Module 1: The Basics of Input-Output Analysis

1.2 The Structure of IO Tables

April 2025

The Structure of IO Tables

An example of a domestic input-output table

- **Let's take the example of a simplified economy with only wheat and bread industries**
  - Factors of production are aggregated into "value added"
  - Final demand is also aggregated, and it only consumes bread

	Wheat	Bread	Final Demand	Total Output
Wheat	30	70	0	100
Bread	0	20	180	200
Imports	10	10	70	-
Value Added (Factors' of Production Remuneration)	60	100	=	
Total Output	100	200		300

- **Reading the IO table:**
  - Vertically: it displays the inputs needed by each industry
    - **e.g. Bread industry used 20 monetary units of its own product, 70 monetary units of wheat and imported 10 monetary units to produce a total output of 200 monetary. Moreover, 100 monetary units were generated as of value added (salaries and profits, for instance)**
  - Horizontally: it displays the output distribution of each industry
    - **e.g. Wheat industry sells 280 monetary units to its own industry, 120 monetary units to the iron industry, and 175 monetary units are sold to be consumed directly by final demand, totalizing (again) 575 monetary units**

The Structure of IO Tables

The Intermediate Consumption Matrix

- **The Intermediate Consumption Matrix is the main and larger matrix of an IO table**
  - It depicts relation between selling and buying sectors
  - Each cell represents the supply from industry i (rows) to industry j (columns)

- **The Intermediate Consumption Matrix is often called "Z Matrix", "T Matrix", or even just "IO table" depending on the dataset**
  - Its size is determined by the number of industries available in the dataset (usually it is squared)
  - e.g. if there are 20 industries in your dataset, the Intermediate Consumption Matrix will be a matrix of 20 lines by 20 columns, totalizing 400 elements (20^2)

Z Matrix / T Matrix / IO Table

	Wheat		Final Demand	Total Output
Wheat	30	70	0	100
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The Structure of IO Tables

Imports

- **Domestic IO Tables display information on imported inputs**
  - The format (vector/matrix) and the type of information displayed depends on the dataset
    - **Vector: each cell represents the imported inputs of domestic industry j_d(columns)**
    - **Matrix: each cell represents the imported inputs of domestic industry j_d from foreign industry i_f**

- **It is usually named as "m vector" or "Z_m Matrix"**

m vector

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Wheat	30	70	0	100
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The Structure of IO Tables

Value-added Matrix

- **The Value-added Matrix displays information on the compensation of factors of production (e.g. wages and profits) and other additional information affecting prices such as taxes, subsidies, transport margins, etc.**

- **It is usually referred to as "v vector" or "VA Matrix"**
  - Despite depicting very detailed information in a matrix extended form, value-added often is aggregated into a single row vector when operated in standard IO Models

v vector

	Wheat	Bread	Final Demand	Total Output
Wheat	30	70	0	100
Bread	0	20	180	200
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Value Added (Factors' of Production Remuneration)	60	100	=	
Total Output	100	200		300

The Structure of IO Tables

Final Demand Matrix

- **The Final Demand Matrix displays information on the components of demand, such as households' consumption, government consumption, investment, exports, and others**
  - The Final demand Matrix in domestic IO Tables is already subtracted from imports
    - **Therefore, the total sum of the Final Demand Matrix equals GDP**

- **It is usually referred to as "f vector", "y vector" or "FD Matrix"**
  - Despite depicting very detailed information in a matrix extended form, final demand also often is aggregated into a single column vector when operated in standard IO Models

	Wheat	Bread	Final Demand	Total Output
Wheat	30	70	0	100
Bread	0	20	180	200
Imports	10	10	70	-
Value Added (Factors' of Production Remuneration)	60	100	=	
Total Output	100	200		300

f vector / y vector

The Structure of IO Tables

Output vector

- **The Total Output vector depicts the total production of each sector in the economy that was needed to satisfy final demand given the current state of interindustry relations**
  - Note: The sum of the Total Output vector ≠ GDP
    - **When aggregated, the Total Output vector double-counts the value generated in the economy**

- **It is usually referred to as the "x vector"**
  - It can be calculated both from input and output perspective, generating identical outputs for the different industries (if matrices are balanced)
    - **Output perspective: "To whom a sector is producing – other sectors or final demand" (eg. demand perspective)**
    - **Input perspective: "What a sector requires to produce – inputs and factors production" (eg., supply perspective)**

