An Introduction to Regional Input-Output Analysis

Introduction

Seven E. Hasnits and Sharon M. Bruce
The Transaction Table

The table below shows the flow of goods and services produced (or transacted) in each of the regions. The transactions table is used to organize all the information about the transactions.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Region A</td>
<td>100</td>
<td>50</td>
<td>20</td>
<td>15</td>
<td>20</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Region B</td>
<td>150</td>
<td>70</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>15</td>
<td>25</td>
</tr>
</tbody>
</table>

The table above shows the flow of goods and services produced in different regions. The transactions table is used to organize all the information about the transactions.

Components of a Regional Input-Output Model

The basic components of a regional input-output model include:

1. **Direct Expenditures:** The sum of all transactions (sales, purchases, etc.) made within a region.
2. **Indirect Expenditures:** The sum of all transactions (sales, purchases, etc.) made outside a region.
3. **Imports:** The sum of all transactions (sales, purchases, etc.) made from regions outside the current region.
4. **Exports:** The sum of all transactions (sales, purchases, etc.) made to regions outside the current region.
5. **Net Expenditures:** The sum of all transactions (sales, purchases, etc.) made within and outside a region, adjusted for imports and exports.

The basic equation for a regional input-output model is:

\[ \text{Net Expenditures} = \text{Direct Expenditures} + \text{Indirect Expenditures} \]

This equation allows for the calculation of the total output of a region, taking into account the interdependencies between different sectors.

The Importance of Input-Output Models

Input-output models are important because they help to understand the interdependencies between different sectors within a region. They provide a comprehensive view of how changes in one sector can affect other sectors, which is crucial for policymakers and businesses in making informed decisions.
The Direct Requirements Table

<table>
<thead>
<tr>
<th>Sector</th>
<th>Immediate Supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>C</td>
<td>A</td>
</tr>
</tbody>
</table>

The importance of the Direct Requirements Table lies in showing the dependencies. Each sector relies on others for its inputs, making the entire economy interlinked.
The Total Requirements Table

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product A</td>
<td>200'000</td>
</tr>
<tr>
<td>Product B</td>
<td>300'000</td>
</tr>
<tr>
<td>Product C</td>
<td>100'000</td>
</tr>
<tr>
<td>Product D</td>
<td>50'000</td>
</tr>
</tbody>
</table>

Note: The above table represents the total requirements needed for the production process.
multiplier effects of goods produced and consumed by the economy. The overall effect of the regional economy. Hence, it is estimated to as the "multiplier effect." Multipliers can provide a view of the nation's economic system. Although multipliers are most commonly referred to as the "multiplier effect," they are a useful tool in understanding the economic impact of changes in one sector of the economy.
Concluding Regional Input-Output Analyses

In short, this model assumes that under economic, social or technological change, the regional model reflects the region's economic structure, the regional model reflects the regional economic structure, the regional model reflects the regional economic structure.

Significant of them (Bills and Bar, 1988; Miller and Blair, 1987).

(1) The output of each sector is produced with a unique set of inputs.  
(2) The amount of production depends only on what is chosen by the industries, not on how much is produced. 
(3) The economic activity of one sector affects the economic activity of the other sectors.
(4) The economic activity of one sector affects the economic activity of the other sectors.
(5) The economic activity of one sector affects the economic activity of the other sectors.
(6) Local resources are efficiently employed (no underemployment of resources). 
(7) There are no constant returns to resources (supply is infinite and perfectly elastic).

Appendix: B. Assumptions of Regional Input-Output Analyses

A summary of the assumptions made from an input-output model for region X are listed below. The assumptions made from the economic impact models are summarized in Appendix B. Assumptions I to III are derived from the existing literature and are used as constant returns to production. These assumptions are stated at an aggregate level and are specific to the model of region X. Appropriate multipliers are used for each region. The model interactions of the three different region models are stated at an aggregate level and are specific to the model of region X.
null
Philosophy

Exposures: 1986, and Poutney (1979), given many detailed

Butler (1968) and Altman (1975).)

