Regional Input-Output Modeling System (RIMS II)

Applications for Tax Incentive Evaluations

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Pew/NCSL Tax Incentive Evaluators’ Conference
November 4, 2022
Overview

• Purpose and development of input-output models

• How to use the RIMS II multipliers

• Applications to tax incentive evaluations in Louisiana
Development of Input-Output (IO) Models

• Goal was to understand the flow of goods and services through the economy in support of final demand.
  • How much does each industry purchase from other industries per unit of output?
  • AKA “interindustry analysis”

• Developed by Wassily Leontief at Harvard in conjunction with BLS beginning in the 1930’s and 40’s.
  • Became controversial in the US in the 1950’s when the USSR used them for central planning, but by 1959 the US resumed using them.

• Input-output relationships are based on estimation.
  • Repeat this process iteratively for all combinations of industries.
Output vs. Value Added

- Gross output is the value of a firm’s goods and services produced, e.g., sales receipts or revenue.

- Merely totaling dollars of output across firms gives an inflated measure of output when supply chains are vertically disintegrated.
  - Each time a good/service moves between firms, its entire output is counted, not just the incremental "value added."

- Value added subtracts out purchased goods and services from other firms.
  - Gross Output – Intermediate Goods = Value Added
  - Except for retail and wholesale, where gross output is sales minus cost of goods sold.

- Value added equals the contribution from labor (compensation of employees) and capital (gross operating surplus), plus taxes less subsidies.

- Gross Domestic Product = Value Added for All Industries
U.S. Gross Output in 2021: $41.4 trillion

Value added for intermediate inputs (44% of gross output) are included in value added for the industry that produces them.

Value added (56% of gross output) inures to:
- Labor (wages)
- Capital (profits/"surplus")
- Govt. (taxes)

Amounts in Trillions
Source: U.S. Bureau of Economic Analysis
Industry Example: Petroleum & Coal Products Manufacturing

- **Compensation of employees, $20**
- **Taxes less subsidies, $4**
- **Gross operating surplus, $105**
- **Energy extraction, $374**
  - **Oil and gas extraction, $374**
  - **All Other, $32**
- **Chemical products, $16**
- **Management of companies and enterprises, $10**
- **Utilities, $8**
- **Construction, $7**
- **Miscellaneous professional, scientific, and technical services, $5**
- **Value Added (see inset), $129**

**Intermediate inputs: $479 billion (79%)**

**Value added: $129 billion (21%)**

**Gross output: $608 billion = $479 billion + $129 billion**

Source: BEA national use table for 2021.
Backward Linkages: Output Creates Input

- RIMS II quantifies not just the immediate impact of a final demand shock, but also the “ripple effects.”

- Direct effects – impact of the first round of inputs purchased by the final-demand industry.

- Indirect effects – impact of subsequent rounds of inputs purchased by supporting industries.
  - Direct effect plus indirect effect = interindustry effect.

- Induced effects – impact of increased household spending out of increased earnings.
  - Only appropriate when final demand shock excludes spending of workers who already live and work in the region.
**Direct, Indirect, and Induced Effects**

- Increased demand for petroleum and coal products from consumers outside the region (final demand shock)
- Refinery adds new capacity (direct effect)
- First round of increased demand for intermediate goods in the region (direct effect)
- Second, etc., rounds of increased demand for intermediate goods in the region (indirect effects)
- Government taxes, licenses, and fees
- Increased demand for consumer goods (induced effects)

**Flow Chart**

1. Refinery adds new capacity (direct effect)
2. First round of increased demand for intermediate goods in the region (direct effect)
3. Second, etc., rounds of increased demand for intermediate goods in the region (indirect effects)
4. Compensation paid to employees
5. Compensation to induced demand firms’ employees
6. Household income in the region
7. Proprietor’s income, dividends and interest
8. Increased demand for consumer goods (induced effects)
9. Government taxes, licenses, and fees
How to Use RIMS II Multipliers

- Produced and sold by U.S. Department of Commerce, Bureau of Economic Analysis
  - Available by industry for all geographies, or by a geography for all industries.

- Useful for fiscal impact studies, or for estimating impact of a particular project/final demand shock.
  - Intermediate goods sold to customers outside the region can be “final demand” for a region because they are not inputs for industries in the region.

- Two types of multipliers:
  - Type I Multipliers: Direct and indirect effects
  - Type II Multipliers: Direct, indirect, and induced effects
Example: $1 million final demand shock to petroleum and coal products in Louisiana

$1.7 million in gross output

$665,000 in value added

$317,000 in household earnings

Hint: $1 of final demand will generally result in:
• >$1 of gross output
• <$1 of value added or household earnings (before including induced effects)

Source: BEA RIMS Type II multipliers.
Types of multipliers

- **Input**
  - Gross Output
  - Earnings
  - Jobs

- **Output**
  - Gross Output
  - Value added
  - Earnings
  - Jobs

E.g., an earnings per gross output multiplier shows the dollars of earnings per $1 of final demand for a certain industry.
  - Earnings includes wages, salaries, employer health contributions, and proprietors’ income.