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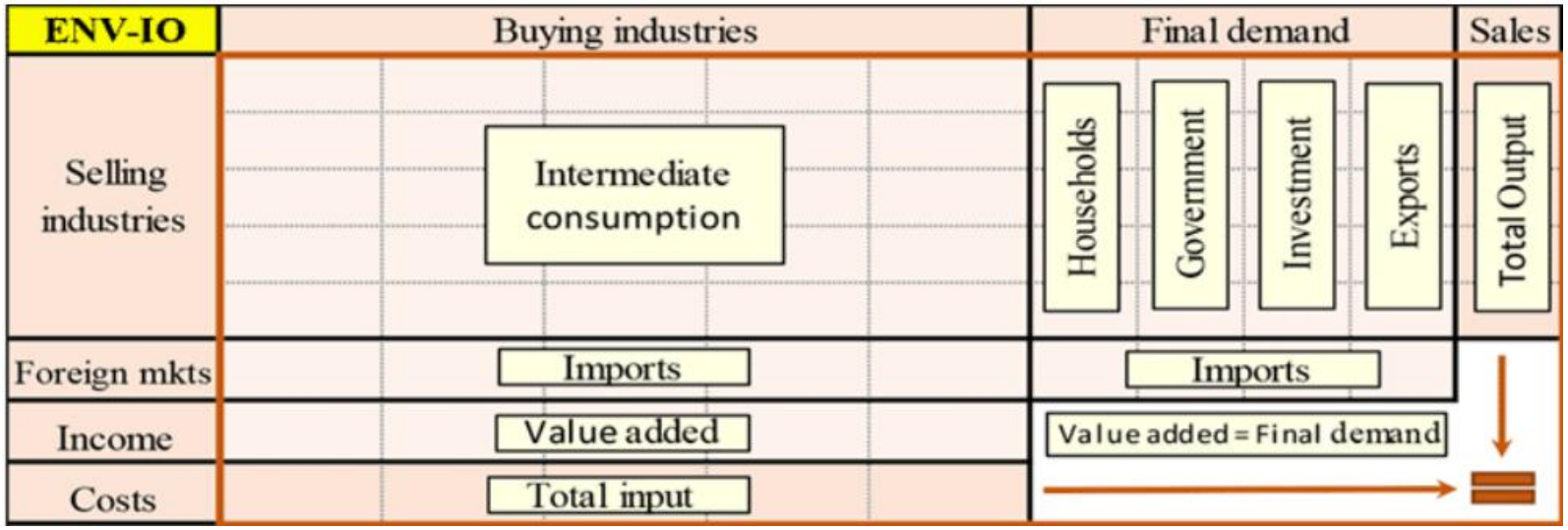
x vector

The Structure of IO Tables

An overview

- **Some fundamental relations of an IO Table:**
  - Aggregated Value-added = Aggregated Final Demand
    - **They are not the same vectors, but their sum should match**
  - Total Output vector should be the same when calculated from both input and output perspectives

- **Below is a stylized image of how an IO Table is structured and its fundamental relations:**



Adapted from Guilhoto (2021)

The Structure of IO Tables

Satellite accounts

- **It is possible to add more information at industrial level to IO Tables related to other economic, social and ecological aspects**
  - These information is usually depicted in the so-called Satellite Account
  - Satellite Accounts are usually referred to as "S Matrix", "U Matrix" or "Q Matrix"

- **Some common information available in Satellite Accounts are detailed employment data (sometimes per gender and skill) and environmental data (such as CO2 emissions and land and water use)**

