Food Balance Sheets (FBS)

FBS component: Production
Outline

1. Introduction
2. Agricultural production domain
3. Production data sources
4. Imputation and estimation
1. Introduction

Data for production should include:
- all production quantities of a given commodity within the country
- both commercial and non-commercial production

Production of primary products:
- reported at the farm gate level (so it does not include harvest losses)
  - It should include: any post-harvest on-farm loss occurring during the different farm operations, such as threshing, cleaning/winnowing or storage

Data for meat production:
- both commercial and farm slaughter
- production should be expressed in terms of carcass weight
1. Introduction

• Production of derived or processed commodities:
   refers to the total output of the product after transformation
   may occur either at the household or at a commercial establishment

• The standard unit for the reporting of agricultural production is metric tonnes (MT)
   But many countries also use local units
1. Introduction

• Data on agricultural production is one of the foundations of the food balance sheet framework.

• Countries not currently collecting agricultural production data should consider first investing their resources in generating reliable data on production.

• Even countries with highly-developed official survey methodologies may not collect production data on all commodities.

• So, some suggestions on alternative data sources and imputation strategies are needed.
Agricultural production domain
2. Agricultural production domain

CROPS

- CEREALS
- ROOTS AND TUBERS
- SUGAR CROPS
- PULSES
- NUTS
- OIL CROPS
- VEGETABLES
- FRUIT
- STIMULANTS
- SPICES
- FORAGE PRODUCTS
- TOBACCO
- NATURAL RUBBER
- FIBERS, VEGETAL OR ANIMAL ORIGIN

CROPS PROCESSED

- SUGAR, RAW, CENTRIFUGAL
- VEGETABLE OILS
- CAKES
- FRUIT PREPARATION
- ALCOHOLIC BEVERAGES
2. Agricultural production domain

LIVESTOCK AND PRODUCTS

Livestock – Live Animals

Product from Slaughtered Animals

Products from Live Animals
2. Agricultural production domain

2. Agricultural production domain

Other relevant variables that could be necessary for:

1. The imputation of missing values (activity and productivity variables)

   Activity variables
   • Crops: area sown, area harvested
   • Livestock: number of animals

   Productivity variables
   • Crops: Yield in MT/HA
   • Livestock: carcass weight and off-take

2. Validation of main production variables
   e.g. to check the production estimate, compilers can (i) analyse the area and yield, (ii) compare yields to historic trends or agronomic potential.
   e.g. to validate the quantity of meat produced from a given number of animals, compilers can use the carcass weight.
Production data sources
3. Production data sources

Official data sources

• The preferred source of data on agricultural production is survey-based official data.
• It is highly recommended that countries:
  o conduct annual production surveys for major commodities;
  o endeavour to measure all commodities in less frequent agricultural censuses or structural surveys;
3. Production data sources

**Official data sources**

- Official sources should collect not only information on **production output**, but also on **activity** and **productivity** variables.

- Outside of surveys, **administrative data** may be another potential data source for certain products.

- **Data from industrial output surveys** may also be useful sources for the **production of derived products**, such as flour or beer.
3. Production data sources

Alternative data sources:

- Records of private firms: where production is delivered to a handful of firms.
- Commodity organizations: if their members represent nearly all production. Some of these commodity organizations are international.
3. Production data sources

Production Questionnaire

<table>
<thead>
<tr>
<th>National Reporting Office and Contact name</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Reporter name</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Administration and Office</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Address</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fax</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-Mail</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This questionnaire contains the following sections:
3. Production data sources

Section 1: PRIMARY CROP PRODUCTION

Please specify the annual production of commodities in metric tons (t) and the area harvested in hectares (ha). Data should relate to calendar year. In the case of crops where harvest takes place, area and production of crops should include all areas actually harvested and the corresponding total harvested production. Cereals and Pulses are reported in dry grain refer to the weight of the whole nut, excluding the fibrous outer husk. Seed Cotton production should include both fibre and seed. Cocoa Beans data relate to fermented and dried beans. Please refer to the description of commodities for more details.

