

Visualizing supply chains in the classroom: Teaching input-output concepts using BEA industry data

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Why this project?

- Students often hear about supply chains but rarely see actual supply-chain data.
- Employers increasingly expect data literacy and spreadsheet skills.
- BEA tables provide an entry point for teaching I-O concepts without a subscription to regional-impact software.
- Input-output data provides a bridge between economic theory and production at both the micro and macro levels.

Goals for today's session

1. Explain the purpose of BEA Input-Output Accounts.
2. Navigate BEA Input-Output data tables.
3. Design classroom activities using supply-chain data.
4. Spark ideas for assignments that build economic reasoning and spreadsheet skills.

Four starting spreadsheets:

Direct requirements – Sector level

Direct requirements – Summary level

Domestic supply of commodities

Use of commodities by industry

Why teach I-O data?

Students can investigate multiple topics

- Supply-chain relationships
- Industry dependence
- Industry growth patterns
- Economic shocks
- Resource use across sectors
- International trade exposure

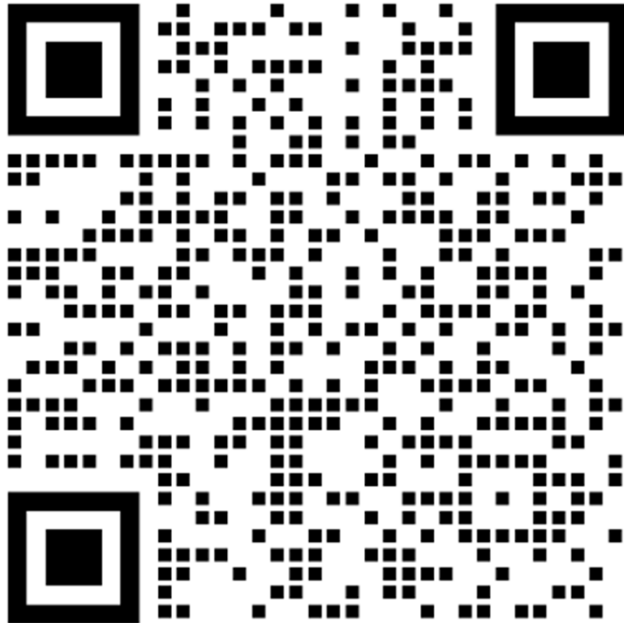
- Data is adaptable to different course levels
 - Principles
 - Intermediate
 - Regional economics
- Practicable for skill development
 - Data interpretation
 - Quantitative reasoning
 - Excel and other spreadsheets

Logistics regarding BEA's I-O accounts

- Aligned with NIPA: Connect industry-level production networks to GDP, income, consumption, investment, trade, and saving
- Aligned with NAICS: Generally compatible with Census, BLS, BEA, and regional economic datasets
- BEA's annual updates usually post in September
- Benchmark revisions occur roughly every five years
 - 2007, 2012, 2017, 2022, etc.
- BEA website offers three aggregation choices
 - 1) Sector - 15 industry groups
 - 2) Summary - 71 industry groups
 - 3) Detailed - 402 industry groups
 - *Note: Detailed tables are updated only in benchmark years*

Starting spreadsheets

Scan QR code



Example: Which industry's supply chain requires the highest share of manufactured goods?

{ Shared spreadsheet: JetSet Direct Requirements, After Redefinitions – Sector }

Classroom Activity

- 1) Which industry's supply chain requires the highest share of manufactured goods? Name the industry and the percentage per dollar of output.
Sample formula to find percentage:
=MAX(C12:Q12)
- 2) Which industry's supply chain requires the lowest share of manufactured goods? Name the industry and the percentage per dollar of output.
Sample formula to find percentage:
=MIN(C12:Q12)
- 3) Provide an example of an intermediate input purchased by one manufacturer from another manufacturer. Explain how that input contributes to the production of the final good.
 - Example: A breakfast cereal producer uses boxes manufactured by another company before shipping the cereal to retailers.
 - Example: A toy manufacturer buys plastic resin from a chemical manufacturer and injection-molds it into plastic toys.

Common student confusions

- **Industry output $\neq$ GDP**

- Output = Intermediate inputs + Value added

- **Industry output $\neq$ Value added**

- Value added = Contribution to GDP
- GDP = Employee compensation + Taxes on production and imports less subsidies + Operating surplus

- **Producer prices $\neq$ Purchaser prices**

- Purchaser prices include producer prices + transportation costs + wholesale and retail margins
- Total value added at producer prices corresponds to 2024 aggregate nominal GDP of \$29.2 trillion

- **Industry $\neq$ Commodity**

- Industry – Think “who is doing the producing?”
- Commodity – Think “what is being created, sold or used?”
- Examples:
 - An automobile manufacturing company (industry) produces motor vehicles (commodity).
 - A local government (industry) produces police and fire protection (commodity).
 - A clothing store (retail industry) provides a shirt for sale. The shirt is a manufactured commodity, while the store is a retail margin.

In the news ...

