FOOD BALANCE SHEETS
APPLICATIONS AND USES

I. STANDARDIZATION OF FOOD BALANCE SHEETS

The utilization of all the information which was assembled for the construction of a food balance sheet often ends up in a rather long list of food commodities. This is certainly very useful in order to select the appropriate food composition factors which are required for expressing per caput food supplies in terms of energy, protein and fat content. On the other hand, this detailed presentation no longer has the advantage of showing a comprehensive picture of a country’s food supply. This dilemma can be solved by standardizing the detailed food balance sheet. Standardization can be achieved by showing only primary commodities. Because the statistical information for processed commodities is mostly limited to trade, the commodity list can be confined to primary commodities - except for sugar, oils, fats and alcoholic beverages. Whenever possible, trade in processed commodities is expressed in the originating/parent commodity equivalent. This procedure greatly facilitates the analysis of food balance sheets with no loss of pertinent information. This is the sort of tool that planners and economists concerned with the preparation of development plans in the food and agriculture sector need. The responsibility of the statistician is to provide the statistical base in a format which is useful to policy makers in taking decisions. If the statistician fails to carry out this task in a satisfactory manner, his/her position in the formulation of sound development plans and policies may be weakened. Through the standardized food balance sheet, the statistician makes a valuable contribution to the policy-making exercise.

The section that follows describes the various steps to be taken in the standardization process.

Illustration I shows the information referring to cereals and milk in a detailed food balance sheet.

<table>
<thead>
<tr>
<th>COMMODITY</th>
<th>PRODUCTION</th>
<th>Change in STOCKS</th>
<th>IMPORT</th>
<th>EXPORT</th>
<th>TOTAL</th>
<th>MANUFACTURE for Food</th>
<th>MANUFACTURE for Industrial Use</th>
<th>WASTE</th>
<th>FOR CAPUT CONSUMPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Input</td>
<td>Output</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WHEAT, HARD</td>
<td>1200</td>
<td></td>
<td>1340</td>
<td>1230</td>
<td>2570</td>
<td>119.3</td>
<td>130.4</td>
<td>25.2</td>
<td>2.5</td>
</tr>
<tr>
<td>WHEAT, SOFT</td>
<td>1000</td>
<td></td>
<td>1200</td>
<td>1000</td>
<td>2200</td>
<td>119.0</td>
<td>130.4</td>
<td>25.2</td>
<td>2.5</td>
</tr>
<tr>
<td>OTHER CEREALS</td>
<td>2000</td>
<td></td>
<td>2200</td>
<td>2000</td>
<td>4200</td>
<td>117.5</td>
<td>130.4</td>
<td>25.2</td>
<td>2.5</td>
</tr>
<tr>
<td>COCONUT MILK</td>
<td>500</td>
<td></td>
<td>600</td>
<td>500</td>
<td>1100</td>
<td>119.0</td>
<td>130.4</td>
<td>25.2</td>
<td>2.5</td>
</tr>
<tr>
<td>SHEEP MILK</td>
<td>102</td>
<td></td>
<td>120</td>
<td>100</td>
<td>220</td>
<td>119.0</td>
<td>130.4</td>
<td>25.2</td>
<td>2.5</td>
</tr>
<tr>
<td>COW MILK</td>
<td>200</td>
<td></td>
<td>220</td>
<td>200</td>
<td>420</td>
<td>117.5</td>
<td>130.4</td>
<td>25.2</td>
<td>2.5</td>
</tr>
<tr>
<td>GOAT MILK</td>
<td>100</td>
<td></td>
<td>120</td>
<td>100</td>
<td>220</td>
<td>117.5</td>
<td>130.4</td>
<td>25.2</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Illustration II shows the first step: bringing processed products back to their originating commodities, i.e., flour to cereals, skim milk to cow milk. For this purpose, calories and nutrients from processed products are simply added to the calorie and nutrient values of the primary commodity.