### Cereals

<table>
<thead>
<tr>
<th>COMMODITY</th>
<th>ELEMENT</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>0111 Wheat</td>
<td>Area Harvested</td>
<td>24,069,420</td>
<td>24,141,400</td>
<td>24,187,000</td>
</tr>
<tr>
<td></td>
<td>Production</td>
<td>126,208,400</td>
<td>130,185,000</td>
<td>128,845,000</td>
</tr>
<tr>
<td>0112 Maize (corn)</td>
<td>Area Harvested</td>
<td>37,123,390</td>
<td>38,119,300</td>
<td>36,768,000</td>
</tr>
<tr>
<td></td>
<td>Production</td>
<td>215,646,300</td>
<td>224,630,000</td>
<td>219,552,000</td>
</tr>
<tr>
<td>0113 Rice</td>
<td>Area Harvested</td>
<td>30,309,870</td>
<td>30,216,700</td>
<td>30,178,000</td>
</tr>
<tr>
<td></td>
<td>Production</td>
<td>206,507,400</td>
<td>208,230,000</td>
<td>207,076,000</td>
</tr>
<tr>
<td>0114 Sorghum</td>
<td>Area Harvested</td>
<td>619,200</td>
<td>574,000</td>
<td>574,000</td>
</tr>
<tr>
<td></td>
<td>Production</td>
<td>2,885,000</td>
<td>2,752,000</td>
<td>2,752,000</td>
</tr>
<tr>
<td>0115 Barley</td>
<td>Area Harvested</td>
<td>466,800</td>
<td>446,600</td>
<td>446,600</td>
</tr>
<tr>
<td></td>
<td>Production</td>
<td>1,812,000</td>
<td>1,868,000</td>
<td>1,868,000</td>
</tr>
</tbody>
</table>
### Section 2: PRIMARY CROP UTILIZATION

Please specify the annual utilization of commodities in metric tons (t). Data should relate to calendar year. Please refer to the section of commodity description for more details on the utilization conditions.

#### Cereals

<table>
<thead>
<tr>
<th>COMMODITY</th>
<th>ELEMENT</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>0111 Wheat</td>
<td>Food</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Seed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Feed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Loss</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Industrial Utilization</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0112 Maize (corn)</td>
<td>Food</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Seed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Feed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Loss</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Liquid biofuel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Solid and gaseous biofuels</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. Production data sources

Please specify the annual total number of heads (or 1000 head for poultry and rabbits) and if applicable to the livestock, milking, laying and slaughtered. Total live animal numbers have October and 30 September of the following year should be considered for the later year. Most production data (reported in terms of dressed carcass weight, i.e. excluding offal and skin, the feet and the skin as well as back-fat, bacon and ham in fresh equivalent. Poultry meat should be expressed in terms of dressed weight, i.e. including the carcass, the edible suckled by young animals but should include quantities fed to livestock. Please refer to the description of commodities for more details.

<table>
<thead>
<tr>
<th>ANIMAL NUMBERS (head)</th>
<th>COMMODITY</th>
<th>ELEMENT</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>NOT IF also as weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Stocks</td>
<td>113,968,500</td>
<td>108,173,000</td>
<td>106,679,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Slaughtered/Prod Animals</td>
<td>49,292,000</td>
<td>50,034,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fem Act Repr</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>02111</td>
<td>Cattle</td>
<td>Stocks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Slaughtered/Prod Animals</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fem Act Repr</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>02112</td>
<td>Buffalo</td>
<td>Stocks</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Slaughtered/Prod Animals</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fem Act Repr</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>02121.01</td>
<td>Camels</td>
<td>Stocks</td>
<td>316,200</td>
<td>356,000</td>
<td>361,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Slaughtered/Prod Animals</td>
<td>85,000</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Fem Act Repr</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>02122</td>
<td>Sheep</td>
<td>Stocks</td>
<td>158,490,000</td>
<td>162,062,000</td>
<td>161,351,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Slaughtered/Prod Animals</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. Production data sources

**Section 4: SELECTED DERIVED AGRICULTURAL**

Please specify the annual production of commodities in metric tons (t). For data on sugar production from home-grown crops only, they should be reported in terms of centrifugal sugar. If bought and imported oilseeds, they should be reported in terms of crude oil. Please specify when reported in a different way. You may refer to the description of commodities for more details. Please refer to section "Utilization of Oils" after the metadata sections.

<table>
<thead>
<tr>
<th>Sugar, raw, centrifugal</th>
<th>ELEMENT</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>23511.01 Cane sugar, centrifugal</td>
<td>Production</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23511.02 Cane sugar, non-centrifugal</td>
<td>Production</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23612 Beet sugar</td>
<td>Production</td>
<td></td>
<td>1,024,051</td>
<td>1,028,096</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vegetable Oils (Crude or Crude Equiv.)</th>
<th>ELEMENT</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>2161 Soya bean oil</td>
<td>Production</td>
<td>11,699,700</td>
<td>13,553,556</td>
<td></td>
</tr>
<tr>
<td>2162 Groundnut oil</td>
<td>Production</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21631.01 Sunflower-seed oil, crude</td>
<td>Production</td>
<td>299,843</td>
<td>615,170</td>
<td></td>
</tr>
<tr>
<td>21631.02 Safflower-seed oil, crude</td>
<td>Production</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21641.01 Rapeseed or canola oil, crude</td>
<td>Production</td>
<td>5,702,700</td>
<td>5,226,500</td>
<td></td>
</tr>
</tbody>
</table>
4. Imputation and estimation
4. Imputation and estimation

The recommended imputation depends somewhat on the commodity for which production is to be estimated.

