 1972 | 14.33 | 172.54 | 136.33 | 158.58 | 108.80 |
| 1973 | 14.26 | 171.89 | 131.34 | 169.33 | 105.45 |
| 1974 | 14.53 | 168.17 | 143.05 | 170.59 | 102.76 |
| 1975 | 15.61 | 163.09 | 144.33 | 175.40 | 98.96 |
| 1976 | 16.36 | 162.33 | 159.18 | 184.92 | 97.93 |
| 1977 | 16.65 | 166.56 | 169.97 | 194.97 | 98.36 |
| 1978 | 16.02 | 174.42 | 164.20 | 202.42 | 102.09 |
| 1979 | 18.70 | 176.31 | 174.28 | 211.27 | 109.80 |
| 1980 | 19.86 | 186.32 | 172.13 | 215.01 | 112.09 |
| 1981 | 19.71 | 190.03 | 148.90 | 215.03 | 112.49 |
| 1982 | 20.10 | 183.12 | 148.75 | 214.05 | 108.45 |
| 1983 | 18.75 | 172.22 | 137.86 | 219.31 | 95.51 |
| 1984 | 21.49 | 182.51 | 156.85 | 229.05 | 95.34 |
| 1985 | 21.18 | 177.03 | 152.50 | 230.08 | 88.16 |
| 1986 | 21.35 | 160.45 | 144.74 | 234.46 | 77.11 |
| 1987 | 22.05 | 158.55 | 166.96 | 241.80 | 71.70 |
| 1988 | 22.82 | 160.08 | 172.39 | 250.32 | 73.24 |
| 1989 | 23.54 | 153.13 | 171.18 | 254.79 | 71.60 |
| 1990 | 24.72 | 154.96 | 171.18 | 258.12 | 65.95 |
| 1991 | 23.92 | 154.86 | 168.72 | 257.15 | 63.93 |
| 1992 | 23.96 | 149.16 | 166.51 | 255.88 | 66.08 |
| 1993 | 22.68 | 150.25 | 165.89 | 265.13 | 66.78 |
| 1994 | 24.79 | 149.69 | 172.21 | 271.35 | 58.10 |
| 1995 | 24.71 | 146.44 | 175.77 | 273.42 | 54.95 |
| 1996 | 25.35 | 149.59 | 179.21 | 278.04 | 57.85 |
| 1997 | 26.26 | 155.46 | 167.98 | 281.63 | 53.36 |
| 1998 | 26.96 | 151.27 | 191.20 | 297.44 | 49.86 |
| 1999 | 26.38 | 141.25 | 186.12 | 302.58 | 53.84 |
| 2000 | 25.73 | 154.75 | 189.50 | 313.43 | 48.79 |
| 2001 | 26.82 | 159.64 | 193.35 | 307.63 | 48.51 |
| 2002 | 26.22 | 145.99 | 197.21 | 315.98 | 45.44 |
| 2003 | 25.60 | 152.74 | 184.86 | 311.10 | 47.91 |
| 2004 | 26.50 | 155.42 | 192.09 | 309.55 | 46.89 |
| 2005 | 27.13 | 153.19 | 184.82 | 303.26 | 48.23 |

Table B11. Industry Output price of Energy industries.

