Employment Outlook: 2024-2034

Layout and Description

Input-Output Tables:

1997 through 2024 Historical and Projected 2034

Bureau of Labor Statistics
Employment Projections Program

August 28, 2025

Employment Projections EP-Info@bls.gov 202-691-5700

Contents

I-O Layout and Description

This document describes input-output, final demand, and value-added data developed by the Bureau of Labor Statistics in the Office of Occupational Statistics and Employment Projections.

For the 2034 projections, input-output, final demand, and value-added data were developed for the years 1997 through 2024 and projected year 2034. Historical tables are provided in both nominal (current) dollars and in 2017 chain-weighted real dollars. The projected tables are provided in 2017 chain-weighted real dollars only.

In addition to the data tables, sectoring plan files "SectorPlan2034.xlsx" and "FDSectorPlan2034.xlsx" are needed because the data files have no labels to signify columns and rows. The "SectorPlan2034.xlsx" file provides our industry sectoring plan with industry codes and titles. The "FDSectorPlan2034.xlsx" file provides our final demand column codes and titles.

Note: The SectorPlan2034.xlsx file contains aggregate sector codes and titles that DO NOT appear in the I-O tables.

The matrix tables described here are in Microsoft Excel (Excel) files. Matrices include only data and sector code column and row identifiers. As stated above, there are no row or column labels.

Data may not add exactly to their totals due to rounding error. In the real tables, the data do not add up to published totals like gross domestic product because of chain-weighting.

This data is based on the 2022 North American Industrial Classification System (NAICS); the U.S. Department of Commerce's Bureau of Economic Analysis (BEA) 2007, 2012, and 2017 benchmark input-output tables; and the BEA Annual input-output tables for 1997-2023. The BLS industry sectoring plan is shown in the industry sectoring plan files discussed above.

Naming conventions for input-output tables

All the file names begin with either “NOMINAL_” for nominal (current) dollars, “REAL_” for 2017 chain-weighted real dollars, or “PROJECTED_” for projections 2034. It should be noted that all input-output projections files only contain real dollar data. No current dollar input-output tables were projected.

Following “NOMINAL_”, “REAL_”, or “PROJECTED_” are either “USE”, “MAKE”, “FD”, “FDAGG”, “INDOUTPUT”, “COMOUTPUT”, or “OUTPUT”.

The "USE" matrix shows the commodities used by individual industries in their production processes (intermediate inputs) as well as commodities that are sold directly to consumers and other buyers (final demand). The table also shows each industry’s contribution to GDP (value added).

Each column sums to its respective industry output. Each row sums to its respective commodity output.

The "MAKE" matrix details the production of commodities by industries. Each row sums to industry output, and each column sums to commodity output.

The "FD" matrix is a detailed set of 132 final demand types. Each of the 132 columns is distributed across the 176 input-output commodity rows identified in “SectorPlan2034.xlsx” as mentioned in page 1. The "FDAGG" is the "FD" matrix collapsed from 132 columns to 11 columns. The column sectors are shown in “FDSectorPlan2034.xlsx” as mentioned in page 1. Each year is a different worksheet in the selected workbook.

The “COMOUTPUT” and “INDOUTPUT” matrices detail the respective historical commodity and industry outputs by each of the 176 sectors identified in the input-output system for the years 1997 through 2024. The sector identifier is in the first column. The time series starts with 1997 outputs in the second column, the next year’s outputs in the third column, and continues through 2024 outputs in the last column.

For the projection year, the “OUTPUT_2034” matrix contains three columns. The sector identifier is in the first column. The second column details industry output for each sector. The third column details the commodity output for each sector.

Standard matrix types

"USE" Matrix (177x177)

This matrix contains intermediate inter-industry inputs plus value added (row 177) for the year specified in the worksheet name. This matrix also contains intermediate inter-industry sales plus final demand (column 177) for the year specified in the matrix name. Each column sums to its respective industry output. Each row sums to its respective commodity output.

"MAKE" Matrix (176x176)

This matrix contains the production of commodities by industries for the year specified in the matrix name. Each row sums to industry output and each column sums to commodity output.

“INDOUTPUT” Matrix (176x28)

This matrix contains the industry output time series for the 176 industry sectors for the years starting from 1997 and continuing through 2024.

