# Estimating Use Tables

*Introduction plus Benchmark and Annual Process*

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*International Workshop on Supply and Use Tables*

*Beijing, Sept 11-13*

- Process is guided by the availability of data

  – Benchmark (every five years)

  – Annual

  – Quarterly

*Benchmark Sources*

## Core Data source: Economic Census
- Measures almost the whole universe of establishments with 5 or more employees

## Supplemented with data from:
- Business Expense Survey (BES)
- Economic Research Service (ERS)
- Bureau of Transportation Statistics (BTS)
- Census of governments.

Non-employer establishments data supplemented with administrative data.

# Census Sources

Output Details for item...

5412131 Tax preparation services

[ Detailed Record ]

| item_from | item_to | occtype | basicVal | comTax | itemOCC_id | ioYear |
|-----------|---------|---------|----------|--------|------------|--------|
| 5412131 | 5412131 | IMPUT | 1.7 | 0 | 118355 | 1997 |
| 5412131 | 5412131 | IMPUT | 2.7 | 0 | 144133 | 1997 |
| 5412131 | 5412131 | MISREPORT | 114.3 | 0.2 | 104721 | 1997 |
| 5412131 | 5412 | | | | | |
| 5412131 | 5412 | | | | | |
| 5412131 | 5412 | | | | | |
| 5412131 | 44X | | | | | |
| 5412131 | 233 | | | | | |
| 5412131 | 233 | | | | | |
| 5412131 | 5415 | | | | | |
| 812210T | 5412 | | | | | |
| 8129901 | 5412 | | | | | |
| 5412131 | 5415 | | | | | |
| 5412131 | 514 | | | | | |
| 5412131 | 5412 | | | | | |
| 5412131 | 5412 | | | | | |
| 5412131 | 5412 | | | | | |
| 5412131 | 5412141 | SECOND | 17 | 0 | 101815 | 1997 |
| 5412131 | 541611T | SECOND | 3 | 0 | 101816 | 1997 |
| 5412131 | 561110T | SECOND | 3 | 0 | 101817 | 1997 |
| 5412141 | 5412131 | SECOND | 9 | 0 | 101823 | 1997 |
| 541219T | 5412131 | SECOND | 635 | 0 | 101835 | 1997 |
| 5416903 | 5412131 | SECOND | 2 | 0 | 102039 | 1997 |
| 561110T | 5412131 | SECOND | 71 | 0 | 56099 | 1997 |
| 561210T | 5412131 | SECOND | 3 | 0 | 56183 | 1997 |

Output Total: 3899.1

Table 1a.  **Major Sources of Receipts From Customers for Firms Subject to Federal Income Tax for the United States:  1997**—Con.

[Includes only establishments with payroll.  For meaning of abbreviations and symbols, see introductory text.  For explanation of terms, see Appendix A]

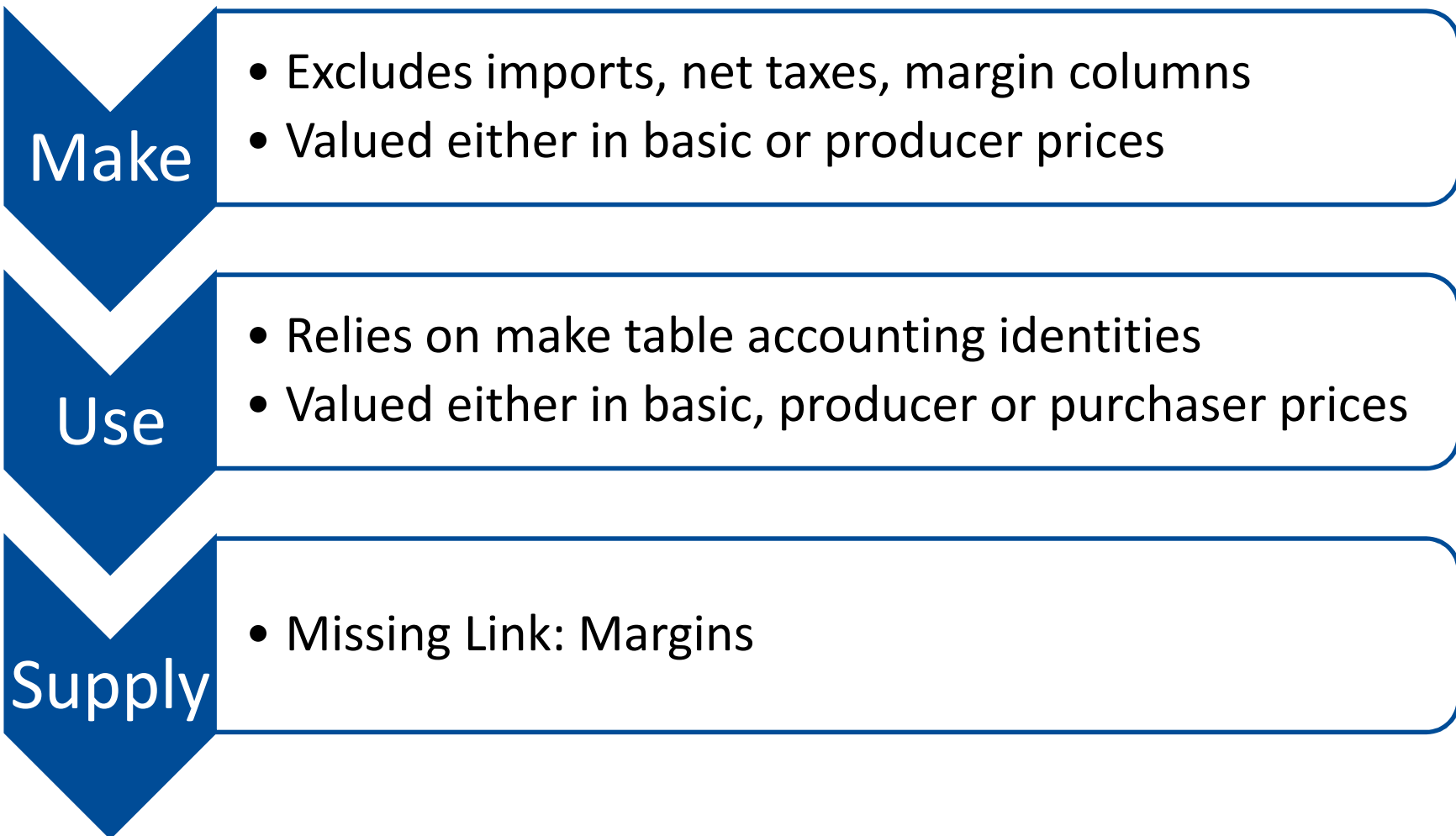| NAICS code and RL code | Kind of business and sources of receipts | Establishments (number) | Receipts[1] ($1,000) | Receipts from specified receipt lines as percent of total receipts[1] | Receipts of establishments reporting sources of receipts as percent of total receipts |
|---|---|---|---|---|---|
| 541219 | Other accounting services | 29 322 | 6 218 823 | 100.0 | 53.3 |
| 0100 | Public relations services | 16 | 1 002 | Z | X |
| 0950 | Custom computer programming and support services | 284 | 6 156 | .1 | X |
| 1000 | Computer systems specification and design services | 47 | 2 353 | Z | X |
| 1100 | Other computer services, except programming, systems design, and computer facilities management | 380 | 14 584 | .2 | X |
| 1200 | Data processing services | 246 | 19 971 | .3 | X |
| 1370 | Social sciences and humanities research and development | 12 | 116 | Z | X |
| 2100 | Accounting and auditing services | 7 677 | 935 572 | 15.0 | X |
| 2150 | Tax return preparation, bookkeeping, billing, and payroll services | 26 004 | 3 011 473 | 80.6 | 46.2 |
| 2151 | Tax return preparation services | 14 171 | 635 353 | 10.2 | X |
| 2152 | Bookkeeping services | 15 750 | 1 306 154 | 21.0 | X |