Different approaches to imputation recommended for:

- crops,
- processed products derived from crops,
- livestock-derived products.
4. Imputation and estimation

Crops

• When estimating production of crops, imputation is based upon the following identity:

\[
Production (MT) = \text{Yield} \left(\frac{MT}{HA}\right) \times \text{Harvested Area (HA)}
\]

• In the agricultural survey program of many countries, data is collected on sown area, but not on harvested area.

• While data on harvested area is preferred, sown area estimates can also be adapted and used for this purpose.
4. Imputation and estimation

Crops

• Calculating any of the three unknowns (production, yield, or area) requires only an estimate of the other two terms.

• So for production, the recommended imputation approach is a three-step procedure:
  o **Step 1:** Measure, impute, or approximate a yield estimate.
  o **Step 2:** Measure, impute, or approximate an estimate of harvested area.
  o **Step 3:** Multiply yield and harvested area estimates together to arrive at a production estimate.
4. Imputation and estimation

Crops

**Step 1:** Measure, impute, or approximate a yield estimate.

- Understand the nature of yields for the crop being modeled graphing of historical yields and some general research into the typical characteristics for yields.
- The graphing of historical yield data should be followed by an analysis to determine which functional form best fits the data.
- Include other relevant explanatory variables in the estimating regressions.
4. Imputation and estimation

Crops

Step 2: Harvested area

- Calculate a harvested area based on the estimate of sown area, and some estimate of the percentage of land that was abandoned (abd).

Estimating some percentage of abandoned area, countries may have some information as to the actual area of land abandoned

\[
\text{Harvested area}_t = \text{Sown area}_t - \text{Abandoned area}_t
\]

- Use sown area to proxy for harvested area if an abandonment rate or a quantity of abandoned area is unknown
4. Imputation and estimation

Crops

Step 3: Derive production estimate by multiplying estimates for harvested area and yield.

• With estimates of both harvested area and yield in hand, FBS compilers need only multiply the two together.

In this case, the quality flag assigned to the production estimate should reflect the quality of the yield and harvested area used.
4. Imputation and estimation

Processed products derived from crops

- Only two pieces of information necessary for imputing values for derived goods:
  - The amount of the primary good that is being processed (that is, quantities of primary goods assigned to the food processing variable).
  - The extraction rate (for most products, extraction rates will fluctuate very little over time).

- Estimating the quantity of a given primary commodity destined for processing can be a bit more complicated.
4. Imputation and estimation

Processed products derived from crops

Example: Mustard seed processed products
4. Imputation and estimation

Processed products derived from crops

Example: Mustard seed processed products

Processing shares for oil of mustard seed and cake of mustard seed will both be 80%, since they two are outputs of a single transformation process (co-production)

<table>
<thead>
<tr>
<th></th>
<th>Mustard seed</th>
<th>Oil of mustard</th>
<th>Cake of mustard seed</th>
<th>Flour of mustard</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Amount Processed</td>
<td>400,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Processing Share</td>
<td></td>
<td>80%</td>
<td>80%</td>
</tr>
<tr>
<td>C</td>
<td>Amount of Input</td>
<td></td>
<td>320,000</td>
<td>320,000</td>
</tr>
<tr>
<td>D</td>
<td>Extraction Rate</td>
<td></td>
<td>36%</td>
<td>60%</td>
</tr>
<tr>
<td>E</td>
<td>Production of derived goods</td>
<td></td>
<td>115,200</td>
<td>192,000</td>
</tr>
</tbody>
</table>
4. Imputation and estimation

Livestock and livestock product imputation

- Using this estimate of animals slaughtered, and applying the appropriate yield conversion factor for the product in question below:

\[
Production (MT) = Carcass Yield \left( \frac{MT}{Animal} \right) \times Animals Slaughtered
\]
4. Imputation and estimation

Livestock and livestock product imputation

• If the number of animals slaughtered is not known, but production of at least one derived product is known, then FBS compilers should start from that number and work backwards to first derive an estimate of the number of animals slaughtered.

\[
\text{Animals Slaughtered} = \frac{\text{Production (MT)}}{\text{Carcass Yield (MT/Animal)}}
\]

FBS compilers are advised to combine official data with an estimate of non-registered animals or production of livestock-derived goods outside of official channels.
References

• Guidelines for the compilation of Food Balance Sheets (FAO, 2017), chapter 3.5, section 3.5.1 (Global Strategy & FBS Team)

• The FAO source book for the compilation of Food Balance Sheets (FAO, 2016) (Global Strategy & FBS Team)

• Technical Conversion Factors for Agricultural Commodities (FAO, 1972)

• FAOSTAT Production domain: http://www.fao.org/faostat/en/#data
THANK YOU!

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www.fao.org/faostat