“Air France-KLM to raise long-haul ticket prices as jet fuel costs spike”

12 March 2026 Reuters

“War Sends Airline Ticket Prices in Europe Soaring, Activist Group Says”

21 April 2026 Wall Street Journal

“Air travel faces unprecedented crisis as flights are canceled and ticket prices rise”

14 May 2026 Le Monde

“Air fare rises ‘inevitable’ as airlines face extra \$100bn jet fuel bill this year”

7 June 2026 The Guardian

“US airlines’ monthly fuel spending topped \$6 billion again in May, up 84% from year ago”

7 July 2026 Associated Press

“Delta says higher airfares expected to last despite drop in oil prices”

10 July 2026 The Guardian

Example: Which industry's requirements use the highest share of refined petroleum products?

{ Shared spreadsheet: JetSet Direct Requirements, After Redefinitions – Sector }

Classroom Activity

- At the Sector level –
 - Crude petroleum → Found in Mining, row 9 / sector 21
 - Crude oil extracted from the ground belongs in Mining
 - Refined petroleum products → Found in Manufacturing, row 12 / sector 31G
 - Gasoline, diesel, jet fuel, lubricating oil, asphalt, and similar products fall under Manufacturing

In the news ...

“US petrol prices surge as Trump’s Iran war triggers inflation worries”

03 March 2026 Financial Times

“US pump prices near 4-year high on Iran war disruption, refinery outages”

28 April 2026 Reuters

“Gasoline costs 50% more in the US than it did before the Iran war”

05 May 2026 Associated Press

“US gas prices dip below \$4 for 1st time since March but remain 25% higher than last year”

18 June 2026 Associated Press

“The tenuous state of a US-Iran ceasefire renews anxiety over high fuel prices”

8 July 2026 Associated Press

“This new round of energy inflation is different”

13 July 2026 Wall Street Journal

Which industries depend most upon petroleum?

{ Sample spreadsheet JetSet Summary 71 Direct requirements after redefinitions }

Classroom Activity

1) Which industry has the highest share of its supply chain dependent upon petroleum and coal products? Name the industry and the percentage per dollar of output.

Sample formula to find percentage

=MAX(C31:BU31)

2) Which industry has the second highest share of its supply chain dependent upon petroleum and coal products? Name the industry and the percentage per dollar of output.

Sample formula to find percentage

=LARGE(C31:BU31,2)

What does it take to produce \$1 of air travel?

Classroom Activity

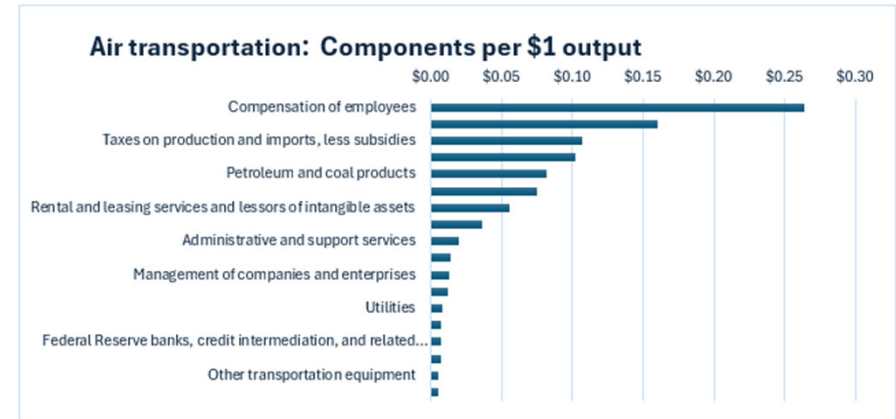
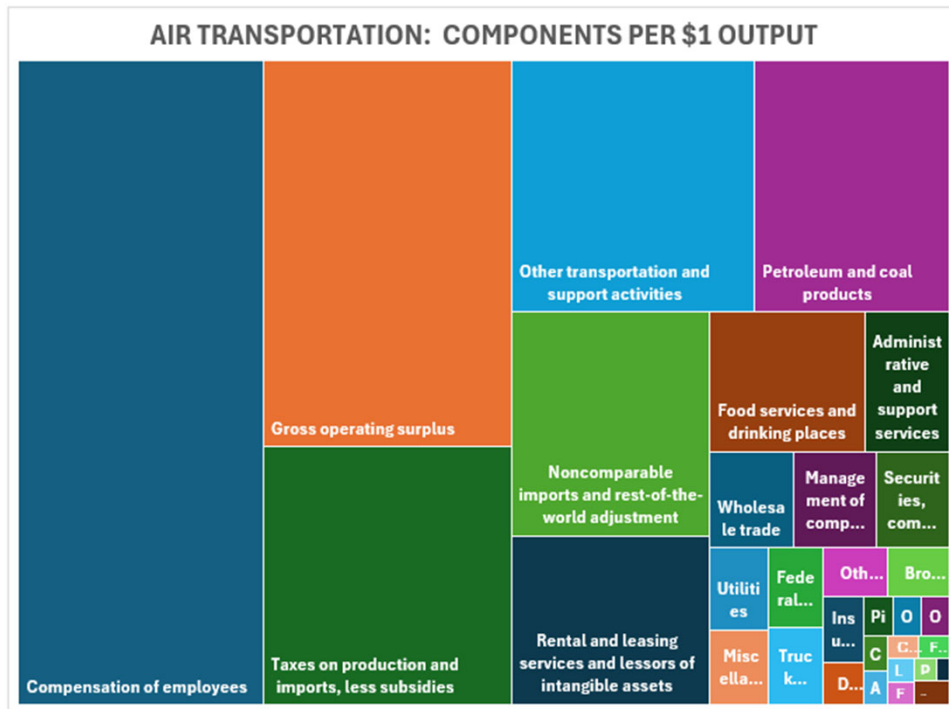
3) For every \$1 of airline output, how many cents go directly to petroleum products?