*Annual Sources*

Other Census Bureau programs:

- Annual Surveys; examples:
  - Annual Retail Trade Survey (ARTS)
  - Annual Wholesale Trade Survey (AWTS)
  - Service Annual Survey (SAS)
  - Annual Survey of Manufactures (ASM)
  - Annual Survey of Government Finances (ASGF)
- Value of Construction Put-in-Place (VPIP)
- Business R&D and Innovation Survey (BRDIS)
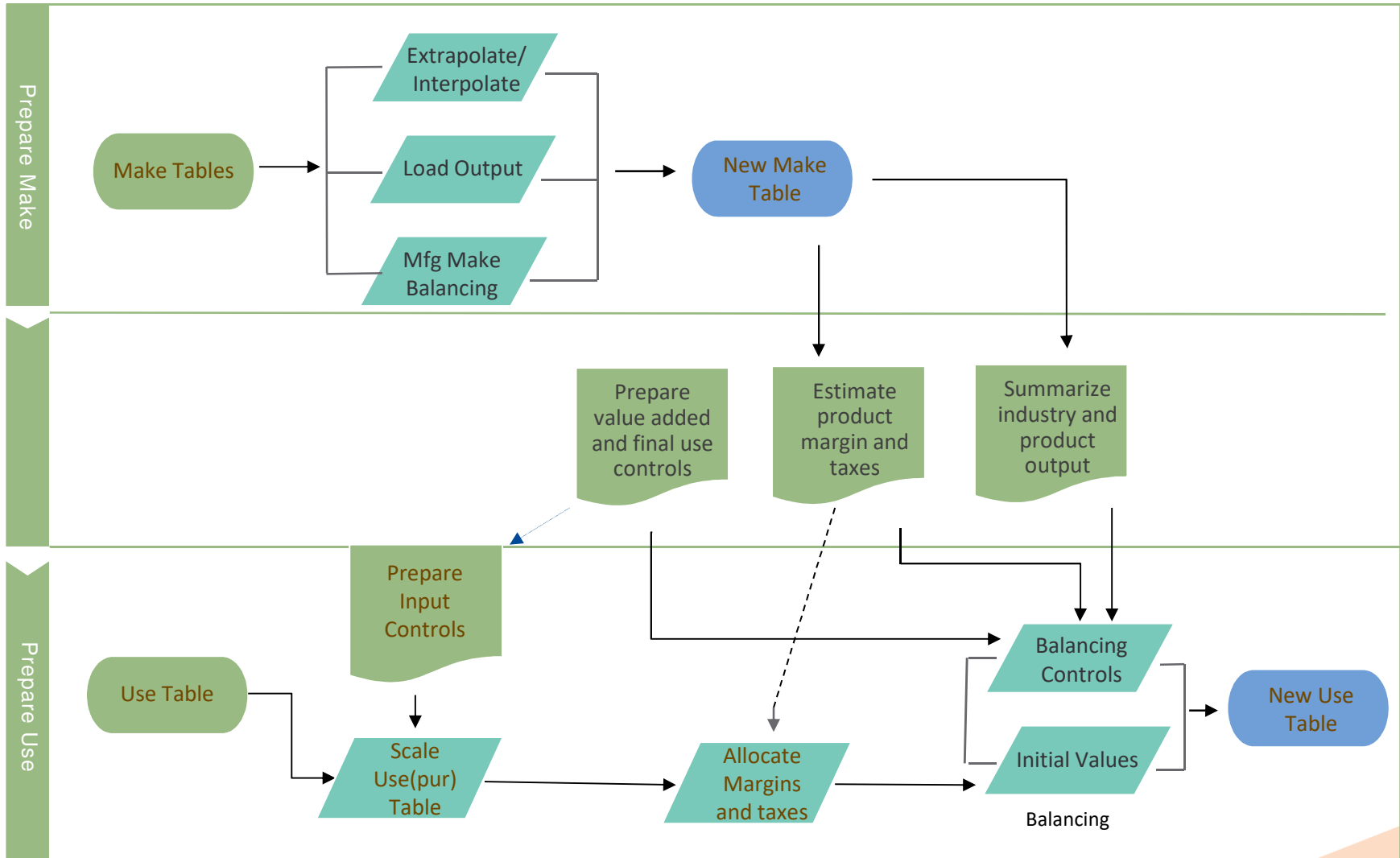- Special Tabulations
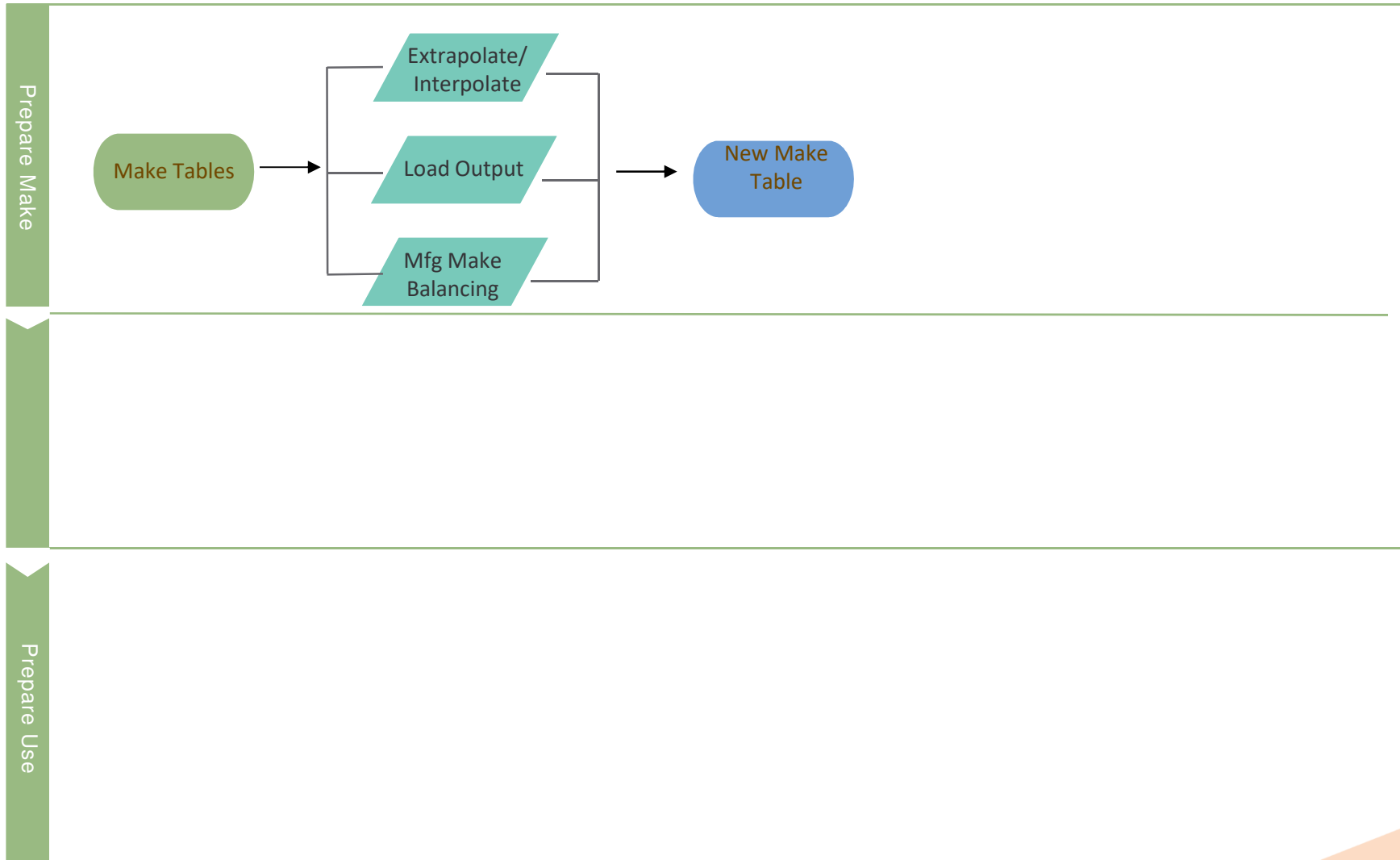
Non Census Bureau programs:

- ERS, BTS

**Make**
- Excludes imports, net taxes, margin columns
- Valued either in basic or producer prices

**Use**
- Relies on make table accounting identities
- Valued either in basic, producer or purchaser prices

**Supply**
- Missing Link: Margins

# Production Flow: Annual Tables

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Bureau of Economic Analysis
U.S. DEPARTMENT OF COMMERCE

## Prepare Make

Make Tables → [ Extrapolate/Interpolate | Load Output | Mfg Make Balancing ] → New Make Table

## Prepare Use

Prepare value added and final use controls

Estimate product margin and taxes

Summarize industry and product output

Prepare Input Controls

Use Table → Scale Use(pur) Table → Allocate Margins and taxes → Balancing Controls / Initial Values → New Use Table

