Food Balance Sheets

Food Balance Sheets Compilation at the national level

The two principal data pillars for the compilation of the Food Balance Sheets (FBS), whether at the national level or at FAO, are the agricultural trade and production data. The trade data are, on the whole, quite accurately recorded and compiled by the national Customs Office, based on the appropriate filled-in forms and on manual checks. The production data are obtained from the national surveys, which are most often yield-based extrapolations. Production and trade (imports and exports) are the main variables of the “supply” side of the FBS.

Reliable data for the other variables of the FBS balancing equation, such as withdrawals or additions from/to stocks (supply), feed, seed, industiral use, loss, etc, (all part of utilization) may or may not be available at the national level, depending on the agricultural data collection framework in a given country. In the absence of such data, one must resort to impuation using the methodolgies described in detail in the preceding chapter.

The FBS equation, as we saw earlier:

Supply:

Production + Imports - Exports - Stock changes =

Utilization:

Food + Food Processing + Feed + Seed + Tourist consumption + Industrial use + Loss + Residuals/other utilizations

Of major importance in the FBS calculation is the “Food” component, expressed in Kcal/person/day. It is essential to bear in mind that this “Food” is an indicator of “availability”, as a national average, and not of actual “consumption”. Household consumption data are more accurately obtained from the various household surveys. The differences between the “food” data from the FBS and the “consumption” from the household surveys are described in detail elsewhere in this manual (such as the absence of data reflecting the public consumption of food in restaurants, at street level, etc. in the household surveys).

The possible data sources for the other variables (such as the agri-food industry data) have been listed elsewhere in this manual.

In this chapter, we will show a step-by-step example of the FBS compilation, starting with the detailed Supply Utilization Accounts (SUA) of a given country in a given year, for a few selected commodities. These SUAs are then aggregated to produce the FBS. The “Residuals/other utilizations” variable will be omitted in the example, in order to simplify the steps.

Wheat

For this example, we will first consider the full process for creating a food balance sheet for wheat. Note that if we do not otherwise mention the units, all quantities are assumed to be in millions of tonnes. We start off with an empty SUA table showing some commodities of the wheat “commodity tree” (wheat as the primary commodity, flour, etc. as the processed commodities). In this table, a dash (i.e. “-”) will represent that a value is currently unknown.

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Wheat	-	-	-	-	-	-	-	-	-	-	-
Wheat flour	-	-	-	-	-	-	-	-	-	-	-
Bulgur	-	-	-	-	-	-	-	-	-	-	-
Breakfast cereals	-	-	-	-	-	-	-	-	-	-	-
Wheat starch	-	-	-	-	-	-	-	-	-	-	-
Wheat bran	-	-	-	-	-	-	-	-	-	-	-

Production

For production data, we first fill in the table with any available official figures. To impute any missing production figures, we must also consider "yield" and "area harvested" data (in the absense of "area sown" data), since yield is defined as production divided by area harvested (and thus with any two variables the third is uniquely defined).

