Compiling the valuation matrices

Workshop on Supply and Use Tables
2-4 October 2018
Chisinau, Moldova
Agenda

- What is the valuation matrix
- Relationship between basic prices and purchasers’ prices
- Transformation of the use table from purchasers’ prices to basic prices
- Estimating valuation matrices in practice
What is the valuation matrix
Introduction

- When SUTs are compiled, the output of industries are valued at basic prices, whereas the intermediate and final use tables are valued at purchasers’ prices.

- This is also how the data is reported:
  - Producers are generally able to report output at basic prices because this is essentially the revenue they retain.
  - Purchasers report their expense details at purchasers’ prices because this is what they pay for goods and services.

- But in the SUTs, each product has to respect the fundamental identity: Supply = Demand.

- How is that identity respected given the difference in valuation between the supply and demand?
The Valuation Matrix

- The valuation matrix bridges the difference in valuation between the supply table at basic prices and the use tables at purchasers’ prices.

- When compiling SUTs at purchasers’ prices, the valuation matrix appears in the supply table.

- Its rows show products whereas the columns show the different margins (e.g. trade, transport) as well as the taxes and subsidies on products that make up the difference between what the producer of a good or services receives, and what the purchaser pays.
### Supply and use tables @ purchasers’ prices

<table>
<thead>
<tr>
<th>Products / Industries / Final Uses</th>
<th>Agriculture, forestry, and fishing</th>
<th>Mining, quarrying and construction</th>
<th>Manufacturing</th>
<th>Trade and transport</th>
<th>Services</th>
<th>General government</th>
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### Total Inputs

- Subsidies on Production: 0
- Taxes on Production: -2
- Compensation of employees (W&S): 72
- Compensation of employees (ESC): 705
- Gross Operating Surplus: 108
- Gross Mixed Income: 186
- Total Gross Value Added: 1,473

Total Inputs: 65, 420, 531, 373, 1,058, 421, 36, 2,905
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<td><strong>421</strong></td>
<td><strong>36</strong></td>
<td><strong>2,905</strong></td>
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</tbody>
</table>
Key Observations

- For each product:
  - Supply @ basic prices + $\Sigma$Margins + TLSP = Use @ purchasers’ prices

- The “margin products” (retail services, wholesale services, transportation services) have zero values in the use table
  - Note that this is not strictly necessary, especially for transportation services, which may be purchased directly

- The “margin products” are balanced (supply=demand), the balancing item being a negative entry in the valuation matrix that equals the total margin available
Relationship between Basic price and purchaser price
An overview of the essential differences between basic, producers’ and purchasers’ prices from section 6.69 of the SNA 2008 manual.
The purchasers’ price can be broken down into:
- Taxes less subsidies
- Trade margins
- Transportation margins
- Basic prices

Each cell in the Intermediate inputs and in the Final uses tables can be decomposed in this way.
From purchasers’ prices to basic prices
From aggregate margin to detailed estimate

- In the purchasers’ prices SUTs, the margins are shown as the aggregate sum of the margins on all use categories.
- These totals are measurable to some extent from source data e.g. retail margins from the Retail Commodity Survey.
- For certain analytical purposes, the SUTs (specifically, the use tables) need to be converted into basic prices.
- To create the basic prices SUTs, the constituent margins and taxes less subsidies of each cell in the use tables must be calculated.
- It is difficult to get solid data on these components by cell; there is a bit of judgement and modelling that takes place in this exercise.
- General method: Use a table of margin rates to calculate initial margins, then prorate to match observable aggregate by product.
- Table of margin rates will need to be updated on an ongoing basis.
Creating basic price estimates, illustration

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<th>Margins</th>
<th>Basic</th>
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</tbody>
</table>

- **For a non-margin product:**
  - Basic = Purchaser – Sum of Margins on that cell

- **For a margin product:**
  - Basic = Sum of Margins corresponding to that margin product
### Supply and Use Tables @ Basic Prices

#### Output of Industries

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<thead>
<tr>
<th>Industry</th>
<th>Agriculture, forestry, and fishing</th>
<th>Mining, quarrying and construction</th>
<th>Manufacturing</th>
<th>Trade and transport</th>
<th>Services</th>
<th>Fictives</th>
<th>General government</th>
<th>WSH</th>
<th>Imports</th>
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#### Use of Industries

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<th>Mining, quarrying and construction</th>
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<th>Trade and transport</th>
<th>Services</th>
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#### Output of Industries

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<tr>
<td>Final use</td>
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<td>74</td>
<td>508</td>
<td>42</td>
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</table>