| | Coal Mining | Petroleum Mining | Petroleum Refining | Electric Utilities | Gas Utilities |
|---|---|---|---|---|---|
| 1960 | 0.250 | 0.127 | 0.181 | 0.183 | 0.137 |
| 1961 | 0.245 | 0.128 | 0.181 | 0.184 | 0.141 |
| 1962 | 0.239 | 0.129 | 0.178 | 0.184 | 0.142 |
| 1963 | 0.235 | 0.129 | 0.177 | 0.185 | 0.141 |
| 1964 | 0.271 | 0.127 | 0.169 | 0.185 | 0.139 |
| 1965 | 0.237 | 0.127 | 0.176 | 0.186 | 0.140 |
| 1966 | 0.242 | 0.129 | 0.182 | 0.185 | 0.139 |
| 1967 | 0.246 | 0.132 | 0.186 | 0.185 | 0.139 |
| 1968 | 0.249 | 0.134 | 0.181 | 0.187 | 0.138 |
| 1969 | 0.266 | 0.139 | 0.183 | 0.190 | 0.140 |
| 1970 | 0.334 | 0.144 | 0.186 | 0.198 | 0.145 |
| 1971 | 0.378 | 0.152 | 0.197 | 0.214 | 0.154 |
| 1972 | 0.410 | 0.154 | 0.200 | 0.226 | 0.165 |
| 1973 | 0.456 | 0.176 | 0.256 | 0.240 | 0.177 |
| 1974 | 0.841 | 0.279 | 0.402 | 0.290 | 0.214 |
| 1975 | 1.028 | 0.341 | 0.463 | 0.338 | 0.281 |
| 1976 | 1.038 | 0.381 | 0.496 | 0.368 | 0.349 |
| 1977 | 1.059 | 0.441 | 0.550 | 0.407 | 0.428 |
| 1978 | 1.164 | 0.487 | 0.582 | 0.439 | 0.472 |
| 1979 | 1.264 | 0.645 | 0.787 | 0.476 | 0.554 |
| 1980 | 1.310 | 0.946 | 1.184 | 0.559 | 0.697 |
| 1981 | 1.405 | 1.312 | 1.397 | 0.644 | 0.822 |