“COMOUTPUT” Matrix (176x28)

This matrix contains the commodity output time series for the 176 commodity sectors for the years starting from 1997 continuing through 2024.

“OUTPUT_2034” Matrix (176x2)

This table contains the total outputs for the projected year 2034. The first column of data is the total industry output and the second is the total commodity output for the sector designated by the sector number column.

"FD" Matrix (176x132)

This is the final demand matrix for the year specified in the worksheet name. Each “FD” matrix has 176 rows and 132 columns. Rows represent commodity final demand. Columns represent final demand by detailed category, margin reallocations, or import valuation adjustments. The column types are described below.

Each “FD” matrix has 116 purchaser value columns containing final demand data by detailed category. Their column sums are obtained from BEA’s National Income Product Accounts (NIPA) and are sub-aggregates of GDP[1]. Using distributional data from BEA’s benchmark Input-Output (IO) tables, the data in each column are allocated to the 176 commodity rows. Summing this data by row yields commodity final demand on a purchaser value basis.

Commodity output in the input-output system is on producers’ value rather than purchaser value. Margin costs, i.e., transportation, wholesale, retail, and insurance, are removed and reallocated to the sectors providing the margin services. In the intermediate portion of the Use table, for a given industry, the input cells reflect the producer cost of the input commodity. Margin costs for commodity inputs are reallocated to the margin sectors.

In the “FD” matrix the columns containing the detailed category data are purchaser value. For imports of goods, the column data is foreign port value. Producer value excludes margin costs and import valuation adjustments, which are removed in the margin reallocation and import valuation adjustment columns, respectively. There are 14 margin reallocation columns and two import valuation adjustment columns[2] in each “FD” matrix.

Three margin columns are associated with two of the ten non-import aggregate final demand categories[3]. The three margin columns are used to reallocate margin costs for four retail, one wholesale trade, and five transportation commodities. Wholesale has one reallocation column and the reallocation of the four retail types and five transportation modes are combined into one column each. Eight of the ten other non-

---

[1] Chain-weighted aggregation methods must be used for tables containing values in chain-weighted dollars.

[2] Import valuation adjustments reconcile differences in the valuation of import goods: NIPA accounting uses foreign port value, whereas input-output accounting uses domestic port value as the producer value. Because imports are negative values in the NIPAs, and because the import valuation adjustments increase the absolute value of imports, the import adjustment values are negative and the reallocation offsets are positive.

[3] The existence of the PCE_Bridge and PEQ_Bridge files from BEA allow us to have 3 margin columns for the Personal Consumption Expenditures and Private Investment in Equipment aggregate final demand categories.

import aggregate final demand categories have one margin column for all of the four retail, one wholesale, and five transportation commodities.

Commodity margin rates[4] are calculated for the margins for each final demand category. Each rate is multiplied by the purchaser value of the commodities within the associated final demand category. The resulting margins appear as negative entries in the margin columns for that final demand category. Within each margin column, the sum of these entries is exactly offset by positive values inserted in the row cells corresponding to the appropriate margin sectors, so that the column sum is zero.

There are two import valuation adjustment columns in the Imports of Goods and Services category. The columns are used to reallocate the import valuation adjustment on imported goods and services for transportation and insurance in one column, and wholesale trade in the other.

Import valuation adjustment rates[5] are calculated on a commodity basis for each of the two import valuation adjustment columns. Each rate is multiplied by the foreign port (or purchaser) value of the commodity row for the Imports of Goods and Services category. The resulting import valuation (margin) adjustments appear as negative entries in the adjustment columns. Within each adjustment column, the sum of these entries is exactly offset by positive values inserted in the row cells corresponding to the appropriate margin sectors, so that the column sum is zero.

[4] Margin rates are based on data from BEA's benchmark IO tables.

[5] Import valuation adjustment rates are calculated from detailed trade data.

"FDAGG" Matrix (176x11)

This matrix is an aggregated version of the "FD" matrix above for the year specified in the matrix name. The 132 detailed final demand categories along the columns of the “FD” matrix are aggregated to 11 categories as shown in the file, “FDSectorPlan2034.xlsx”. The 11 columns corresponding to the 11 aggregate categories are on a producer value basis.