Balancing

# Production Flow: Annual Tables

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*Make Table*

## MAKE TABLE

| INDUSTRIES | COMMODITIES | | | | | | | | | | | | | | | TOTAL INDUSTRY OUTPUT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Agriculture, forestry, fishing, and hunting | Mining | Utilities | Construction | Manufacturing | Wholesale Trade | Retail Trade | Transportation and Warehousing | Information | Finance, Insurance, Real Estate, Rental, and Leasing | Professional and Business Services | Educational Services, Healthcare, and social assistance | Arts, entertainment, recreation, accomodation, and food services | Other services, except government | Government | |
| Agriculture, forestry, fishing, and hunting | ■ | | | | | | | | | | | | | | | |
| Mining | | ■ | | | | | | | | | | | | | | |
| Utilities | | | ■ | | | | | | | | | | | | | |
| Construction | | | | ■ | | | | | | | | | | | | |
| Manufacturing | | | | | ■ | | | | | | | | | | | |
| Wholesale Trade | | | | | | ■ | | | | | | | | | | |
| Retail Trade | | | | | | | ■ | | | | | | | | | |
| Transportation and Warehousing | | | | | | | | ■ | | | | | | | | |
| Information | | | | | | | | | ■ | | | | | | | |
| Finance, Insurance, Real Estate, Rental, and Leasing | | | | | | | | | | ■ | | | | | | |
| Professional and Business Services | | | | | | | | | | | ■ | | | | | |
| Educational Services, Healthcare, and social assistance | | | | | | | | | | | | ■ | | | | |
| Arts, entertainment, recreation, accomodation, and food services | | | | | | | | | | | | | ■ | | | |
| Other services, except government | | | | | | | | | | | | | | ■ | | |
| Government | | | | | | | | | | | | | | | ■ | |
| TOTAL COMMODITY OUTPUT | | | | | | | | | | | | | | | | |

Internal structure of MFG Make arrived at through balancing

Internal structure elsewhere loaded, extrapolated, interpolated

# Production Flow: Annual

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**Prepare Make**

Make Tables → [ Extrapolate Output / Load Output / Mfg Make Balancing ] → New Make Table

- Prepare value added and final use controls
- Estimate product margin and taxes
- Summarize industry and product output

**Prepare Use**
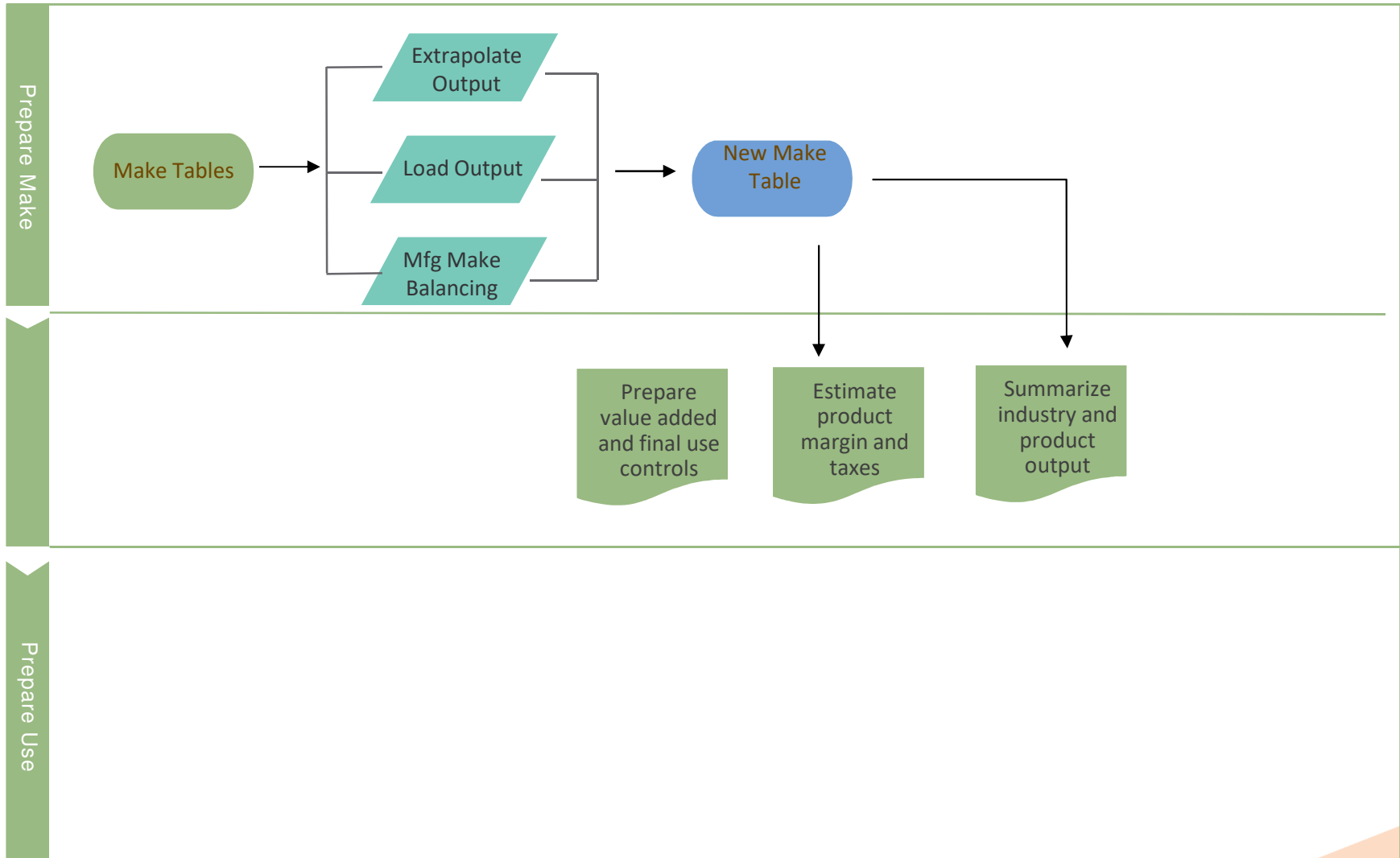
# Sample Level of Detail for Retail Margin Controls

New autos--PCE

New trucks--PCE

Used autos

Used trucks and vans

New autos-PDE

New trucks--PDE

Mobile homes

Recreational vehicles, parts, and trailers

Furniture and fixtures

Major kitchen & household appliances

China, giftware, glassware, tableware, utensils, and decorative home furnishings

Floor coverings

Telephones and other durable house furnishings, n.e.c.