1/12/97 (1/12/98) BM, 10/12/98, 11/12/98


Notes

and weaknesses of the technique.

and importance of the technique.
where, 

\[ \lambda - (\lambda - I) = \lambda \] (6) 

\[ \lambda = \lambda (\lambda - I) \] (5) 

Solving Equation (4) for \( \lambda \), the output of the production sector equal

\[ \begin{bmatrix} \lambda \\ x \\ \lambda \\ x \end{bmatrix} = \lambda \begin{bmatrix} z_a \\ z_b \\ 1 \\ 1 \end{bmatrix} = x \begin{bmatrix} z_a \\ z_b \\ 1 \\ 1 \end{bmatrix} \]

where, 

\[ \lambda + x = \lambda \] (4)

A similar equation exists for each sector in the economy. Therefore, this system of equations can be represented in matrix notation as

\[ \begin{bmatrix} z_a & z_b & 1 & 1 \end{bmatrix} \begin{bmatrix} \lambda \\ x \\ \lambda \\ x \end{bmatrix} = \begin{bmatrix} z_a & z_b & 1 & 1 \end{bmatrix} \begin{bmatrix} \lambda \\ x \\ \lambda \\ x \end{bmatrix} \]

The values of \( \lambda \) and \( x \) are considered endogenous and the values of \( z_a \) and \( z_b \) are considered exogenous. Therefore, the total of final demand for the \( z_a \) and \( z_b \) are the desired inputs.

The desired inputs, the output of the production sector, and final demand for the \( x \) are considered endogenous and the values of \( x \) are considered exogenous. Therefore, the total of final demand for the \( x \) are the desired inputs.

Solving Equations (2) and (4) for \( x \), (5) for \( z_a \), and substituting

\[ \begin{bmatrix} \lambda \\ x \\ \lambda \\ x \end{bmatrix} = \lambda \begin{bmatrix} z_a \\ z_b \\ 1 \\ 1 \end{bmatrix} \]

becomes

\[ \begin{bmatrix} \lambda \\ x \\ \lambda \\ x \end{bmatrix} = \begin{bmatrix} z_a \\ z_b \\ 1 \\ 1 \end{bmatrix} \begin{bmatrix} \lambda \\ x \\ \lambda \\ x \end{bmatrix} \]

The flow from \( z_a \) to \( x \) is the desired inputs of \( z_a \) to \( x \) as a desired inputs. Therefore, the total of final demand for the \( z_a \) are the desired inputs.

The flow from \( z_b \) to \( x \) is the desired inputs of \( z_b \) to \( x \) as a desired inputs. Therefore, the total of final demand for the \( z_b \) are the desired inputs.

The flow from \( x \) to \( x \) is the desired inputs of \( x \) to \( x \) as a desired inputs. Therefore, the total of final demand for the \( x \) are the desired inputs.

\[ \begin{bmatrix} \lambda \\ x \\ \lambda \\ x \end{bmatrix} = \begin{bmatrix} z_a \\ z_b \\ 1 \\ 1 \end{bmatrix} \begin{bmatrix} \lambda \\ x \\ \lambda \\ x \end{bmatrix} \]

where, 

\[ \begin{bmatrix} \lambda \\ x \\ \lambda \\ x \end{bmatrix} = \begin{bmatrix} z_a \\ z_b \\ 1 \\ 1 \end{bmatrix} \begin{bmatrix} \lambda \\ x \\ \lambda \\ x \end{bmatrix} \]

products in a two sector economy.

Under the assumption of production sectors, the output of the production sector can be determined.
Appendix B

Table 1A: Output and Income Measures from Input-Output Analysis, Region X

<table>
<thead>
<tr>
<th>Sector Name</th>
<th>Output Multiplier</th>
<th>Total Income Effects</th>
<th>Income Effects</th>
<th>Income Multipliers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Type 1 (^1)</td>
<td>Type II (^2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture</td>
<td>1.99</td>
<td>4.76</td>
<td>0.52</td>
<td>0.27</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>2.51</td>
<td>4.88</td>
<td>0.44</td>
<td>0.08</td>
</tr>
<tr>
<td>Trade</td>
<td>2.08</td>
<td>3.37</td>
<td>0.28</td>
<td>0.07</td>
</tr>
<tr>
<td>Service</td>
<td>1.65</td>
<td>4.21</td>
<td>0.56</td>
<td>0.41</td>
</tr>
</tbody>
</table>

1. Total row from open model (Table 3).
2. Total row from closed model (Table 4).
3. Total (direct and indirect) income effects per $1 of final demand. TO CALCULATE: Multiply each element of the sector’s total requirements column (Table 3) by the direct income effect (column 5) and sum.
4. Total (direct, indirect and induced) income effects per $1 of final demand. TO CALCULATE: Multiply each element of the sector’s total requirements column (Table 4) by the direct income effect (column 5) and sum.
5. Household row of the direct requirements table (Table 2).
6. Total income effects from open model (column 3) minus the direct effect (column 5).
7. Total income effects from the closed model (column 4) minus total income effects from the open model (column 3).
8. Total (direct and indirect) income effects per $1 change in initial income. TO CALCULATE: Divide the total income effect from an open model (column 3) by the direct income effect (column 5).
9. Total (direct, indirect and induced) income effects per $1 change in initial income. TO CALCULATE: Divide the total income effect from a closed model (column 4) by the direct income effect (column 5).