#### Use of Industries

<table>
<thead>
<tr>
<th>Industry</th>
<th>Agriculture, forestry, and fishing</th>
<th>Mining, quarrying and construction</th>
<th>Manufacturing</th>
<th>Trade and transport</th>
<th>Services</th>
<th>Fictives</th>
<th>General government</th>
<th>WSH</th>
<th>Imports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use</td>
<td>1,024</td>
<td>6,000</td>
<td>529</td>
<td>2,905</td>
<td>469</td>
<td>3,374</td>
<td>1,981</td>
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</table>

#### Subsidies on Products

<table>
<thead>
<tr>
<th>Product</th>
<th>Agriculture, forestry, and fishing</th>
<th>Mining, quarrying and construction</th>
<th>Manufacturing</th>
<th>Trade and transport</th>
<th>Services</th>
<th>Fictives</th>
<th>General government</th>
<th>WSH</th>
<th>Imports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subsidies on production</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
<td>-10</td>
<td>-1</td>
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<td>-17</td>
</tr>
<tr>
<td>Taxes on production</td>
<td>1</td>
<td>8</td>
<td>15</td>
<td>10</td>
<td>6</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>Elasticity</td>
<td>1</td>
<td>7</td>
<td>13</td>
<td>3</td>
<td>8</td>
<td>4</td>
<td>10</td>
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</tbody>
</table>

#### Subsidies on Production

<table>
<thead>
<tr>
<th>Product</th>
<th>Agriculture, forestry, and fishing</th>
<th>Mining, quarrying and construction</th>
<th>Manufacturing</th>
<th>Trade and transport</th>
<th>Services</th>
<th>Fictives</th>
<th>General government</th>
<th>WSH</th>
<th>Imports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subsidies on production</td>
<td>-2</td>
<td>-2</td>
<td>-2</td>
<td>-2</td>
<td>-2</td>
<td>-10</td>
<td>-1</td>
<td></td>
<td>-8</td>
</tr>
<tr>
<td>Taxes on production</td>
<td>1</td>
<td>8</td>
<td>15</td>
<td>10</td>
<td>6</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>Elasticity</td>
<td>1</td>
<td>7</td>
<td>13</td>
<td>3</td>
<td>8</td>
<td>4</td>
<td>10</td>
<td></td>
<td>54</td>
</tr>
</tbody>
</table>

#### GVA Matrices

<table>
<thead>
<tr>
<th>Industry</th>
<th>Agriculture, forestry, and fishing</th>
<th>Mining, quarrying and construction</th>
<th>Manufacturing</th>
<th>Trade and transport</th>
<th>Services</th>
<th>Fictives</th>
<th>General government</th>
<th>WSH</th>
<th>Imports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Mixed Income</td>
<td>6</td>
<td>18</td>
<td>186</td>
<td>404</td>
<td>447</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Gross Operating Surplus</td>
<td>22</td>
<td>228</td>
<td>404</td>
<td>1,473</td>
<td>1,981</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

#### Total Inputs

<table>
<thead>
<tr>
<th>Industry</th>
<th>Agriculture, forestry, and fishing</th>
<th>Mining, quarrying and construction</th>
<th>Manufacturing</th>
<th>Trade and transport</th>
<th>Services</th>
<th>Fictives</th>
<th>General government</th>
<th>WSH</th>
<th>Imports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>65</td>
<td>420</td>
<td>531</td>
<td>373</td>
<td>906</td>
<td>152</td>
<td>421</td>
<td>36</td>
<td>2,905</td>
</tr>
<tr>
<td>Use</td>
<td>1,024</td>
<td>6,000</td>
<td>529</td>
<td>2,905</td>
<td>469</td>
<td>3,374</td>
<td>1,981</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- No valuation matrix in the supply table
- Margin services and taxes and subsidies on products appear explicitly in the use tables
- All products remain balanced (supply=use)
- Output, Imports, GVA matrices remain unchanged
Estimating valuation matrices in practice
Example margins in the SUTs

- **Wholesale (8)**
  - farm products
  - petroleum and petroleum products
  - food, beverages and tobacco products
  - personal and household goods
  - motor vehicles, motor vehicle parts and accessories
  - building materials and supplies
  - machinery, equipment and supplies
  - miscellaneous products

- **Retail (11)**
  - motor vehicles and parts
  - furniture and home furnishings
  - electronics and appliances
  - building materials, garden equipment and supplies
  - food and beverages
  - health and personal care products
  - automotive fuels
  - clothing and clothing accessories
  - sporting and leisure products
  - miscellaneous products
  - household fuels