Office equipment and writing equipment (excl computer equipment)

Ophthalmic products and orthopedic appliances

# Production Flow: Annual

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## Prepare Make

Make Tables → [ Extrapolate/Interpolate | Load Output | Mfg Make Balancing ] → New Make Table

## Prepare Use

Prepare value added and final use controls

Estimate product margin and taxes

Summarize industry and product output

Prepare Input Controls

Use Table → Scale Use(pur) Table → Allocate Margins and taxes → Initial Values

# Example: Scaling Use table to Expense Controls



- Scale to expense controls
  - Expense controls span multiple commodities, and often span multiple industries
  - Expense controls are valued at purchaser prices, and margin cells are scaled jointly with underlying basic value cells to match the controls
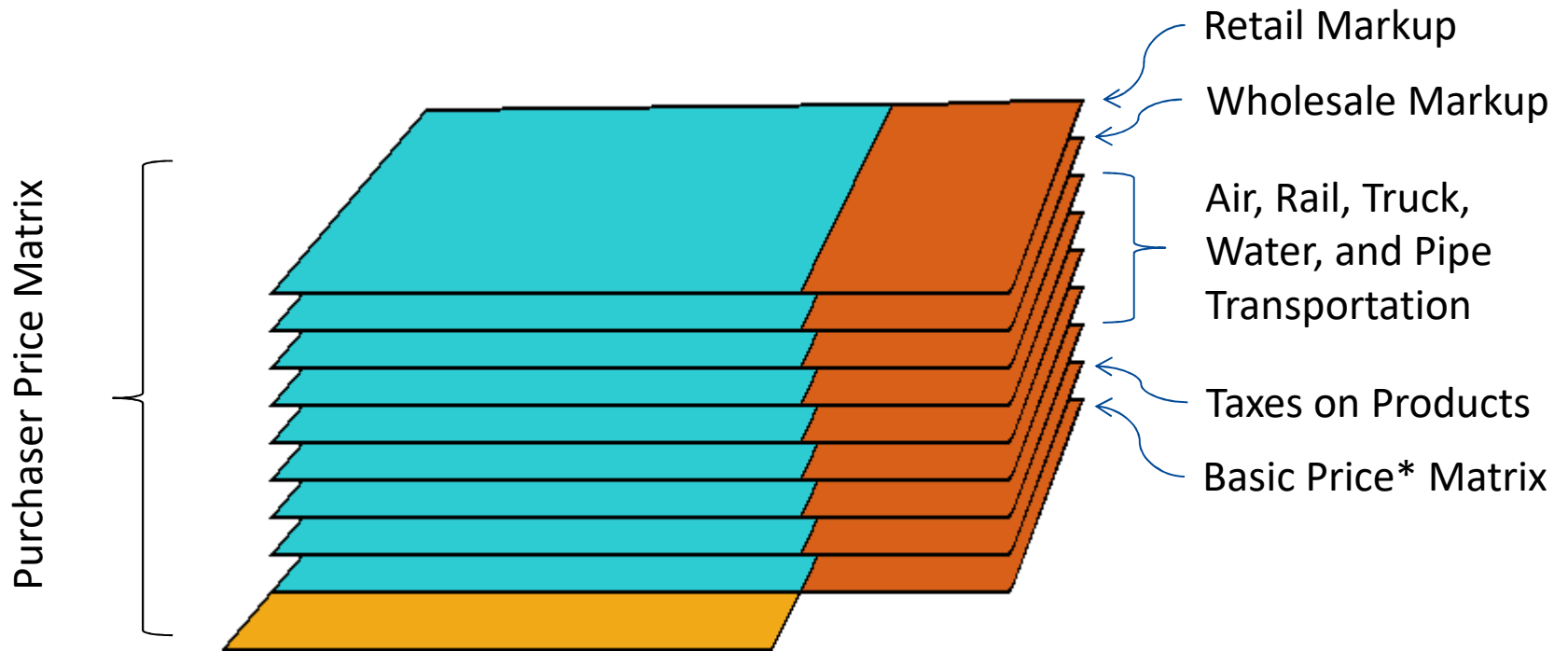  - Source data for intermediate input controls largely based on data from the U.S. Census Bureau.

Prior to scaling use table records to expense controls, use table records were first adjusted as follows:

- Impute a real growth based on the real growth of output for the purchasing industry.
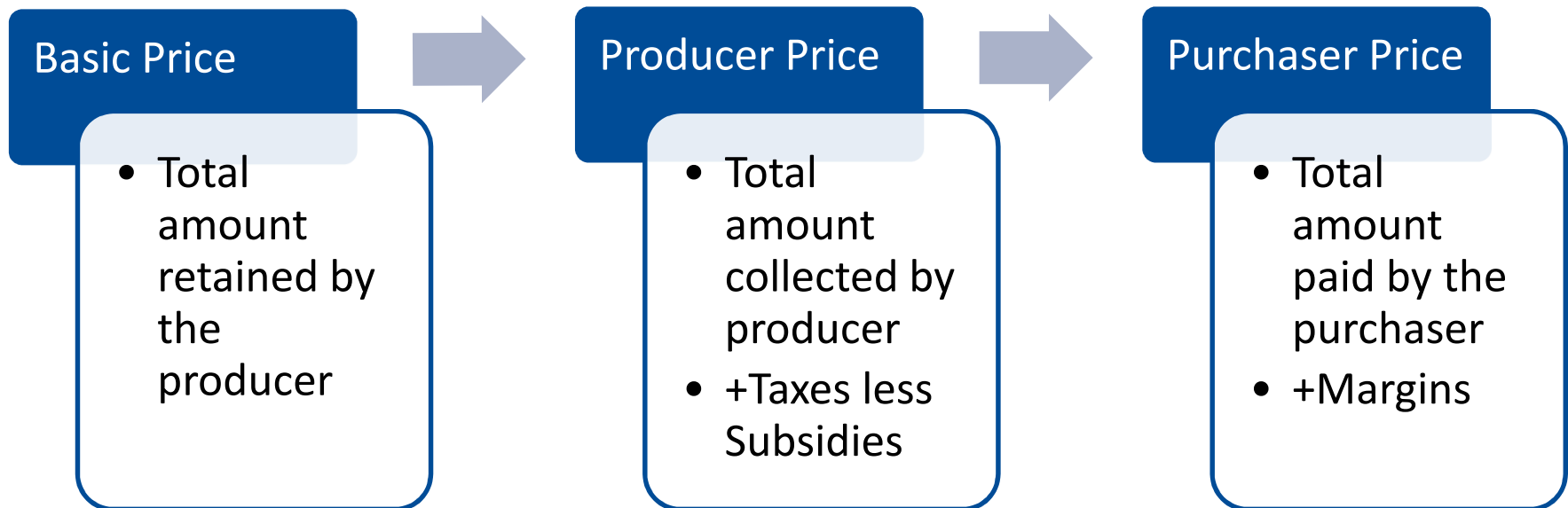- price growth based on the average price growth of the given commodity/product.

$$p_t q_t = p_{t-1} q_{t-1} * \Delta q^{GO} * \Delta p$$

This step in the process was abandoned because resulting real value and input-output coefficients were not noticeably different without it.
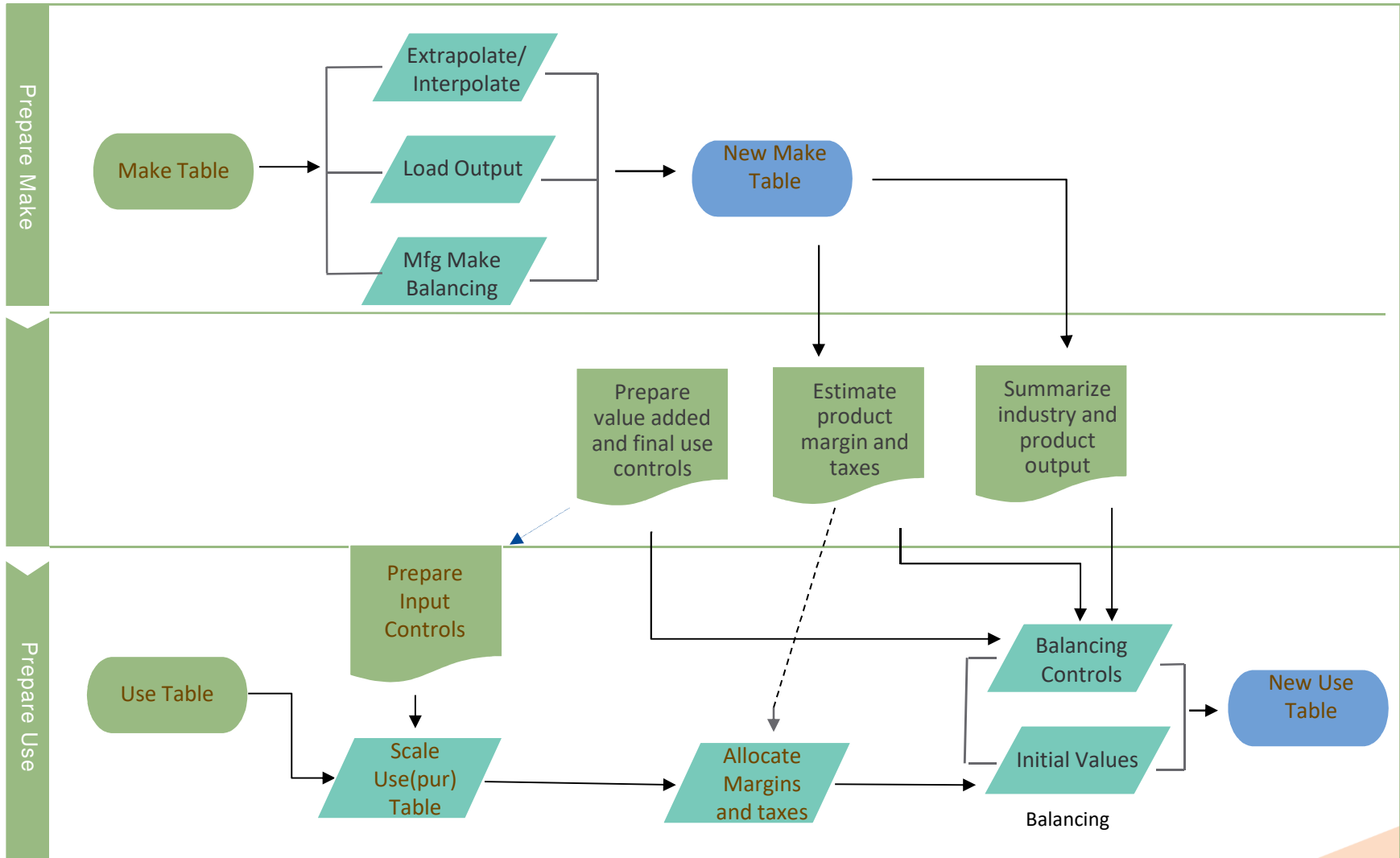
# Example: Allocation of margins and taxes