Gross output is generally sales receipts or revenue.
  - For wholesale and retail, sales less of cost of goods sold.

BEA provides six types of multipliers. The others can be derived arithmetically.
  - E.g., value added per job created: jobs/jobs ÷ jobs/output * value-added/output
Start-Up vs. Continuing Operations

- RIMS multipliers are based on continuing operations and include capital and maintenance spending needed to maintain existing levels of output.
  - Includes purchases of goods that will be used $\leq 1$ year.

- Initial capital expenditures and construction services should be accounted for separately.
  - E.g., construction services, building materials, goods that will be used $>1$ year, etc.

- Important to consider regional purchasing coefficients on start-up purchases.
Oil Refinery Expansion with Equipment Purchases

Final demand shock to oil refinery output

× Output-Earnings Multiplier for Petroleum and Coal Products Manufacturing

= Earnings Impact of Continuing Operations

Amount spent by refinery on locally produced equipment and local installation services

× Output-Earnings Multiplier for Machinery or Construction Services

= Earnings Impact of Equipment Purchases

Total Earnings Impact of Refinery Expansion on Earnings
Bill of Goods Approach

• Instead of using final-demand change for the expanding industry, use the specific amount spent by the expanding industry on specific categories of locally-sourced goods.

- Locally manufactured metal tanks
  × Output-earnings multiplier for metal tank manufacturing
  = Impact of metal tanks

- Local trucking company
  × Output-earnings multiplier for truck transportation
  = Impact of transportation of metal tanks

- Local concrete company
  × Output-earnings multiplier for concrete manufacturing
  = Impact of concrete

- Local construction company
  × Output-earnings multiplier for construction
  = Impact of construction services

- Local industrial supplier’s wholesale margin
  × Output-earnings multiplier for wholesale
  = Impact of wholesaler

Total Earnings Impact of Start-up Phase
What RIMS Multipliers Do NOT Capture

• Forward linkages, e.g., air, water, and ground transportation grow in response to the greater availability of fuel.
  • RIMS assumes backward linkages, i.e., increased final demand triggers growth in “upstream” industries.

• Economic impact outside the region.
  • BEA generates multipliers to order for a specific region, which must include at least one U.S. county.
  • Important to consider possibility of “leakages” when capital and labor are sourced from outside of a given region.
But-for Analysis

• “But for” and regional purchasing percentages have to be determined outside of RIMS II and applied by the evaluator.
  • How much final demand shock would not have occurred “but for” the incentive?

\[
\text{Final Demand Shock} \times \text{But-For Percentage} \times \text{RIMS Multiplier} = \text{Output/ Value Added/ Earnings Impact}
\]
Other Limitations

• Different from Keynesian macroeconomic multipliers, which account for marginal propensities to consume, labor supply/consumption/saving adjustments, supply constraints, etc.

• Possible for disasters and major shocks to impact industry purchasing patterns.

• Supply constraints/inability of all upstream industries to grow proportional to the demand shock may impact multipliers.
  • More concerning for extremely large projects relative to their suppliers, or if supply is inelastic.

• Based on historical data – purchasing patterns may change over time.

• No balanced budget requirement.
Example: LLA Performance Audit on Quality Jobs Incentive Program

• Provides payroll rebates of up to 6% on newly created payrolls for companies that create at least 15 new jobs (5 for companies with 50 or fewer employees)

• Companies that meet job creation requirements can receive either:
  • Rebate of state sales and use taxes, currently 4.45% (and local, if locals approve, averaging ~5%)
  • Project facility expense rebate (i.e., investment tax credit) of 1.5% of qualified capital expenditures.

• Cost the state an estimated $99.9 million in FY 2018.
LLA Methodology for QJ Audit

• Impact of continuing operations: Earnings-earnings multiplier based on newly created payrolls for that industry.

• Impact of start-up:
  • Earnings-earnings multiplier for construction and engineering.
  • Output-earnings multiplier for industrial machinery manufacturing, times in-state purchasing percentage based on statistical sample of invoices submitted by participating companies.

• Continuing operations and start-up demand shocks were multiplied by but-for percentages.
Impact of Regional Purchasing

• Increased in-state investment would have increased the effect of the program on household income and the overall net gain of the program.

<table>
<thead>
<tr>
<th>In-state percentage of investment spending</th>
<th>Effect on Household Income</th>
<th>Overall Net Gain of Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>33.5%</td>
<td>$176,487,179</td>
<td>($63,334,264)</td>
</tr>
<tr>
<td>34.5%</td>
<td>$176,986,823</td>
<td>($62,796,514)</td>
</tr>
<tr>
<td>100.0%</td>
<td>$216,717,897</td>
<td>($20,035,370)</td>
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</tbody>
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Source: Prepared by legislative auditor’s staff using information from LED, LDR, LWC, BLS, and BEA.
Impact of Capping SUTR/PFER

- Capping the SUTR/PFER rebates at 21% of gross payrolls would improve the overall net gain of the program.
Conclusion

• RIMS multipliers allow for estimation of direct, indirect, and induced effects of a final demand shock.

• Applications to economic development/tax incentives.

• Requires careful methodology to account for but-for percentages, regional purchasing, etc.

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