- **Transportation and storage (13)**
  - Natural gas distribution
  - Transportation of crude oil and other commodities by pipeline margins
  - Transportation of natural gas by pipeline margins
  - Grain storage
  - Air freight transportation
  - Rail freight transportation
  - Water freight transportation
  - Truck transportation services for general freight
  - Truck transportation services for specialized freight
  - Water transportation support
  - Road transportation support
  - Freight transportation arrangement
  - Other transportation
1. Generate estimates of outputs, inputs, imports, and final demand categories
   • Trade margins represent the difference between Sales of Goods Purchased for Resale, and the Costs of those same Goods Purchased for Resale
   • Trade margins are measured mainly using Annual Wholesale Survey and Annual Retail Survey; other surveys also capture secondary trade-related activity
   • This step provides the supply and demand of the margin products (e.g. retail services, transportation services, etc.); the difference between supply and demand of these services is the total margin amount

2. Distribute total margin to obtain margin aggregates by product
   • Each margin is allocated to products using source data: the Retail Commodity Survey; the Wholesale origin; destination of goods survey; etc

3. Allocate margin aggregates by product to obtain margin details (by use category) by applying margin rates and prorating to match the aggregates
### Estimating margins – Illustrative example

**STEP 1: Build Output, input, and final uses tables**

#### Use at purchasers' prices

<table>
<thead>
<tr>
<th>Product</th>
<th>Ind1</th>
<th>Ind2</th>
<th>Ind3</th>
<th>HHFCe</th>
<th>Exports</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product1</td>
<td>12,079</td>
<td>1,003</td>
<td>28,552</td>
<td>73</td>
<td>1,239</td>
<td>318</td>
</tr>
<tr>
<td>Product2</td>
<td>2,410</td>
<td>30,446</td>
<td>70,744</td>
<td>7,038</td>
<td>24,201</td>
<td>121</td>
</tr>
<tr>
<td>Product3</td>
<td>11,246</td>
<td>65,766</td>
<td>152,826</td>
<td>16,843</td>
<td>28,141</td>
<td>42,406</td>
</tr>
<tr>
<td>Product4</td>
<td>1,329</td>
<td>3,607</td>
<td>8,351</td>
<td>30,251</td>
<td>7,768</td>
<td>38,219</td>
</tr>
<tr>
<td>Product5</td>
<td>5,978</td>
<td>58,071</td>
<td>30,754</td>
<td>74,861</td>
<td>207,376</td>
<td>53,935</td>
</tr>
<tr>
<td>Product6</td>
<td>3,705</td>
<td>6,004</td>
<td>17,655</td>
<td>18,899</td>
<td>52,951</td>
<td>0</td>
</tr>
<tr>
<td>Trade services</td>
<td>-200,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**STEP 2: Distribute total margin to obtain margin aggregates by product**

#### Use at purchasers' prices

<table>
<thead>
<tr>
<th>Product</th>
<th>Ind1</th>
<th>Ind2</th>
<th>Ind3</th>
<th>HHFCe</th>
<th>Exports</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product1</td>
<td>15,000</td>
<td>12,079</td>
<td>1,003</td>
<td>28,552</td>
<td>73</td>
<td>1,239</td>
</tr>
<tr>
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<td>10,000</td>
<td>2,410</td>
<td>30,446</td>
<td>70,744</td>
<td>7,038</td>
<td>24,201</td>
</tr>
<tr>
<td>Product3</td>
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<td>65,766</td>
<td>152,826</td>
<td>16,843</td>
<td>28,141</td>
</tr>
<tr>
<td>Product4</td>
<td>5,000</td>
<td>1,329</td>
<td>3,607</td>
<td>8,351</td>
<td>30,251</td>
<td>7,768</td>
</tr>
<tr>
<td>Product5</td>
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<td>5,978</td>
<td>58,071</td>
<td>30,754</td>
<td>74,861</td>
<td>207,376</td>
</tr>
<tr>
<td>Product6</td>
<td>30,000</td>
<td>3,705</td>
<td>6,004</td>
<td>17,655</td>
<td>18,899</td>
<td>52,951</td>
</tr>
<tr>
<td>Trade services</td>
<td>-200,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**STEP 3: Allocate margin aggregates by product to obtain margin details**