The "input" to the processed commodity - Wheat, hard (1064); Wheat, soft (708); Other cereals (1259) and Skim milk (150)- is subtracted from the quantities shown under "Manufacture for food". This should eliminate the data under the latter. If more than one processed product results from the originating commodity, then each input is subtracted. In the case of by-products, just one subtraction is necessary cancelling all processing inputs.
The data of other entries concerning the processed products with the exception of "food" (i.e., in this example trade, feed, waste) is added to the equation of the originating commodity after multiplication by the reciprocal of the extraction rate.

### Wheat, hard

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Extraction rate (wheat/flour)</th>
<th>Reciprocal</th>
<th>Waste</th>
<th>Total waste (wheat equivalent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>85%</td>
<td>118%</td>
<td>Wheat</td>
<td>91</td>
</tr>
<tr>
<td>Wheat flour</td>
<td>18</td>
<td></td>
<td>Wheat flour</td>
<td>18</td>
</tr>
<tr>
<td>Wheat equivalent of flour</td>
<td>(18 x 118%)</td>
<td>21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total waste (wheat equivalent)</td>
<td>112</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Wheat, soft

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Extraction rate (wheat/flour)</th>
<th>Reciprocal</th>
<th>Imports</th>
<th>Total imports (wheat equivalent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>80%</td>
<td>125%</td>
<td>Wheat</td>
<td>400</td>
</tr>
<tr>
<td>Wheat flour</td>
<td>45</td>
<td></td>
<td>Wheat flour</td>
<td>45</td>
</tr>
<tr>
<td>Wheat equivalent of flour</td>
<td>(40 x 125%)</td>
<td>56</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total imports (wheat equivalent)</td>
<td>456</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Other cereals

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Extraction rate (other cereals/flour)</th>
<th>Reciprocal</th>
<th>Imports</th>
<th>Total Waste (wheat equivalent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other cereals</td>
<td>80%</td>
<td>125%</td>
<td>Other cereals flour</td>
<td>35</td>
</tr>
<tr>
<td>Other cereals equivalent of flour</td>
<td>(35 x 125%)</td>
<td>44</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waste</td>
<td></td>
<td></td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>
Other cereals 175  
Other cereals flour 73  
Other cereals equivalent of flour (73 x 125%) 91  

Total waste (other cereals equivalent) 266

Cow milk

Extraction rate (milk/skim milk) 96%  
Reciprocal 104%  
Feed  
Skim milk 36  
Milk equivalent of skim milk (36 x 104%) 38  
Waste  
Cow milk 21  
Skim milk 10  
Milk equivalent of skim milk (10 x 104%) 10  

Total waste (milk equivalent) 31

The “food” data of the original/parent commodity is now recalculated using the new values of its equation. One equation for the primary commodity now replaces the two former equations. The above procedure involves one subtraction, some multiplications and final additions.

In Illustration III a further reduction of the number of equations in the standardization process can be achieved by aggregating the equations for commodities of similar nutritive values, such as wheat and other cereals into cereals, and cow, goat and sheep milk into milk, etc. This procedure requires simply adding the equations of the commodities concerned which reduces a very long list of commodities to a workable size for input into econometric models.

<table>
<thead>
<tr>
<th>COMMODITY</th>
<th>PRODUCTION</th>
<th>CHANGE IN STOCKS</th>
<th>SUPPLY</th>
<th>DOMESTIC UTILIZATION</th>
<th>PER CAPUT CONSUMPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Input</td>
<td>Output</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WHEAT</td>
<td>1750</td>
<td>1268</td>
<td>486</td>
<td>2466</td>
<td>199</td>
</tr>
<tr>
<td>OTHER CEREALS</td>
<td>2360</td>
<td>449</td>
<td>3944</td>
<td>861</td>
<td>520</td>
</tr>
<tr>
<td>CEREALS TOTAL</td>
<td>4610</td>
<td>520</td>
<td>2384</td>
<td>4961</td>
<td>423</td>
</tr>
<tr>
<td>COW MILK</td>
<td>480</td>
<td>413</td>
<td>413</td>
<td>413</td>
<td>413</td>
</tr>
<tr>
<td>GOAT-SHEEP MILK</td>
<td>420</td>
<td>36</td>
<td>45</td>
<td>42</td>
<td>42</td>
</tr>
<tr>
<td>MILK TOTAL</td>
<td>480</td>
<td>413</td>
<td>413</td>
<td>413</td>
<td>413</td>
</tr>
</tbody>
</table>

