Economic diversification

Production side

- Industries/products
  - Raw materials (mining, agriculture) / Processed materials / Manufactured products / Services

- Primary inputs
  - Capital / labour / nature inputs

Demand side

- Consumer types
  - Households, government, companies (investment/capital goods)

- Markets
  - Domestic / international – regional / global
Existing measures of economic diversification\textsuperscript{1}

- Product / industry shares in aggregated economic indicators
  - Exports, production, value added, employment
  - e.g. Herfindahl / Herfindahl-Hirschman Index $\sum s_i^2$, Ogive $\sum \frac{(s_i-1/N)^2}{1/N}$, Entropy $\sum s_i \ln \frac{1}{s_i}$
- Export Concentration Index (ECI) & Export Vulnerability Index (EVI)\textsuperscript{2}
- Export sophistication: PRODY and EXPY\textsuperscript{3}
- Markowitz' portfolio theory considering uncertainties
- **Input-Output-based measures**\textsuperscript{4-6}
Input-output tables give a detailed snapshot of a country's economic structure.

### Value added
- Labour
- Capital

### Production
- Agriculture & Forestry
- Mining: energy
- Mining: non-energy
- Manufacturing: process
- Manufacturing: equipment
- Manufacturing: other
- Utilities
- Trade and transport
- Services
- Households
- Government
- Investments
- Exports to neighbours
- Exports to region
- Exports to continent
- Exports to other continents

### Intermediate Demand
- Biotic materials
- Abiotic materials
- Emissions
- Emissions

### Final Demand
- Trade
- Exports & Imports
- Primary inputs
  - Employment (1000')
  - Raw materials
  - Emissions
Input-output tables give a detailed snapshot of a country's economy

- IO tables are consistent with the System of National Accounts (SNA)
  → Macro-economic aggregates
  → With industry detail
- Production and use of intermediate and final products by industry/economic actor
- Factor input use (e.g. labour, capital) by industry
  → Identification of linkages through production chains/network

\[ x = (I - A)^{-1}Y \]
Example of a diversified economy - but, is it?

<table>
<thead>
<tr>
<th>Value Added</th>
<th>Agriculture &amp; Forestry</th>
<th>Mining: energy</th>
<th>Mining: non-energy</th>
<th>Manufacturing: process</th>
<th>Manufacturing: equipment</th>
<th>Manufacturing: other</th>
<th>Utilities</th>
<th>Trade and transport</th>
<th>Services</th>
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<td>Taxes &amp; subsidies</td>
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<tr>
<th>Environment</th>
<th>Biotic materials</th>
<th>Abiotic materials</th>
<th>Emissions</th>
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<td>Agriculture &amp; Forestry</td>
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</table>
Copper exports

- **Copper** is produced by non-energy mining
- Intermediate inputs
  - Electricity
  - Equipment
  - Transport services
- Primary inputs: all

### Diagram

- **Direct effects**
  - Intermediate Demand
  - Final Demand
  - Exports

<table>
<thead>
<tr>
<th>Intermediate Demand</th>
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<tbody>
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<td>Biotic materials</td>
<td>Abiotic materials</td>
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<td>Emissions</td>
</tr>
</tbody>
</table>

**Intermediate inputs**

- Electricity
- Equipment
- Transport services

**Primary inputs**

- All

**Exports**

- Neighbours
- Region
- Continent
- Other continents
Copper exports

- Copper is produced by non-energy mining
- Intermediate inputs
  - **Electricity**
    - Mining: energy
    - Equipment
    - Utilities
  - Equipment
  - Transport services
  - Primary inputs: all
Copper exports

- **Copper** is produced by non-energy mining
- Intermediate inputs
  - **Electricity**
    - Mining: energy
      - Equipment
      - Utilities
      - Trade & transport
    - Equipment
    - Utilities
    - Equipment
    - Transport services
    - Primary inputs: fossil fuels
Copper exports

- **Copper** is produced by non-energy mining
- Intermediate inputs
  - **Electricity**
    - Mining: energy
  - **Equipment**
    - Utilities
    - Trade & transport
  - **Equipment**
    - Utilities
  - **Equipment**
    - Transport services
  - Primary inputs: all
Copper exports

- **Copper** is produced by non-energy mining
- Intermediate inputs
  - **Electricity**
    - Mining: energy
    - Equipment
    - Utilities
  - Trade & transport
  - Equipment
  - Utilities
- **Equipment**
- Transport services
- Primary inputs
  - **Labour → income**
  - **Household consumption**

### Social Accounting Matrix / Econometric feedback model

<table>
<thead>
<tr>
<th>Intermediate Demand</th>
<th>Final Demand</th>
<th>Exports</th>
</tr>
</thead>
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<td>Abiotic materials</td>
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<td>Emissions</td>
<td>Food</td>
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<td>Clothess</td>
<td>Education</td>
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</tbody>
</table>