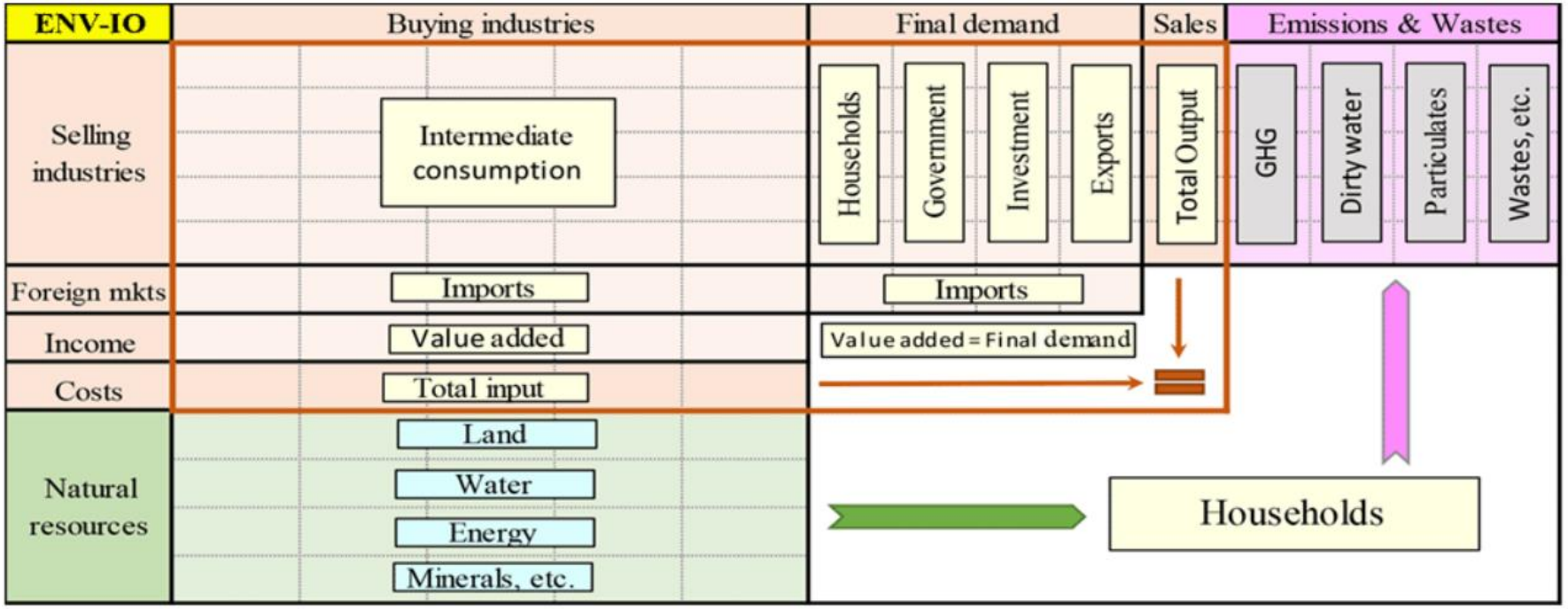
S Matrix / U Matrix / Q Matrix

	Wheat	Bread	Final Demand	Total Output
Wheat	30	70	0	100
Bread	0	20	180	200
Imports	10	10	70	-
Value Added (Factors' of Production Remuneration)	60	100	=	
Total Output	100	200		300
Employment	100 workers	50 workers		
Land Use	200 hectares	1 hectare		

The Structure of IO Tables

Env-IO Tables or EE-IO Tables

- **IO Tables that contain ecological and environmental data are named "Environmental Input-Output Tables" (Env-IO) or "Environmentally Extended Input-Output Tables" (EE-IO)**
  - In addition to the resources employed in production, these tables also display data on emissions, residuals and waste of the industries



Guilhoto (2021)

The Structure of IO Tables

An example: WIOD Table for 2010

- **We invite you now to watch the following videos where we present you a real IO Table dataset from the World Input-Output Database (WIOD) 2013 Release (Timmer et al., 2015)**
  - WIOD domestic IO Tables are possible to be visualized in Excel given their low level of industry disaggregation

- **Later, as we move into IO Models and larger datasets such as the Multi-Regional Input-Ouput Tables and Models (MRIO), it will become almost impossible (due to computational reasons) to open, visualize and manipulate the complete IO Table datasets together**
  - We will operate large matrices full of numbers and without headings
  - Therefore, it is important to understand what kind of information is inside each matrix and vector of an IO Table, so that we are able to properly understand and manipulate larger datasets

- **Watch the videos here!**
  - The dataset can be downloaded here -> select the option of "National IO tables"
  - Open, for example, the file "BRA_NIOT_ROW_Sep12"

Suggested Readings:

Textbooks and further readings

- **Textbooks:**
  - Miller, R. E., & Blair, P. D. (2021). Input-Output Analysis: Foundations and Extensions (3rd ed.). Cambridge University Press. https://doi.org/10.1017/9781108676212
    - **Chapters 1 and 2**
  - Raa, T. ten (Ed.). (2017). Handbook of input-output analysis. Edward Elgar Publishing. https://doi.org/10.4337/9781783476329
    - **Chapters 2 and 5**

- **Recommended readings:**
  - Guilhoto, J. J. M. (2021). Input–Output Models Applied to Environmental Analysis. In J. J. M. Guilhoto, *Oxford Research Encyclopedia of Environmental Science*. Oxford University Press. https://doi.org/10.1093/acrefore/9780199389414.013.573
  - Timmer, M. P., Dietzenbacher, E., Los, B., Stehrer, R., & De Vries, G. J. (2015). An Illustrated User Guide to the World Input-Output Database: The Case of Global Automotive Production: User Guide to World Input-Output Database. Review of International Economics, 23(3), 575–605. https://doi.org/10.1111/roie.12178
  - Dietzenbacher, E., Los, B., Stehrer, R., Timmer, M., & De Vries, G. (2013). THE CONSTRUCTION OF WORLD INPUT–OUTPUT TABLES IN THE WIOD PROJECT. Economic Systems Research, 25(1), 71–98. https://doi.org/10.1080/09535314.2012.761180