Illustration IV. While there are practically no difficulties in standardizing the equations for individual commodities or groups of commodities of similar nutritive values (Illustrations II and III) some conceptual problems arise in calculating the aggregate equation for the whole food balance sheet. Such an aggregate is a useful tool for many types of analysis. It enables the calculation of ratios, such as the ratio of production to total supply or imports to total supply, which are helpful in assessing self-sufficiency or import-dependence. The calculation of shares of the different components over total utilization allows the assessment of trends of domestic utilization versus exports, for example.
The first problem in calculating the aggregate equation concerns the elimination of intermediate consumption and double-counting, particularly when there exist processed commodities originating from the same parent commodity (e.g., skim milk and butter) which belong by their very nature to different food groups, e.g., skim milk to the food group "Milk" and butter to the food group "Oils and fats". The appropriate procedure has already been described and need not be repeated here (see Illustration II). The second problem is related to the selection of the unit to be used for the conversion of the elements of the various commodities into homogeneous values. These can be monetary values or nutritive values. In the first case, prices are used as conversion factors, in the second, the nutrient content per weight.

In the example below, caloric factors are used to convert the standardized equations of wheat, other cereals, cow milk and goat and sheep milk into homogeneous values which can then be added in order to obtain the aggregate of these commodities.

After having standardized the equations of the various commodities (see Illustration III) the number of calories for the newly-defined commodities are divided by the new "food" quantities in order to arrive at an endogenous calorie conversion factor. Needless to say, in the unstandardized detailed food balance sheet (Illustration I) these factors came from an external food composition table. Each element in the equation can now be converted into calories. The calculations for the various commodities are illustrated below.

### Wheat

<table>
<thead>
<tr>
<th>Calories</th>
<th>MT</th>
<th>Calories</th>
</tr>
</thead>
<tbody>
<tr>
<td>1016</td>
<td>0.567 x</td>
<td>1710 (production) = 969.5</td>
</tr>
<tr>
<td>Food 1792</td>
<td></td>
<td>456 (imports) = 258.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2166 (supply) = 1228.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>190 (seed) = 107.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>184 (waste) = 104.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1792 (food) = 1016.1</td>
</tr>
</tbody>
</table>

### Other cereals

<table>
<thead>
<tr>
<th>Calories</th>
<th>MT</th>
<th>Calories</th>
</tr>
</thead>
<tbody>
<tr>
<td>639</td>
<td>0.527 x</td>
<td>2500 (production) = 1317.5</td>
</tr>
<tr>
<td>Food 1212</td>
<td></td>
<td>44 (imports) = 23.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2544 (supply) = 1340.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8 (exports) = 42.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2464 (total) = 1298.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>750 (feed) = 395.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>236 (seed) = 124.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>266 (waste) = 140.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1212 (food) = 638.7</td>
</tr>
</tbody>
</table>
Cow milk

<table>
<thead>
<tr>
<th>Calories</th>
<th>MT</th>
<th>Calories</th>
</tr>
</thead>
<tbody>
<tr>
<td>38</td>
<td>400 (production) = 44.2</td>
<td></td>
</tr>
<tr>
<td>Food</td>
<td>344 (imports) = 1.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>413 (supply) = 45.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>38 (feed) = 4.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>31 (waste) = 3.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>344 (food) = 38.0</td>
<td></td>
</tr>
</tbody>
</table>

Goat milk and sheep milk

<table>
<thead>
<tr>
<th>Calories</th>
<th>MT</th>
<th>Calories</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>40 (production) = 8.0</td>
<td></td>
</tr>
<tr>
<td>Food</td>
<td>20 (imports) = 8.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20 (supply) = 4.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20 (waste) = 4.0</td>
<td></td>
</tr>
</tbody>
</table>

The sums of each column (production, trade, feed, seed, manufacture, waste and food) represent the caloric value (in terms of kilocalories/caput/day) of the respective elements of all the commodities shown in Illustration I.