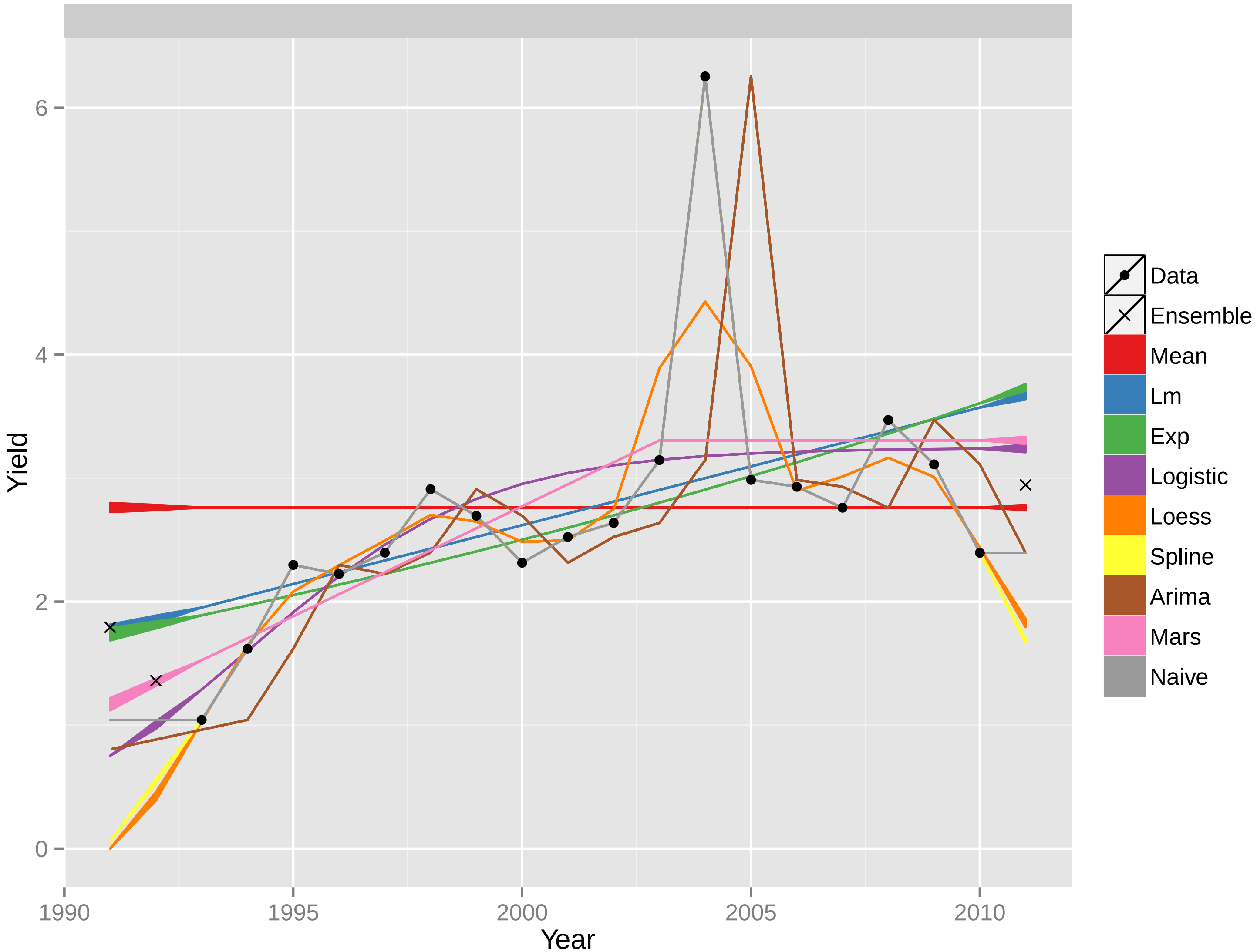
Suppose we only have the official data below. Please note that for the sake of demonstration we have considered the flour production quantity as given, and the wheat as unknown and must therefore be imputed. In reality, of course, it is almost always the reverse (with wheat production officially available, and flour less so):

Name	Area Harvested (hectare)	Yield (tonnes/hectare)	Production (tonnes)
Wheat	18,500,000	-	-
Wheat flour	-	-	18,650,000

So, in this case, the production quantity is only known for wheat flour (it is missing for wheat), and for wheat we are also missing the yield value. The procedure for determining how to impute production data is:

- If all three variables are available, we use any two variables in the Yield = Production / Area harvested formula to cross-check the third variable. If the formula indicates an error for one of the given variables, a quick time-series check should identify the incorrect value.
- If only two variables are available, the third is computed with the above formula.
- If only the production or area harvested variable is available, we impute yield using its historical time series (using the ensemble approach described in detail in chapter 2). The other missing element would then be calculated using the aforementioned formula.
- If only the yield variable is available, we impute production using the historical time series (using the ensemble approach); then using the formula as above, the area harvested would be calculated.
- If all three variables (area harvested, yield, and production) are missing, we impute yield and production data using the historical time series (using the "ensemble' approach). The area harvested would then be calculated by the formula: Area harvested = Production/Yield.