Appendix B

Table 1B: Employment Measures from Input-Output Analysis, Region X

<table>
<thead>
<tr>
<th>Sector Name</th>
<th>Sector Employment(^10)</th>
<th>Total Employment Effects</th>
<th>Employment Effects</th>
<th>Employment Multipliers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Open(^1)</td>
<td>Closed(^2)</td>
<td>Direct(^3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Jobs per $100,000 final demand)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Column</td>
<td></td>
<td>(10)</td>
<td>(11)</td>
<td>(12)</td>
</tr>
<tr>
<td>Agriculture</td>
<td>221</td>
<td>63</td>
<td>123</td>
<td>30</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>100</td>
<td>69</td>
<td>122</td>
<td>21</td>
</tr>
<tr>
<td>Trade</td>
<td>1000</td>
<td>76</td>
<td>110</td>
<td>36</td>
</tr>
<tr>
<td>Service</td>
<td>1200</td>
<td>64</td>
<td>130</td>
<td>40</td>
</tr>
</tbody>
</table>

10. Assumed employment for Region X; employment data would be provided by the analyst.
11. Total (direct and indirect) employment effects per $100,000 of final demand. TO CALCULATE: Multiply each element of the sector’s total requirements column (Table 4) by the direct employment effect (column 13) and then sum.
12. Total (direct, indirect and induced) employment effects per $100,000 of final demand. TO CALCULATE: Multiply each of the sector’s total requirements (column 2) by the direct employment effect (column 13) and then sum.
13. Total sector employment (column 10) divided by sector output in $100,000 (Table 1).
14. Total employment effects from open model (column 11) minus the direct employment effects (column 13).
15. Total employment effect from closed model (column 12) minus the total employment effect of the open model (column 11).
16. Total (direct and indirect) employment effects per change in initial employment. TO CALCULATE: Divide the total employment effect from the open model (column 11) by the direct employment effect (column 13).
17. The total (direct, indirect and induced) employment effects per change in initial employment. TO CALCULATE: Divide the total employment effect from a closed model (column 12) by the direct employment effect (column 13).
change in Real Income (column 9 of appendix B: Real Income) indicated by modulate column (I) when the initial change in real income is zero and the final change in real income is not.

Input Multipliers (Type II): (Column 5, Appendix B) Use when the initial change in real income is not zero, and the final change in real income is zero.

Output Multipliers (Type II): (Column 7, Appendix B) Use when the change in real income in that sector is not zero.

Total Income Multipliers (Type III): (Column 3, and Appendix D) Use when change in total income is known and real income is not.

Input Multipliers (Type III): (Column 2, Appendix B) Use when change in total income is known and real income is not.

Output Multipliers (Type III): (Column 1, Appendix B) Use when change in total income is known and real income is not.

For a change in population of a region, the change in regional GDP is obtained by changing the multiplier in the appropriate equation in Table 1.

I. Which Multiplier is Appropriate?

Input Output Multipliers

I. What is the Value and Sector of Change?

Identification of Initial Change in Final Demand

Input-Output Calculations

Appendix C

Steven E. Hassler and Sharon M. Broker
1. Are Multiples Enough?

Calculating the Model

Multiples

Some regions with growth of income or a very large sector with a very small gain may be small, but it is also meaningful to figure out the sector. A sector with the largest multiplier in the region's primary exports is identified, and the marginal growth of that sector is used to determine the necessary of the total growth. The only

2. Are Big Multiples Better?

The New Jobs

model, and all the remaining people in the region have the skills required to

3. Are Medium Multiples Useful?

3. Do You Improve It by Interacting with Users/Clients?

Job Training Programs

an industry's growth with the model's and coefficients for both single

4. Are You Ready for Independence?

an industry’s growth with the model's and coefficients for both single

5. How to Start?

Empirical Multiples

3. Are Multiples Enough?

If size of a sector's multiplier is being used to evaluate factors for growth, the

4. Are Multiples Better?

the New Jobs

model, and all the remaining people in the region have the skills required to

5. How to Start?

Empirical Multiples

6. What Do Empirical Multiples Imply?

A sector’s direct, indirect, and induced changes in employment can

7. What are Marginal Changes?

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