# Valuation Concepts

**Basic Price**

- Total amount retained by the producer

**Producer Price**

- Total amount collected by producer
- +Taxes less Subsidies

**Purchaser Price**

- Total amount paid by the purchaser
- +Margins

Production Flow: Annual Tables

# Example: Balancing Controls

| Commodities | | Industries | | Final Demand | control |
|---|---|---|---|---|---|
| **Margin** | | 108 | 107 | 50 | |
| | | 50 | 28 | 60 | |
| | | 11 | 16 | 5 | |
| **Basic** | | 992 | 903 | 500 | 2,400 |
| | | 462 | 282 | 600 | 1,600 |
| | | 1,037 | 994 | 500 | 2,400 |
| **Value Added** | | 415 | 1,300 | | 1,800 |
| **control** | | 2,390 | 4,500 | 1,800 | |

- Prepare balancing controls
  - Total value for transportation, trade margin, and taxes drawn from the make matrix in the supply table
  - Total distributed to commodities (or commodity groups) using various data sources:
    - Air and Water – Ton miles with a "handling multiplier" adjustment from the U.S. Census Commodity Flow Survey
    - Rail – Revenue by commodity group from the American Association of Railroads Freight Commodity Statistics
    - Truck – Revenue by commodity group from the U.S. Census' Survey of Annual Services
    - Pipe – Revenue by commodity from U.S. Census product line detail
    - Wholesale – Margin output available by type of wholesaler
    - Retail – Data on nominal sales by product line available from the U.S. Census Bureau Economic Census

# BEA Balancing Algorithm

- Iterative process where values are altered to match sets of constraints

- Multi-dimensional (not simply row/column)

- Allows for two ways of meeting constraints
  – Proportional Scaling
  – Distributive Scaling

| | | Industries | | Final Demand | sum | control |
|---|---|---|---|---|---|---|
| Commodities | Margin | 86 | 130 | 54 | 480 / 450 | 450 |
| | | 49 | 50 | 81 | | |
| | | 13 | 20 | 8 | 40 / 40 | 40 |
| | Basic | 763 | 1,152 | 484 | 2,400 | 2,400 |
| | | 438 | 444 | 717 | 1,600 | 1,600 |
| | | 750 | 1,194 | 456 | 2,400 | 2,400 |
| Value Added | | 300 | 1,500 | | 1,800 | 1,800 |
| sum | | 2,390 | 4,500 | 1,800 | | |
| control | | 2,390 | 4,500 | 1,800 | | |

- Balance using modified RAS balancing technique
    - Scale to industry/final demand controls using standard scaling
    - Scale to value added and basic value commodity controls using standard scaling
    - Scale to margin controls using proportional allocation based on underlying basic value matrix
    - Underlying assumption: All purchasers of a product pay the same margin rates and markups
    - Repeat until table is fully balanced

# Redefinitions

| | Industry X Primary | Industry X Secondary |
|---|---|---|
| Input A | 100 | 2 |
| Input B | 50 | 3 |
| Input C | 30 | 4 |
| Value Added | 100 | 2 |
| OUTPUT | 280 | 11 |

Changes are mostly cosmetic.  The framework outlined above already converts between purchaser prices and producer prices. What remains to convert Use table to basic prices is