| 1982 | 1.449 | 1.350 | 1.324 | 0.713 | 0.970 |
| 1983 | 1.381 | 1.269 | 1.213 | 0.741 | 1.106 |
| 1984 | 1.363 | 1.253 | 1.172 | 0.786 | 1.102 |
| 1985 | 1.341 | 1.184 | 1.127 | 0.817 | 1.072 |
| 1986 | 1.267 | 0.768 | 0.763 | 0.827 | 0.955 |
| 1987 | 1.229 | 0.794 | 0.807 | 0.825 | 0.883 |
| 1988 | 1.175 | 0.727 | 0.775 | 0.835 | 0.866 |
| 1989 | 1.163 | 0.821 | 0.865 | 0.858 | 0.894 |
| 1990 | 1.160 | 0.936 | 1.045 | 0.881 | 0.911 |
| 1991 | 1.146 | 0.841 | 0.949 | 0.927 | 0.909 |
| 1992 | 1.121 | 0.837 | 0.919 | 0.950 | 0.914 |
| 1993 | 1.057 | 0.853 | 0.887 | 0.965 | 0.953 |
| 1994 | 1.034 | 0.802 | 0.855 | 0.971 | 0.993 |
| 1995 | 1.015 | 0.781 | 0.883 | 0.989 | 0.967 |
| 1996 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 1997 | 0.970 | 1.025 | 0.979 | 1.004 | 1.067 |
| 1998 | 0.939 | 0.826 | 0.761 | 0.994 | 1.042 |
| 1999 | 0.885 | 0.825 | 0.880 | 0.994 | 1.007 |
| 2000 | 0.825 | 0.852 | 1.286 | 1.018 | 1.035 |
| 2001 | 0.877 | 0.862 | 1.190 | 1.084 | 1.215 |
| 2002 | 0.907 | 0.804 | 1.140 | 1.064 | 1.027 |
| 2003 | 0.901 | 1.078 | 1.390 | 1.114 | 1.273 |
| 2004 | 0.950 | 1.264 | 1.696 | 1.165 | 1.405 |
| 2005 | 0.993 | 1.699 | 2.276 | 1.272 | 1.637 |

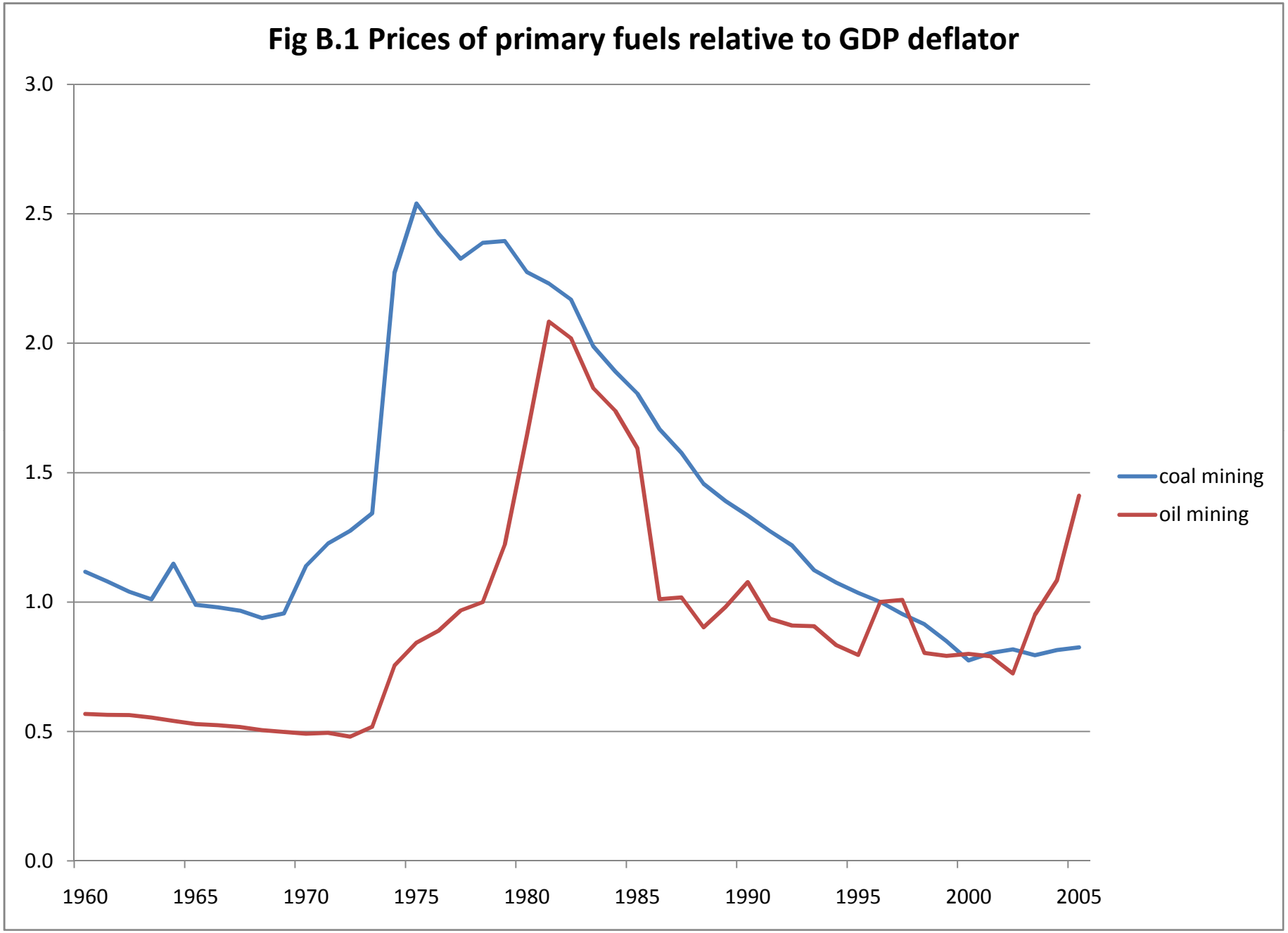