II. IMPORT DEPENDENCY RATIO (IDR)

In the course of analysing the food situation of a country, an important aspect is to know how much of the available domestic food supply has been imported and how much comes from the country's own production. The IDR answers this question. It is defined as

$$\text{IDR} = \frac{\text{Imports}}{\text{production} + \text{imports} - \text{exports}} \times 100$$

The complement of this ratio to 100 would represent that part of the domestic food supply that has been produced in the country itself. There is, however, a caveat to be kept in mind: these ratios hold only if imports are mainly used for domestic utilization and are not re-exported.

Based on the figures contained in Illustration III above, the IDR for wheat, other cereals, cow milk, total cereals and total milk would be calculated as follows:

**Wheat**

$$\text{IDR} = \frac{456}{1710 + 456 - 0} \times 100 = 21.05\%$$

**Other cereals**

$$\text{IDR} = \frac{44}{2500 + 44 - 80} \times 100 = 1.79\%$$
Cow milk

\[
\text{IDR} = \frac{13}{400 + 13 - 0} \times 100 = 3.15\%
\]

Total cereals

\[
\text{IDR} = \frac{500}{4210 + 500 - 80} \times 100 = 10.80\%
\]

Total milk

\[
\text{IDR} = \frac{13}{440 + 13 - 0} \times 100 = 2.87\%
\]

Based on these calculations, it can be concluded that around 80% of the domestic supply of wheat, 98% of other cereals, 97% of cow milk, 89% of all cereals and 97% of all milk come from domestic production.

Using the figures shown in Illustration IV, the IDR for the aggregate of cereals and milk, including processed products derived therefrom, would be:

\[
\text{IDR} = \frac{283.2}{2342.2 + 283.2 - 42.2} \times 100 = 10.96
\]

indicating that almost 90% of the domestic supply of this aggregate was produced in the country.

III. SELF-SUFFICIENCY-RATIO (SSR)

The self-sufficiency-ratio expresses the magnitude of production in relation to domestic utilization. It is defined as:

\[
\text{SSR} = \frac{\text{Production}}{\text{Production} + \text{imports} - \text{exports}} \times 100
\]

Again, as in the case of the IDR, the SSR can be calculated for individual commodities, groups of commodities of similar nutritional values and, after appropriate conversion of the commodity equations, also for the aggregate of all commodities.

Using the figures shown in Illustrations III and IV, the self-sufficiency-ratio would be determined as follows.

Wheat

\[
\text{SSR} = \frac{1710}{1710 + 456 - 0} \times 100 = 78.95\%
\]
**Other cereals**
\[
\text{SSR} = \frac{2500}{2500 + 44 - 80} \times 100 = 101.46\%
\]

**Cow milk**
\[
\text{SSR} = \frac{400}{400 + 13 - 0} \times 100 = 96.85\%
\]

**Total cereals**
\[
\text{SSR} = \frac{4210}{4210 + 500 - 80} \times 100 = 90.93\%
\]

**Total milk**
\[
\text{SSR} = \frac{440}{440 + 13 - 0} \times 100 = 97.13\%
\]

Based on the figures shown in Illustration IV, the SSR for the aggregate of cereals and milk, including processed products derived therefrom, would be:
\[
\text{SSR} = \frac{2342.2}{2342.2 + 283.2 - 42.2} \times 100 = 90.67\%
\]

indicating that around 90% of the country’s supply of cereals and milk originates from the country’s own production.