Sample formula
=AH31

4) What is the air transportation industry's highest requirement? Name the component and the percentage share.

Sample formula
=MAX(AH8:AH83)

Visualizing supply chains



Components per \$1 Output	Air transportation
Compensation of employees	\$ 0.26
Gross operating surplus	\$ 0.16
Taxes on production and imports, less subsidies	\$ 0.11
Other transportation and support activities	\$ 0.10
Petroleum and coal products	\$ 0.08
Noncomparable imports and rest-of-the-world adjustment	\$ 0.07
Rental and leasing services and lessors of intangible assets	\$ 0.06
Food services and drinking places	\$ 0.04
Administrative and support services	\$ 0.02
Wholesale trade	\$ 0.01
Management of companies and enterprises	\$ 0.01
Securities, commodity contracts, and investments	\$ 0.01
Utilities	\$ 0.01
Miscellaneous professional, scientific, and technical services	\$ 0.01
Federal Reserve banks, credit intermediation, and related activities	\$ 0.01
Truck transportation	\$ 0.01
Other transportation equipment	\$ 0.01

Petroleum, imports & tariffs: Reading the U.S. Supply Table

{ Sample spreadsheet: JetSet Summary 71 Domestic supply of commodities by industry }

Classroom Activity

1) What is the value of petroleum and coal commodities imported into the U.S.?

=BW31

2) How much petroleum and coal commodities were available for use in the U.S.?

=BY31

3) What was the dollar amount of duties on imported petroleum and coal that were paid to the federal government?

=CC31

4) Which commodity had the highest \$ amount of imports?

=MAX(BW8:BW80)

5) On which commodity was the highest level of import duties paid?

=MAX(CC8:CC80)

6) Which goods and services (i.e. commodities) account for the largest shares of U.S. imports? What percentage of total imports is within that category?

{ Import_share_heat }

From construction to labor costs: Reading the U.S. Use Table

{ Sample spreadsheet: JetSet Summary 71 Use of commodities by industry }

Classroom Activity

1) Where is the value of a new petroleum refinery being built?

=BX14

2) After the refinery is in use, where is the value of a facility repair undertaken by the refinery itself?

=Z14

3) Which industry has the highest dollar amount of employee compensation?

=MAX(C82:BU82)

4) Which industry has the highest employee compensation relative to its output?

{ Sheet Labor_Heat_Table }

Supply chain detective: An industry investigation

Ideas for assignment

- Each student selects an industry.
 - *Instructor may specify zero duplicates.*
- Tasks:
 - Identify top commodities required
 - Identify major users
 - Determine exposure to global trade
 - Determine exposure to labor market changes
 - Explain importance to macroeconomic output
- Deliverable:
 - Heat map
 - Infographic
 - Class presentation
 - Professional memo

Ideas for grading rubric

Category	Description
Data Extraction & Accuracy	Correctly identifies top commodities, major users, trade exposure, and labor-related measures from the spreadsheet.
Supply Chain Analysis	Demonstrates understanding of industry relationships, inputs, outputs, and supply-chain structure.
Economic Interpretation	Explains why findings matter economically; Connects results to market behavior, production, trade, or current events.
Use of Evidence	Uses data in support of claims and statements; Avoids assertions without support.
Data Visualization	Heat map (or infographic) is accurate, readable, visually effective, and supports the analysis.
Professional Communication	Memo is clearly organized, concise, and written for a professional audience. Presentation is polished and understandable.
Critical Thinking & Insight	Goes beyond reporting numbers by identifying patterns, surprises, risks, or implications for the broader economy.

Considerations for classroom use of I-O data

➤ Confidence

- Provide starter spreadsheet files to reduce class time spent on cleaning data
- Choose industry aggregation level manageable for the student group

➤ Timeframe

- Consider fall semester scheduling with annual BEA data updates in September

➤ Accuracy

- Warn that ChatGPT, Copilot, etc. may pull outdated sector numbers and industry groupings

Ending questions

- What industry would your students investigate?
- How could this activity fit into your courses?
- What resources would be most helpful for you when adopting material for class use?