1 Personal consumption expenditures
2 Private investment in equipment
3 Private investment in intellectual property products
4 Private investment in nonresidential structures
5 Private investment in residential structures
6 Change in private inventories
7 Exports of goods and services
8 Imports of goods and services
9 Federal government defense consumption and investment
10 Federal government non-defense consumption and investment
11 State and local government consumption and investment

Conversion of Tables to Inverse and Other Coefficient Matrices

From the make and use tables, the following are defined:

^: A symbol that, when placed over a vector, indicates a square matrix in which the elements of the vector appear on the main diagonal and zeros elsewhere.

q: Total commodity output. A column vector in which each entry shows the total amount of commodity output. It is a commodity-by-one vector.

g: Total industry output. A column vector in which each entry shows the total amount of each industry's output, including its production of scrap. It is an industry-by-one vector.

U: Intermediate portion of the use matrix in which the column shows for a given industry the amount of each commodity it uses, including noncomparable imports and rest of the world adjustment and scrap, used and secondhand goods. This is a commodity-by-industry matrix.

V: Make matrix, in which the column shows for a given commodity the amount produced in each industry. It is an industry-by-commodity matrix.

B: Direct input coefficients matrix (also known as the direct requirements matrix) in which entries in each column show the amount of a commodity used by an industry per dollar of output of that industry. It is a commodity-by-industry matrix.

$$B = U\,\hat{g}^{-1} \qquad (1)$$

D: A matrix in which entries in each column show, for a given commodity (excluding scrap), the proportion of the total output of that commodity produced in each industry. It is assumed that each commodity (other than scrap) is produced by the various industries in fixed proportions (*industry technology assumption*). D is an industry-by-commodity matrix. D also is referred to as the market share matrix or transformation matrix.

$$D = V\,\hat{q}^{-1} \qquad (2)$$

i: Unit (summation) vector containing only l's.

I: Identity matrix, where $I = \hat{\imath}$. Each of the diagonal elements of the matrix contain the value 1, and zeros elsewhere.

e: A column vector in which each entry shows the total final demand purchases for each commodity from the use table.

Mathematical Derivation of the Total Requirements Tables for Input-Output Analysis[i]

From the above definitions, the following identities are derived:

$$q = Ui + e \quad (3)$$

$$g = Vi \quad (4)$$

The model expressed in equations (1) through (4) thus involves two constants (*B, D*) and five variables (*U, V, e, q, g*). The model solution is derived as follows:

From (1) and (3), we derive:

$$q = Bg + e \quad (5)$$

From (2) and (4), we derive:

$$g = Dq \quad (6)$$

Substituting (6) into (5) and solving for g:

$$q = B(Dq) + e$$

$$(I - BD)q = e$$

$$q = (I-BD)^{-1}e \quad (7)$$

The matrix $(I-BD)^{-1}$ is known as the commodity-by-commodity total requirements matrix and it shows, on a per-dollar basis, the commodity output the economy generates to provide commodities to final users.

Substituting (5) into (6) and solving for *g* gives:

$$g = D(Bg + e)$$

$$(I - DB)g = De$$

$$g = (I - DB)^{-1}De \quad (8)$$

The matrix $(I - DB)^{-1}$ is known as the industry-by-industry total requirements matrix and it shows, on a per-dollar basis, the industry output the economy generates to provide an industry's commodities to final users. The vector *De* is a final demand vector where each entry shows the final demand for an industry's output.

Substituting (7) into (6) and solving for q gives:

$$g = D(I - BD)^{-1}e \quad (9)$$

The matrix $D(I - BD)^{-1}$ is known as the industry-by-commodity total requirements matrix and it shows, on a per-dollar basis, the industry output the economy generates to provide commodities to final users.

---

[i] The notation and derivation of the tables presented follow the System of National Accounts recommended by the United Nations. See: A System of National Accounts Studies in Methods, Series F No. 2 Rev. 3, United Nations, New York, 1968; also, Stone, R., Bacharach, M. & Bates, J., "Input-Output Relationships, 1951-1966," Programme for Growth, Volume 3, London, Chapman, and Hall, 1963.