Fig B.1 Prices of primary fuels relative to GDP deflator
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
coal mining
oil mining

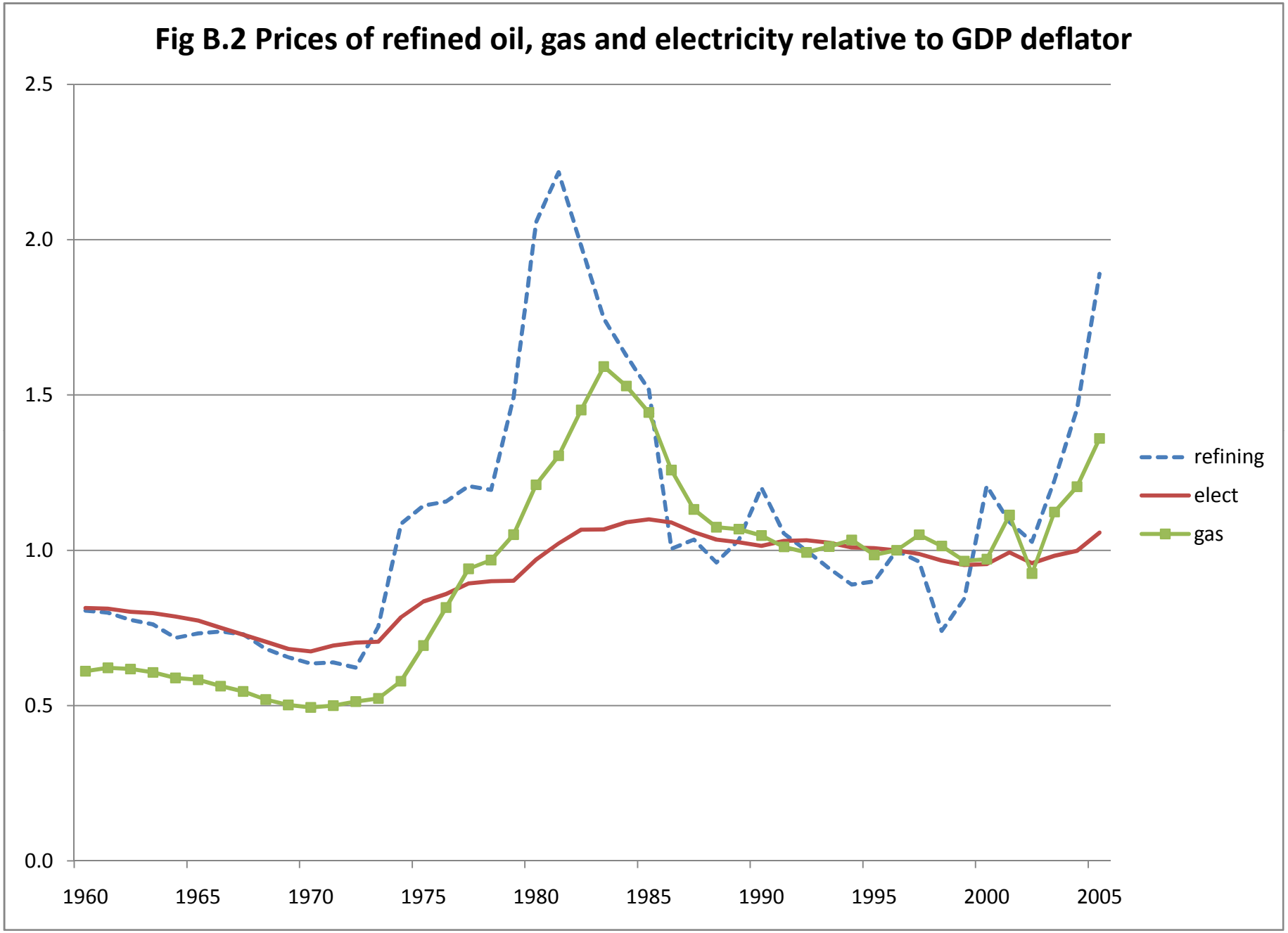


Fig B.2 Prices of refined oil, gas and electricity relative to GDP deflator
2.5
2.0
1.5
1.0
0.5
0.0
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
refining
elect
gas

**Fig. B3. Value-added share of output, 2005**

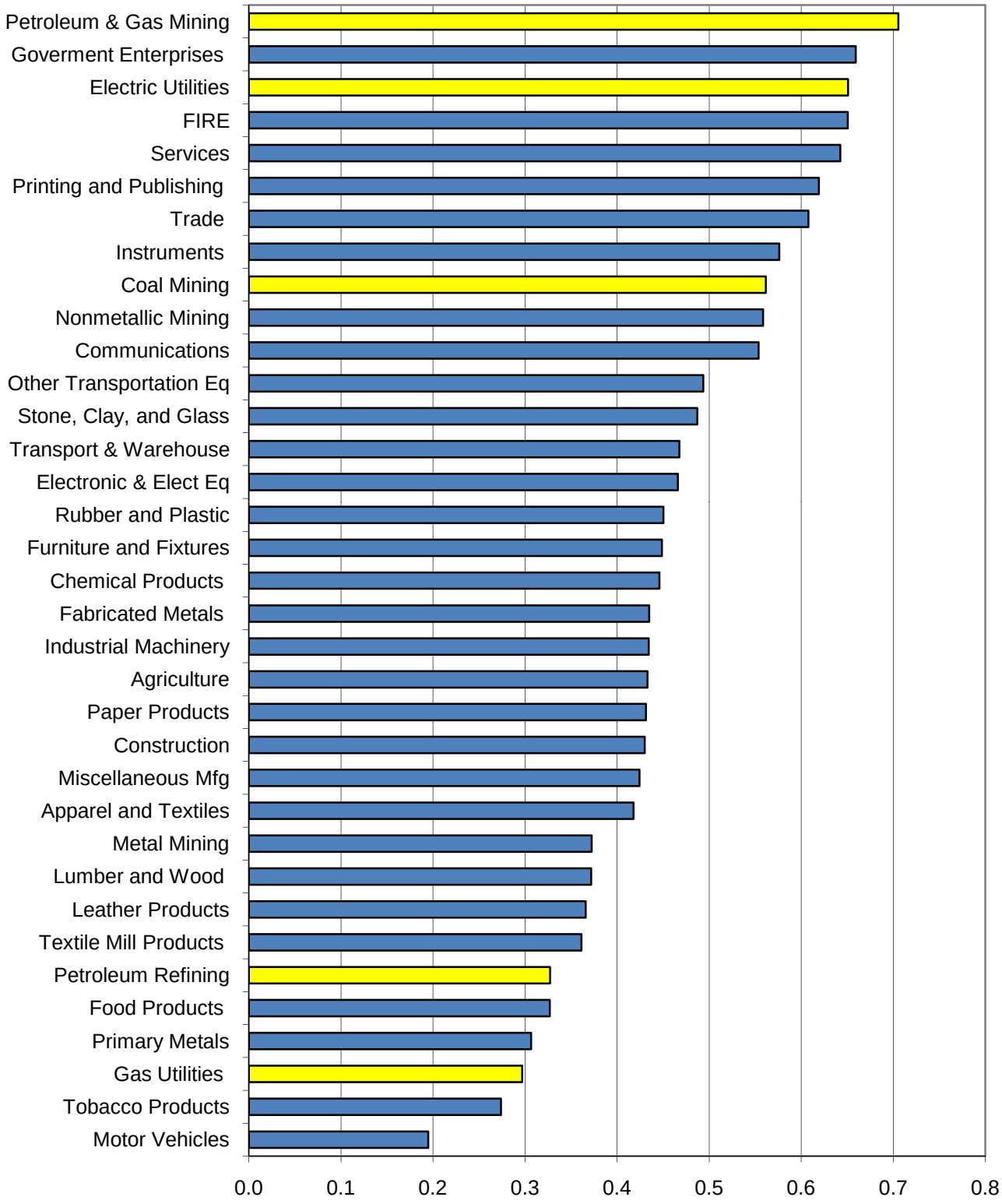
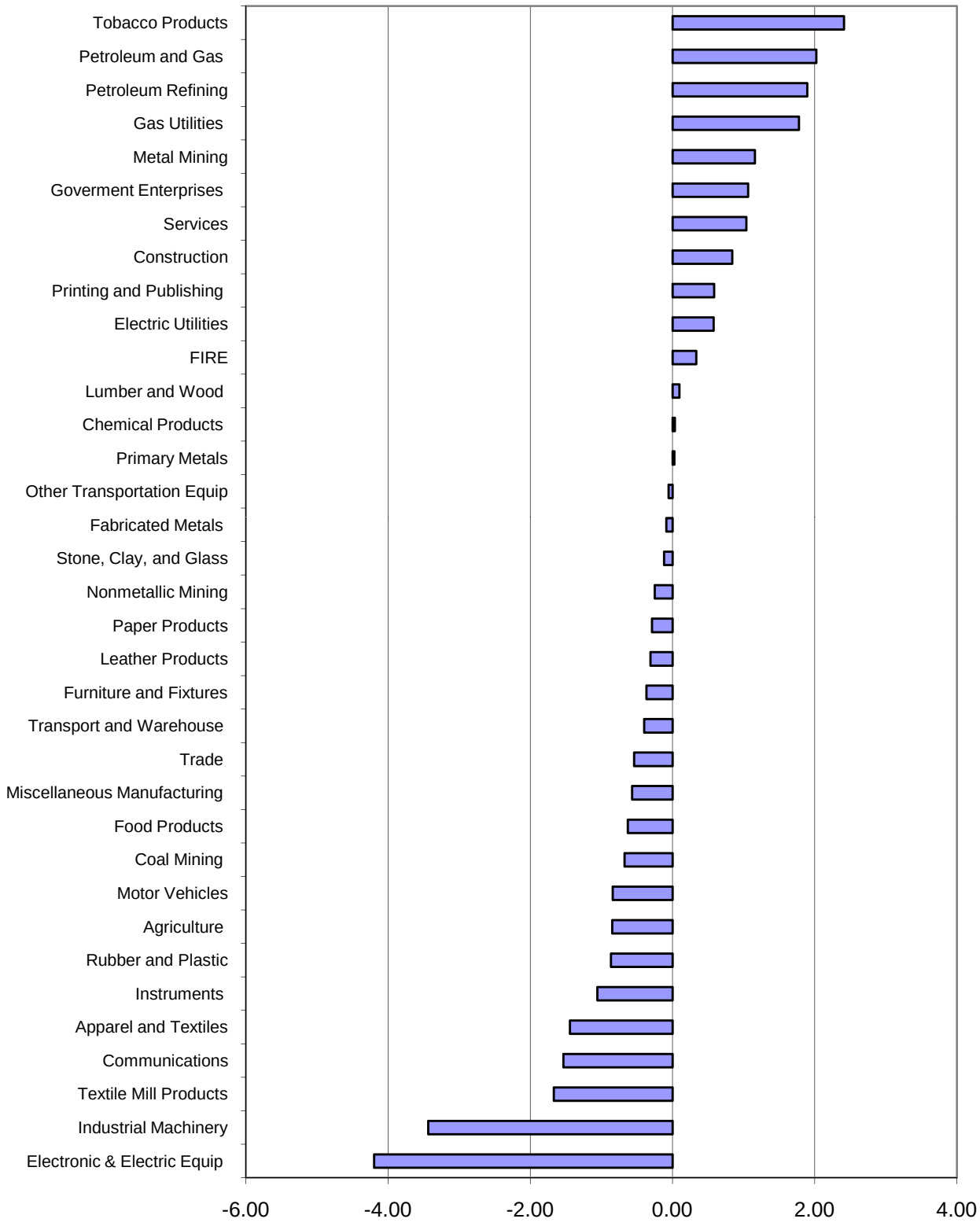


**Fig. B4: Growth Rate of Industry Price relative to GDP deflator 1960-2005**



## Fig. B5. Output of energy industries (billion $1996)