In this example, we need to impute the yield. In the graph below, several models are fit to the historical yield values (models are represented as lines and historical data as points). These models are combined in a weighted average (where the weights are chosen based on how well the model fits the data) to form a final ensemble of models. This ensemble is used to predict the yield value in the current year.



The final imputed value for yield in the most recent year (shown in the graph above as the last "x" representing the "ensemble" imputation result) is

2.94 tonnes/hectare. This is a reasonable estimate when compared to the historical time series. Some models fit the data fairly well (such as the logistic regression, spline, and ARIMA). Some of these models do not produce good forecasts (in particular, the forecast for the loess model is quite low) but by averaging together well-performing models, we get a good final estimate for the yield. See chapter 2 for further details on these models and the ensemble imputation approach.

Name	Area Harvested (hectare)	Yield (tonnes/hectare)	Production (tonnes)
Wheat	18,500,000	2.9422	-
Wheat flour	-	-	18,650,000

Now, we have enough information to compute the production data:

Name	Area Harvested (hectare)	Yield (tonnes/hectare)	Production (tonnes)
Wheat	18,500,000	2.9422	54,420,000
Wheat flour	-	-	18,650,000

Next, we fill in the table with our imputed and official production quantities. Production is only imputed for primary products (and occassionally official figures are provided for processed products, as is the case here). So, in this case, no additional quantities are filled in outside of wheat and flour.

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Wheat	**54,420,000**	-	-	-	-	-	-	-	-	-	-
Wheat flour	**18,650,000**	-	-	-	-	-	-	-	-	-	-
Bulgur	**-**	-	-	-	-	-	-	-	-	-	-
Breakfast cereals	**-**	-	-	-	-	-	-	-	-	-	-
Wheat starch	**-**	-	-	-	-	-	-	-	-	-	-
Wheat bran	**-**	-	-	-	-	-	-	-	-	-	-

Trade

Trade data are usually recorded in much more detail, covering more commodities, than production data. The national trade dataset, usually provided by the customs office, should consist of detailed quantity and value import and export flows, by commodity (using the Harmonized System (HS) codification), by partner country, for each year The country codes used should be the international standard M49 codes. The level of commodity detail is country-specific, with some countries reporting at the basic standard 6-digit level of the HS, while others go up to 12-digit HS detail (please refer to the section on trade data on p.???? for more detail).

The total imports and exports for each commodity in this example, such as wheat, are obtained by aggregating the respective trade flows by partner.

A typical trade dataset with wheat data would look like this (the dataset has been simplified for this example):

Year	reporter	partner	hs	flow	weight	Value
2014	950	932	100110	1	3,350,000	502,500,000
2014	950	899	100110	1	1,200,000	264,000,000
2014	950	961	100190	2	870,000	113,100,000

So, in the table above the country codes refer to a specific reporter and three different partners. The HS codes are a standard 6-digit, in this case indicating wheat (for more information on the HS classification please see the footnote/link in the trade section). The flows (1) and (2) indicate imports and exports, respectively. The quantity weights are in kilograms and the values are, in this case, in US Dollars. So, the totals for wheat imports would be obtained by summing up all the import flows, and likewise for the total exports (a typical trade dataset would have many more flows than the simple example above). For the compilation of FBS we are only interested in the quantities, and not in the monetary values. So, we now insert the total imports and exports for wheat, as well as the other commodities, into the SUA table.