11
Copper exports

- **Copper** is produced by non-energy mining
- Intermediate inputs
  - **Electricity**
    - Mining: energy
    - Equipment
    - Utilities
    - Trade & transport
  - Equipment
  - Utilities
- Equipment
- Transport services
- Primary inputs
  - Labour → income
  → Household consumption
- Demand for final goods

![Social Accounting Matrix / Econometric feedback model](image-url)
Copper exports

- **Copper** is produced by non-energy mining
- Intermediate inputs
  - **Electricity**
    - Mining: energy
    - Equipment
    - Utilities
    - Trade & transport
  - **Equipment**
  - **Utilities**
  - **Transport services**
- Primary inputs
  - **Labour → income**
  - Household consumption
- Demand for final goods
- Intermediate production in all industries

### Induced effects
- **Labour → income**
- Household consumption
- Demand for final goods
- Intermediate production in all industries

### Direct effects
- Copper is produced by non-energy mining
- Intermediate inputs
  - **Electricity**
    - Mining: energy
    - Equipment
    - Utilities
    - Trade & transport
  - **Equipment**
  - **Utilities**

### Socioeconomic effects
- **Labour** → income
- Household consumption
- Demand for final goods
- Intermediate production in all industries

### Industrial production

<table>
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</table>

### Social Accounting Matrix / Econometric feedback model
Copper exports
Quantifying economic diversification for informing policy using IO tools

- Common concentration measures applied to a variety of production and demand side indicators

- IO-specific diversification measures
  - Inverse important coefficient[^7-9]:
    Which change in intermediate supply has the largest economy-wide effect?
  - Trade in Value Added (TiVA) indicators: [http://oe.cd/tiva](http://oe.cd/tiva)
  - Production dependence on demand:
    % of value added and employment depending on the set of largest export goods

[^7-9]: Reference numbers or sources for the inverse important coefficient.
Trade in Value Added (TiVA) indicators
http://oe.cd/tiva

Domestic value added share of gross exports

Source: OECD, Trade in Value Added (TiVA) database, December 2018

Note:
EU28 and G20 averages are unweighted averages of countries' foreign value added share of gross exports. Estimates for 2016 are preliminary projections.
Shares of largest exports goods

Calculations based on GTAP9 power database

<table>
<thead>
<tr>
<th>Argentina</th>
<th>Bolivia</th>
<th>Brazil</th>
<th>Chile</th>
<th>Colombia</th>
<th>Ecuador</th>
<th>Paraguay</th>
<th>Peru</th>
<th>Uruguay</th>
<th>Venezuela</th>
<th>Rest of South America</th>
<th>Costa Rica</th>
<th>Guatemala</th>
<th>Honduras</th>
<th>Nicaragua</th>
<th>Panama</th>
<th>El Salvador</th>
<th>Rest of Central America</th>
<th>Dominican Republic</th>
<th>Jamaica</th>
<th>Puerto Rico</th>
<th>Trinidad &amp; Tobago</th>
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</thead>
<tbody>
<tr>
<td>Vegetable</td>
<td>Minerals</td>
<td>Minerals</td>
<td>Minerals</td>
<td>Metals nec</td>
<td>Oil</td>
<td>Oil</td>
<td>Oil seeds</td>
<td>Metals nec</td>
<td>Meat:</td>
<td>cattle, shee</td>
<td>Oil</td>
<td>Metals nec</td>
<td>Electronic equipment</td>
<td>Crops nec</td>
<td>Textiles</td>
<td>Textiles</td>
<td>Chemical, rubber, plastic</td>
<td>Textiles</td>
<td>Transport nec</td>
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</tbody>
</table>

The image shows a bar chart representing the share of the 8 biggest export goods in total exports for various countries. The chart is color-coded to represent different types of goods, including vegetable oils and fats, minerals, metals, and various other categories. Each bar indicates the percentage of total exports that each commodity represents for a particular country.
% of employment and value added depending on 5 largest export goods

Employment and value added share of 5 biggest export goods in total exports

Calculations based on GTAP9 power database
Pros and cons for using IO to measure economic diversification

**Pros**

- Consistent with SNA
- Consistent production-side and demand-side indicators
- Use of common concentration indicators
- Additional indicators considering indirect effects

**Cons**

- Timeliness of data availability
- Aggregation level of industries
Take away

Quantifying economic diversification for informing policy using IO tools

Lessons learned

• Calculation of common concentration measures (CCMs) with IO data
• An economy might look diversified when considering only one or two indicators (production & employment) using the CCMs, when it is – in fact – not

Using IO analysis tools

• Considering indirect effects
• Simultaneous consideration of markets and products
• Consistent framework for measuring diversification from production- and demand-side for a large variety of indicators
1. UNFCCC (2016) Technical Paper: The concept of economic diversification in the context of response measures
2. Measures developed by UNCTAD
Technology for a better society

Teknologi for et bedre samfunn