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TRAINING IN THE PREPARATION OF FOOD BALANCE SHEETS

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FOOD BALANCE SHEETS

APPLICATIONS AND USES

The paper illustrates how food balance sheet data can be further processed in order to obtain meaningful tools for analytical studies, thus increasing the informational value of food balance sheets. In particular, it describes the standardization of food balance sheets, the calculation of the import dependency ratio and of the self-sufficiency ratio.

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, i.e. processed commodities are converted into their originating primary commodity equivalent.. 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.

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.

<u>Wheat, hard:</u>

Extraction rate (wheat/flour)			85%	
Reciprocal				118%
Waste				
Wheat				91
Wheat flour		18		
Wheat equivalent of flour	(18 x 118%)			21
Total waste (wheat equivalent)			112	

<u>Wheat, soft:</u>

Extraction rate (wheat/flour)			80%	
Reciprocal				125%
Imports				
Wheat				400
Wheat flour		45		
Wheat equivalent of flour	(40 x 125%)			56
Total imports (wheat equivalent)				456
Waste				
Wheat				57
Wheat flour		12		
Wheat equivalent of flour	(12 x 125%)			15
Total waste (wheat equivalent)				72

Other cereals:

Extraction rate (other cereals/flour)		80%	
Reciprocal			125%
Imports			
Other cereals flour		35	
Other cereals equivalent of flour	(35 x 125%)		44
Waste			
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.

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.

			Metric Tons			Calories
			Wheat			
Calories	1016	= 0.567 x	1710	(production)	=	969.5
Food	1792		456	(imports)	=	258.6
			2166	(supply)	=	1228.1
			190	(seed)	=	107.7
			184	(waste)	=	104.3
			1792	(food)	=	1016.1

Other cereals

Calories 639 / Food 1212	= O.527 x	2500 (production)	=	1317.5
		44 (imports)	=	23.2
		2544 (supply)	=	1340.7
		80 (exports)	=	42.2
		2464 (total)	=	1298.5
		750 (feed)	=	395.2
		236 (seed)	=	124.4
		266 (waste)	=	140.2
		1212 (food)	=	638.7

Cow milk

Calories 38 / Food 344	= 0.110 x	400 (production)	=	44.0
		13 (imports)	=	1.4
		413 (supply)	=	45.4
		38 (feed)	=	4.2
		31 (waste)	=	3.4
		344 (food)	=	37.8

Goat milk and sheep milk

Calories 4 / Food 20	= 0.200 x	40 (production)	=	8.0
		40 (supply)	=	8.0
		20 (waste)	=	4.0
		20 (food)	=	4.0

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

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

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:

$$\text{IDR} = \frac{44}{2\,500 + 44 - 80} \times 100 = 1.79\%$$

Cow milk:

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

Total cereals:

$$\text{IDR} = \frac{500}{4\,210 + 500 - 80} \times 100 = 10.80\%$$

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:

$$IDR = \frac{283.2}{2339.0 + 283.2 - 42.2} \times 100 = 10.98\ \%$$

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:

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

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:

$$SSR = \frac{1710}{1710 + 456 - 0} \times 100 = 78.95\%$$

Other cereals:

$$SSR = \frac{2\ 500}{2\ 500 + 44 - 80} \times 100 = 101.46\%$$

Cow milk:

$$SSR = \frac{400}{400 + 13 - 0} \times 100 = 96.85\%$$

Total cereals:

$$SSR = \frac{4\,210}{4\,210 + 500 - 80} \times 100 = 90.93\%$$

Total milk:

$$SSR = \frac{440}{440 + 13 - 0} \times 100 = 97.13\%$$

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

$$SSR = \frac{2\,342.2}{2\,339.0 + 283.2 - 42.2} \times 100 = 90.66$$

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:

$$SSR = \frac{2\,869.2}{2\,866.0 + 283.2 - 569.2} \times 100 = 111.09\%$$

$$IDR = \frac{283.2}{2\,866.0 + 283.2 - 569.2} \times 100 = 10.98\%$$

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.

Food Balance Sheet

Population 14.000 (thousand) **Country ....** **Year.................**

(Thousand metric tons, unless otherwise specified)

Commodity	Production		Change in Stocks	Gross Import	Supply	Gross Export	**Domestic utilization**							**Per caput consumption**				
	Input	Output					Total	Feed	Seed	Manufacture for		Waste	Food	Kg/ year	Grams/ day	Cal./ day	Prot./ day	Fat/ day
										Food	Industrial Use					No	Grams	Grams
ILLUSTRATION I																		
Wheat, hard		1300			1300		1300		145	1064		91						
Wheat, hard/flour	1064	904			904		904					18	886	63.3	173.4	607	23.2	2.4
Wheat, soft		410		400	810		810		45	708		57						
Wheat, soft/flour	708	566		45	611		611					12	599	42.8	117.2	409	11.5	1.5
Other cereals		2500			2500	80	2420	750	236	1259		175						
Other cereals/flour	1259	1007		35	1042		1042					73	969	69.2	189.6	639	18.4	3.6
Cow milk		400		13	413		413			150		21	242	17.3	47.4	31	1.7	1.7
Cow milk/skim milk	150	144			144		144	36				10	98	7	19.2	7	0.7	0.1
Goat milk		22			22		22					11	11	0.8	2.2	2	0.1	0.1
Sheep milk		18			18		18					9	9	0.6	1.8	2	0.1	0.1
Total																1697	55.7	9.5

ILLUSTRATION II

Wheat, hard		1300			1300		1300		145			112	1043			607	23.2	2.4
Wheat, soft		410		456	866		866		45			72	749			409	11.5	1.5
Other cereals		2500		44	2544	80	2464	750	236			266	1212			639	18.4	3.6
Cow milk		400		13	413		413	38				31	344			38	2.4	1.8
Goat milk		22			22		22					11	11			2	0.1	0.1
Sheep milk		18			18		18					9	9			2	0.1	0.1
Total																1697	55.7	9.5

ILLUSTRATION III

Wheat		1710		456	2166		2166		190			184	1792			1016	34.7	3.9
Other cereals		2500		44	2544	80	2464	750	236			266	1212			639	18.4	3.6
Cereals total		4210		500	4710	80	4630	750	426			450	3004			1655	53.1	7.5
Cow milk		400		13	413		413	38				31	344			38	2.4	1.8
Goat + sheep milk		40			40		40					20	20			4	0.2	0.2
Milk total		440		13	453		453	38				51	364			42	2.6	2
Total																1697	55.7	9.5

ILLUSTRATION IV

Wheat		969.5		258.6	1228.1		1228.1		107.7			104.3	1016.1			1016	34.7	3.9
Other cereals		1317.5		23.2	1340.7	42.2	1298.5	395.2	124.4			140.2	638.7			639	18.4	3.6
Cow milk		44.0		1.4	45.4		45.4	4.2				3.4	37.8			38	2.4	1.8
Goat + sheep milk		8.0			8.0		8.0					4.0	4.0			4	0.2	0.2
Total		2339.0		283.2	2622.2	42.2	2580.0	399.4	232.1			251.9	1696.6			1697	55.7	9.5