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Wheat	54,420,000	**1,999,100**	**32,790,000**	-	-	-	-	-	-	-	-
Wheat flour	18,650,000	**341,500**	**572,800**	-	-	-	-	-	-	-	-
Bulgur	-	**-**	**-**	-	-	-	-	-	-	-	-
Breakfast cereals	-	**312,500**	**217,300**	-	-	-	-	-	-	-	-
Wheat starch	-	**624,900**	**224,500**	-	-	-	-	-	-	-	-
Wheat bran	-	**2,589,000**	**2,343,700**	-	-	-	-	-	-	-	-

The missing Bulgur trade data can be obtained from "mirrored" trading partner data available on the FAOSTAT website. These "mirrored" data are the total trade flows as reported by all other countries (trading partners) for this reporter (code 950). Thus, the "mirrored" imports are the exports of this reporter; and conversely for the "mirrored" exports. Please refer to the trade section on p.???? for more details on "mirrored" trade data.

So now we insert the "mirrored" imports and exports for bulgur, in the table:

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Wheat	54,420,000	1,999,100	32,790,000	-	-	-	-	-	-	-	-
Wheat flour	18,650,000	341,500	572,800	-	-	-	-	-	-	-	-
Bulgur	-	**182,900**	**580,000**	-	-	-	-	-	-	-	-
Breakfast cereals	-	312,500	217,300	-	-	-	-	-	-	-	-
Wheat starch	-	624,900	224,500	-	-	-	-	-	-	-	-
Wheat bran	-	2,589,000	2,343,700	-	-	-	-	-	-	-	-

Lastly, data quality validation indicates that there is a quantity error for wheat bran imports, based on median unit-value analysis in the original trade dataset. The unit-value is the monetary value/quantity (weight, numbers, etc.). Please refer to the trade section for more detail. In this case, the quantity it is simply an extra digit error, so the actual quantity should have one less zero (to reflect the correct import unit-value). We do this quantity correction, so the table will look like this:

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Wheat	54,420,000	1,999,100	32,790,000	-	-	-	-	-	-	-	-
Wheat flour	18,650,000	341,500	572,800	-	-	-	-	-	-	-	-
Bulgur	-	182,900	580,000	-	-	-	-	-	-	-	-
Breakfast cereals	-	312,500	217,300	-	-	-	-	-	-	-	-
Wheat starch	-	624,900	224,500	-	-	-	-	-	-	-	-
Wheat bran	-	**258,900**	2,343,700	-	-	-	-	-	-	-	-

For all the next steps, this example will consider all the data for the various variables as unavaiable, and thus all the figures are to be imputed.

Stock Changes

We now estimate the stock changes. Generally, stocks will be held for a select number of primary level products (such as wheat or rice). The numbers below represent the estimated stock changes for the example country we are considering. The stock imputation methodology, as described more thoroughly in chapter 2, estimates stock change in the current year as a linear regression on the cumulative stock changes in the previous years. In this case, our estimate represents a withdrawal (hence the negative sign) in the stocks held.

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Wheat	54,420,000	1,999,100	32,790,000	**-230,600**	-	-	-	-	-	-	-
Wheat flour	18,650,000	341,500	572,800	**0**	-	-	-	-	-	-	-
Bulgur	-	182,900	580,000	**0**	-	-	-	-	-	-	-
Breakfast cereals	-	312,500	217,300	**0**	-	-	-	-	-	-	-
Wheat starch	-	624,900	224,500	**0**	-	-	-	-	-	-	-
Wheat bran	-	258,900	2,343,700	**0**	-	-	-	-	-	-	-

Food

The module estimating food allocation uses food consumption estimates from the previous year and extrapolates these estimates forward using changes in GDP and product-related income elasticities. The allocation to food can potentially be considered for any edible item at the SUA level; however, the food module estimates variables at the primary level only. This is done by estimating the food variable at the primary level if the commodity is eaten directly (this will not apply in the case of wheat) and by standardizing/aggregating all the processed consumption quantities to the primary level in the "Food Processing" variable. We now impute food consumption for the example country and update the SUA table below.