**Blueprint of margins**

<table>
<thead>
<tr>
<th>Ind1</th>
<th>Ind2</th>
<th>Ind3</th>
<th>HHFCe</th>
<th>Exports</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>29%</td>
<td>27%</td>
<td>30%</td>
<td>29%</td>
<td>32%</td>
<td>29%</td>
</tr>
<tr>
<td>2%</td>
<td>4%</td>
<td>5%</td>
<td>7%</td>
<td>1%</td>
<td>8%</td>
</tr>
<tr>
<td>20%</td>
<td>20%</td>
<td>19%</td>
<td>24%</td>
<td>19%</td>
<td>17%</td>
</tr>
<tr>
<td>2%</td>
<td>4%</td>
<td>2%</td>
<td>4%</td>
<td>0%</td>
<td>3%</td>
</tr>
<tr>
<td>21%</td>
<td>18%</td>
<td>24%</td>
<td>19%</td>
<td>24%</td>
<td>17%</td>
</tr>
<tr>
<td>35%</td>
<td>35%</td>
<td>31%</td>
<td>32%</td>
<td>35%</td>
<td>28%</td>
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</tbody>
</table>

**Blueprint * Use at purchasers' prices**

<table>
<thead>
<tr>
<th>Ind1</th>
<th>Ind2</th>
<th>Ind3</th>
<th>HHFCe</th>
<th>Exports</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>3,503</td>
<td>271</td>
<td>8,566</td>
<td>21</td>
<td>397</td>
<td>92</td>
<td>12,849</td>
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<tr>
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<td>1,218</td>
<td>3,537</td>
<td>493</td>
<td>242</td>
<td>10</td>
<td>5,548</td>
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<tr>
<td>2,249</td>
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<td>29,037</td>
<td>4,042</td>
<td>5,347</td>
<td>7,209</td>
<td>61,038</td>
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<tr>
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<td>1,147</td>
<td>2,695</td>
</tr>
<tr>
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<td>7,381</td>
<td>14,224</td>
<td>49,770</td>
<td>9,169</td>
<td>92,252</td>
</tr>
<tr>
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<td>6,048</td>
<td>18,533</td>
<td>0</td>
<td>33,452</td>
</tr>
</tbody>
</table>

**Prorate to equal margin aggregates**

<table>
<thead>
<tr>
<th>Ind1</th>
<th>Ind2</th>
<th>Ind3</th>
<th>HHFCe</th>
<th>Exports</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,089</td>
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<td>9,999</td>
<td>25</td>
<td>463</td>
<td>108</td>
<td>15,000</td>
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<tr>
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<td>2,195</td>
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<td>17</td>
<td>10,000</td>
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<tr>
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<td>60,000</td>
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<td>5,000</td>
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<td>12,335</td>
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<td>80,000</td>
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<td>5,424</td>
<td>16,621</td>
<td>0</td>
<td>30,000</td>
</tr>
</tbody>
</table>
Taxes on products are mandatory fees or levies paid by consumers on the purchase of products

Estimation of taxes on products can be broken down into 5 main steps:

1. Estimate tax aggregates ("controls") from Government Finance Statistics
2. Adjust expenditure to remove certain non-taxable items (e.g. illegal tobacco purchases, tips paid for meals and alcoholic beverages)
3. Calculate tax rates to determine taxable proportions of purchases
4. Estimate taxes on products by use category using tax rates and adjusted expenditures
5. Calibration of estimates to match controls
Calculating applicable tax rates

- In order to determine what portion of the purchase of a product by businesses and households is taxable, tax rates are created to determine the taxable proportions of the cells in the use table.
- These rates represent a translation from the legislation into the SUT framework.
- They indicate what proportion of a purchase of a product is not taxable.
- Everything is initially assumed to be 100% taxable.
- Tax rates are created for exemptions, rebates, and input tax credits for each combination of product and industry and final use category.
- These amounts are then deducted from the 100% to arrive at a final taxable proportion.
Taxable Proportion (TP) formula:

$$TP = (1 - \text{non taxable}) \times (1 - \text{exempt} - \text{zero rated} - \text{POS rebate}) \times (1 - ITC)$$

- The table on the right shows the tax rate values for “Snack food products” for a) HFCE and b) Bakeries and tortilla manufacturing.
Non-sales taxes such as tobacco taxes, liquor taxes, and environment taxes, are allocated based on the expenditure weights after applying the taxable proportions.

Sales taxes (incl. VAT), are determined as follows:

\[ TAX_i = \text{Expenditure} \times \left( \frac{LR_i \times TP_i}{\sum LR_i \times TP_i + 1} \right), \text{ where} \]

- \( LR_i = \text{Legal rate for government level } i \)
- \( TP_i = \text{Taxable proportion for government level } i \)
Summary

- The valuation matrix bridges the valuation difference between the domestic and foreign supply in basic prices, and the consumption in purchasers’ prices.
- The use table can be transformed from purchasers’ prices into basic prices by calculating margins, taxes on products, and subsidies on products for every cell in the use table.
- The valuation matrices may be estimated using a combination of survey data and calculated rates.