- Allocating import matrix

- Allocating duties matrix

- Allocating subsidies matrix

# Make Table Underlying Structure
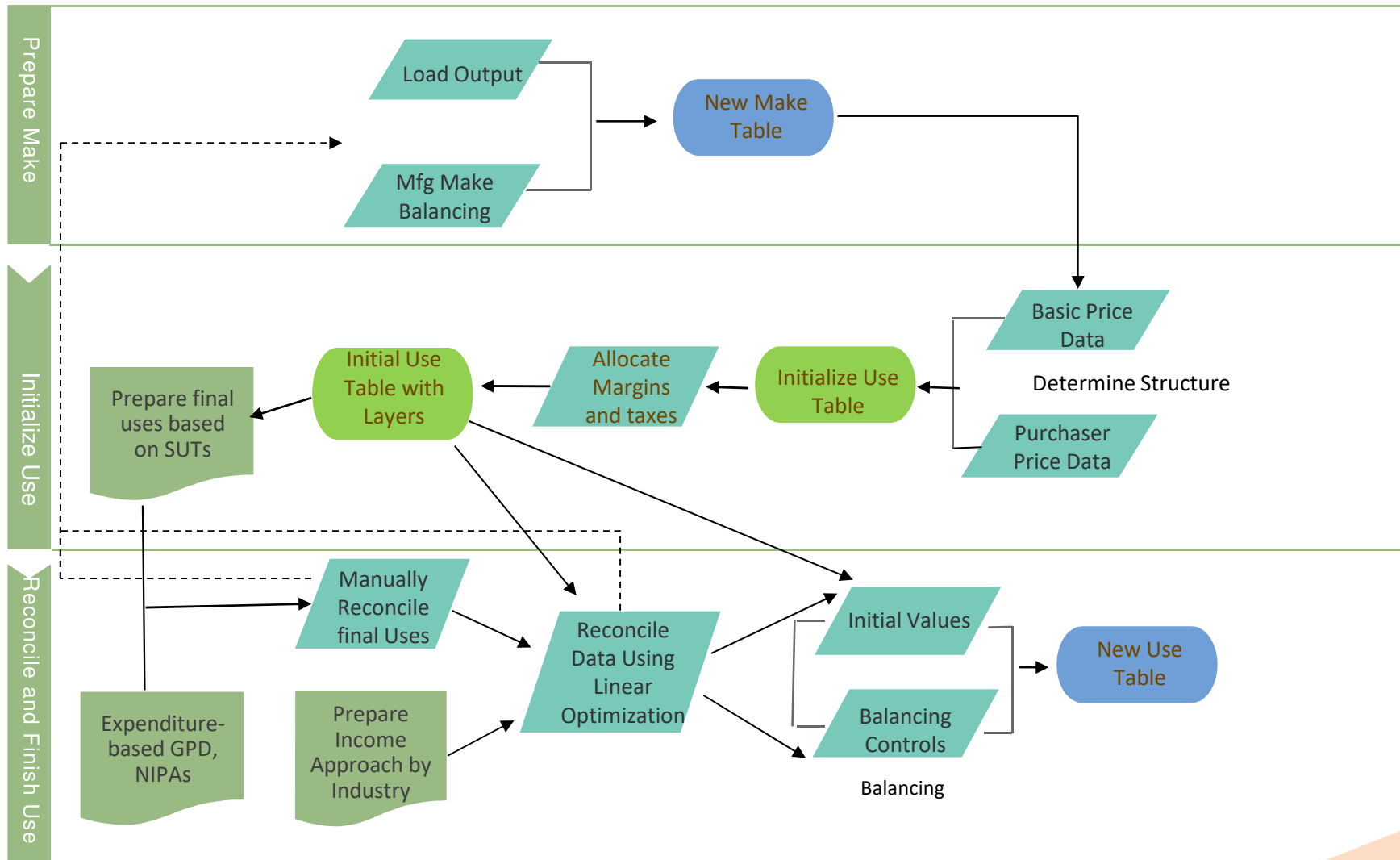
## Estimating Supply-Use Tables



Producer Price Matrix

Basic Price*

Taxes on Products

# Production Flow: Benchmark Tables

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**Prepare Make**

Load Output

Mfg Make Balancing

New Make Table

**Initialize Use**

Basic Price Data

Determine Structure

Purchaser Price Data

Initialize Use Table

Allocate Margins and taxes

Initial Use Table with Layers

Prepare final uses based on SUTs

**Reconcile and Finish Use**

Manually Reconcile final Uses

Expenditure-based GPD, NIPAs

Prepare Income Approach by Industry

Reconcile Data Using Linear Optimization

Initial Values

Balancing Controls

Balancing

New Use Table

# Production Flow: Benchmark Tables

# Creating Benchmark PCE transactions

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## Commodity Flow Fixed Supply Transactions

### Domestic Supply ($mm)

| itmCode | itmDescr | BasicVal Output | ComTax | M (Imports) | X (Exports) | I (Inventory Change) | DS (Domestic Supply) |
|---|---|---|---|---|---|---|---|
| 31182M3118214 | Cookies, wafers, and ice cream cones and cups (except frozen) | 5455 | 0 | 100 | -100 | 0 | 5455 |

### Use and Consumption ($mm)

| indCode | indDescr | itmCode | itmDescr | TransType | DS (Domestic Supply) | II | PCE | PFI (Incl. Inv.) | Gov. | Net Exports (X-M) | UNALLOCATED |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CBAK00 | Bakery products | 31182M3118214 | Cookies, wafers, and ice cream cones and cups (except frozen) | PCE CFS (Commodity Flow of Supply) rate 95% or 0.95. | 5455 | 400 | 5182 | 0 | 145 | 0 | -272 |

# Creating Benchmark PCE transactions

## Final Use Category Transaction Details

| indCode | itmCode | itmDesc | bas | ctx | Transp. Costs | Wholesale Margin | Wholesale Excise (owt) | Retail Margin | Retail Excise (ort) | TransType/rule Code | cfPer | PurVal |
|---------|---------|---------|-----|-----|---------------|------------------|------------------------|---------------|---------------------|---------------------|-------|--------|
| CBAK00 | 31181M3118121 | Bread (white, wheat, rye, etc.), including frozen | 12202.0 | 0.0 | 291.5 | 2084.9 | 0.0 | 5949.6 | 0.0 | CFR | 1 | 20527.9 |
| CBAK00 | 31181M3118125 | Rolls (bread-type), muffins, bagels, and croissants | 8039.6 | 0.0 | 192.0 | 1373.7 | 0.0 | 3920.1 | 0.0 | CFR | 1 | 13525.3 |
| CBAK00 | 31181M311813T | Frozen cakes, pies and other pastries | 4804.9 | 0.0 | 114.8 | 821.0 | 0.0 | 2342.9 | 0.0 | CFR | 1 | 8083.5 |
| CBAK00 | 31182M3118214 | Cookies, wafers, and ice cream cones and cups (except frozen) | 4910.0 | 0.0 | 120.1 | 820.7 | 0.0 | 2344.1 | 0.0 | CFR | 1 | 8194.8 |
| CBAK00 | 31181M3118127 | Soft cakes, except frozen | 3201.2 | 0.0 | 76.5 | 547.0 | 0.0 | 1560.9 | 0.0 | CFR | 1 | 5385.6 |
| CBAK00 | 31181M311812D | Other sweet goods, except frozen | 3024.7 | 0.0 | 72.3 | 516.8 | 0.0 | 1474.8 | 0.0 | CFR | 1 | 5088.6 |
| CBAK00 | 31182M3118212X | Saltine crackers & all other crackers, biscuits, & related products and nsk | 2747.1 | 0.0 | 68.7 | 469.4 | 0.0 | 1340.7 | 0.0 | CFR | 1 | 4625.9 |
| CBAK00 | 31181M311812W | Commercial bakeries, nsk, total | 2558.4 | 0.0 | 61.1 | 437.1 | 0.0 | 1247.4 | 0.0 | CFR | 1 | 4304.0 |
| CBAK00 | 31181M311812A | Pies (fruit, cream, and custard), except frozen | 1727.5 | 0.0 | 41.3 | 295.2 | 0.0 | 842.3 | 0.0 | CFR | 1 | 2906.3 |
| CBAK00 | 31182M311821W | Cookie and cracker manufacturing, nsk, total | 243.7 | 0.0 | 6.1 | 41.6 | 0.0 | 118.9 | 0.0 | OUT_EXTRAP | 0 | 410.4 |
| CBAK00 | Total | | 43459.1 | 0.0 | 1044.2 | 7407.3 | 0.0 | 21141.8 | 0.0 | | | 73052.4 |