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Wheat	54,420,000	1,999,100	32,790,000	-230,600	**0**	**26,720,000**	-	-	-	-	-
Wheat flour	18,650,000	341,500	572,800	0	-	-	-	-	-	-	-
Bulgur	-	182,900	580,000	0	-	-	-	-	-	-	-
Breakfast cereals	-	312,500	217,300	0	-	-	-	-	-	-	-
Wheat starch	-	624,900	224,500	0	-	-	-	-	-	-	-
Wheat bran	-	258,900	2,343,700	0	-	-	-	-	-	-	-

Feed

The Feed variable is then imputed (see the methodology described in detail in Chapter 2, based on the animal numbers and feed "intensification" factors, resulting in calculated feed requirements). The assumption here is that some of the primary level quantities are used as feed, as well as all of the bran (which is a by-product of the flour production process). The feed requirements apply at a country level, and we will first reduce from this total, country level requirement that estimated amount of bran and other feed products. The remainder of the feed requirements will be satisfied by allocating to the feed commodities at primary level (such as cereals, oil crops, etc.) according to their availability. Negligible amounts of bran may go into such products as breakfast cereals, but for the sake of simplicity, such quantities will be ignored in this example.

The feed amount allocated to bran is computed using the food amount allocated to flour (as they are produced in the same process). Thus, we take the flour production, convert it into wheat by dividing by the flour extraction rate, and then compute bran production by multiplying by the bran extraction rate. Here flour production is given as official; if it must be calculated then we first must deduct from the wheat food quantity the amount which will be processed into other commodities (i.e. bulgur, breakfast cereals, etc.) to satisfy trade imbalances. Then, the remainder of the food variable is processed into flour, and we create the bran commodity in this process as well.

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Wheat	54,420,000	1,999,100	32,790,000	-230,600	0	26,720,000	**4,898,000**	-	-	-	-
Wheat flour	18,650,000	341,500	572,800	0	-	-	**-**	-	-	-	-
Bulgur	-	182,900	580,000	0	-	-	**-**	-	-	-	-
Breakfast cereals	-	312,500	217,300	0	-	-	**-**	-	-	-	-
Wheat starch	-	624,900	224,500	0	-	-	**-**	-	-	-	-
Wheat bran	**5,699,300**	258,900	2,343,700	0	-	-	**3,614,500**	-	-	-	-

Losses

These refer to losses from the post-harvest stage up to (but not including) the retail level. Retail and household losses/wastes are therefore not included here. The methodology for calculating agricultural and food losses is continuously being revised and improved. Currently, the methodology, as described in chapter 2, uses information about the perishable category of a commodity and the country/region to estimate a hierarchical linear regression model. Also, it should be noted here that losses are assumed to occur only at the primary level.

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Wheat	54,420,000	1,999,100	32,790,000	-230,600	0	26,720,000	4,898,000	-	-	-	**560,300**
Wheat flour	18,650,000	341,500	572,800	0	-	-	-	-	-	-	**0**
Bulgur	-	182,900	580,000	0	-	-	-	-	-	-	**0**
Breakfast cereals	-	312,500	217,300	0	-	-	-	-	-	-	**0**
Wheat starch	-	624,900	224,500	0	-	-	-	-	-	-	**0**
Wheat bran	5,699,300	258,900	2,343,700	0	-	-	3,614,500	-	-	-	**0**

Seed

The seed quantities are then imputed (again based on the methodology described in chapter 2). The seed module fits a hierarchical linear model to seed data in previous years and uses global data. Seed, of course, is only allotted to the primary commodity.