In the context of food security, the SSR is often taken to indicate the extent to which a country relies on its own production resources, i.e., the higher the ratio the greater the self-sufficiency. While the SSR can be the appropriate tool when assessing the supply situation for individual commodities, a certain degree of caution should be observed when looking at the overall food situation. In the case, however, where a large part of a country’s production of one commodity, e.g., other cereals, is exported, the SSR may be very high but the country may still have to rely heavily on imports of food commodities to feed the population. This is easily demonstrated by increasing in Illustration I both production and export figures of the commodity “other cereals” by 1 000 MT. The elements for production and exports in the equation for “total cereals and milk” in Illustration IV would change to 2 869.2 and 569.2, respectively. The SSR and IDR would then change as follows:
\[
\text{SSR} = \frac{2869.2}{2869.2 + 283.2 - 569.2} \times 100 = 111.07\%
\]
\[
\text{IDR} = \frac{283.2}{2869.2 + 283.2 - 569.2} \times 100 = 10.96\%
\]
It follows that in spite of a very high self-sufficiency rate the country imports about 11% of its supply of the aggregate "Cereals and Milk" with only about 90% of its domestic supply coming from the country's own production.

These explanations have been given to show that the self-sufficiency rate (as defined above) cannot be the complement to 100 of the import dependency rate, or vice-versa.

IV. ANALYSIS OF THE PATTERN OF PER CAPUT FOOD SUPPLY

As mentioned previously, food balance sheets contain the basic information which is useful in analysing a country's food supply situation. The section that follows provides a few examples regarding the analysis of the pattern of per caput food supplies.

The first table shows the daily per caput food supply by food groups in terms of calories, protein and fat over the period 1992 to 1995 for the aggregate of the following 15 countries: Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, The Former Yugoslav Republic of Macedonia, Republic of Moldova, Poland, Romania, Slovak, Slovenia, Federal Republic of Yugoslavia (Serbia and Montenegro) together with the percent contribution of various food groups to the daily per caput food supplies. The second table shows whether, and to what extent, the pattern of the per caput food supplies has changed over time.

In reviewing the tables, it becomes clear that over the 4-year period the energy content of the total food supply in terms of calories and protein remained fairly stable, while the fat content decreased by around 5%. Three-quarters of the energy supply, half of the protein and more than one-third of the fat originates from vegetable products. Per caput supply of animal products - contributing the rest of the total supply - decreased during these years. Although there were no major changes in the level of the overall food supply, some noteworthy shifts in the food pattern can be observed during these years.

Cereals are the major source of calories and protein. They alone contribute about 40% of the supply of calories and protein. It is interesting to note the important role of cereals as a source of fat which is often not fully recognized.

Roots and tubers contribute around 5% to the energy supply and 4% to the protein supply.

Sugar, syrups and honey - mainly a source of energy - are the second largest contributor to the total calorie supply. Over the years under observation, per caput availability is, however, decreasing.

Although consumption of pulses is not important in these countries, the relevant figures suggest a continuing increase in the food intake of these commodities.

Vegetable oils and animal fats are the major sources of fat. They alone account for about one-half of the total per caput supply of fat, indicating the considerable amount of fat in the diet coming from other food groups. It is also interesting to note the shift occurring from animal fats to vegetable oils during the period under observation.

Vegetables and fruits are usually considered as sources of minerals and vitamins. But the tables confirm that that they also provide energy, protein and small amounts of fat.

Alcoholic beverages account for about 5% of the total energy supply. Their consumption appears to be relatively stable.

The per caput supply of meat and offals has decreased by around 10% over the years. Still, they contribute about 10% of calories and around a quarter of protein and of fat.

Milk is second only to meat in importance as a source of animal protein, accounting for around 18% of total protein supply.
Eggs and fish are important mainly as an animal protein. Their consumption, however, decreased over the years by more than 10%.