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Wheat	54,420,000	1,999,100	32,790,000	-230,600	0	26,720,000	4,898,000	**1,904,200**	-	-	560,300
Wheat flour	18,650,000	341,500	572,800	0	-	-	-	**0**	-	-	0
Bulgur	-	182,900	580,000	0	-	-	-	**0**	-	-	0
Breakfast cereals	-	312,500	217,300	0	-	-	-	**0**	-	-	0
Wheat starch	-	624,900	224,500	0	-	-	-	**0**	-	-	0
Wheat bran	5,699,300	258,900	2,343,700	0	-	-	3,614,500	**0**	-	-	0

Industrial Utilization

For most commodities, there is no industrial utilization and therefore its quantity will be zero. The estimates for this variable are often taken from external sources; see the methodology discussion in chapter 2. This variable can be important when considering commodities related to biofuels (such as maize) and vegetable oils (such as palm oil). For the wheat "commodity tree," the main commodity that has industrial use is "wheat starch."

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Wheat	54,420,000	1,999,100	32,790,000	-230,600	0	26,720,000	4,898,000	1,904,200	-	**0**	560,300
Wheat flour	18,650,000	341,500	572,800	0	-	-	-	0	-	**-**	0
Bulgur	-	182,900	580,000	0	-	-	-	0	-	**-**	0
Breakfast cereals	-	312,500	217,300	0	-	-	-	0	-	**-**	0
Wheat starch	-	624,900	224,500	0	-	-	-	0	-	**-**	0
Wheat bran	5,699,300	258,900	2,343,700	0	-	-	3,614,500	0	-	**-**	0

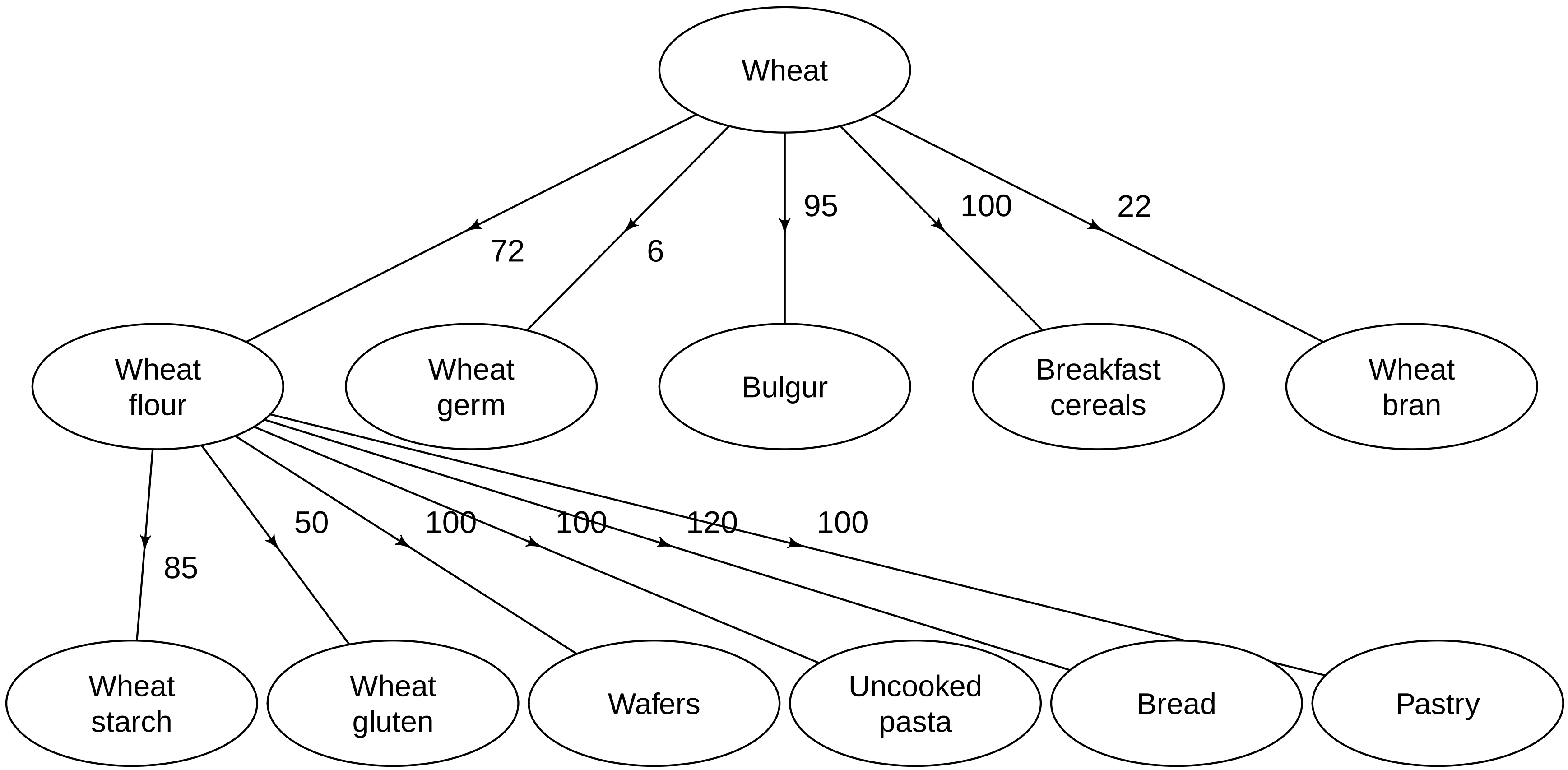
Tourist Consumption

The tourist consumption estimation approach uses tourist data from the World Trade Organization (UNWTO) to compute tourist flows as well as previous year consumption patterns of the country of origin to estimate tourist consumption amounts while abroad. Note that tourist consumption can be negative; as an extreme example consider a case where many nationals travel abroad but no tourists enter. In this case, the country will have a negative "tourist consumption" because more calories will be consumed abroad than locally.

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Wheat	54,420,000	1,999,100	32,790,000	-230,600	0	26,720,000	4,898,000	1,904,200	**-39,800**	0	560,300
Wheat flour	18,650,000	341,500	572,800	0	-	-	-	0	**0**	-	0
Bulgur	-	182,900	580,000	0	-	-	-	0	**0**	-	0
Breakfast cereals	-	312,500	217,300	0	-	-	-	0	**0**	-	0
Wheat starch	-	624,900	224,500	0	-	-	-	0	**0**	-	0
Wheat bran	5,699,300	258,900	2,343,700	0	-	-	3,614,500	0	**0**	-	0

Standardization and Balancing

Now, suppose we have the following wheat commodity tree:



We first start with the pre-standardized table that we have so far compiled:

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Wheat	54,420,000	1,999,100	32,790,000	-230,600	0	26,720,000	4,898,000	1,904,200	-39,800	0	560,300
Wheat flour	18,650,000	341,500	572,800	0	-	-	-	0	0	-	0
Bulgur	-	182,900	580,000	0	-	-	-	0	0	-	0
Breakfast cereals	-	312,500	217,300	0	-	-	-	0	0	-	0
Wheat starch	-	624,900	224,500	0	-	-	-	0	0	-	0
Wheat bran	5,699,300	258,900	2,343,700	0	-	-	3,614,500	0	0	-	0

The initial “Food Processing” estimate was based on our module; however, we may have other information that needs to be considered. For example, we know that we may have trade imbalances or official production quantities of processed commodities, and these should inform the food processing estimate. Thus, we will now calculate the production quantities of each commodity in cases where we do not yet have an estimate.

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Wheat	54,420,000	1,999,100	32,790,000	-230,600	0	26,720,000	4,898,000	1,904,200	-39,800	0	560,300
Wheat flour	18,650,000	341,500	572,800	0	-	-	-	0	0	-	0
Bulgur	**397,100**	182,900	580,000	0	-	-	-	0	0	-	0
Breakfast cereals	**0**	312,500	217,300	0	-	-	-	0	0	-	0
Wheat starch	**0**	624,900	224,500	0	-	-	-	0	0	-	0
Wheat bran	5,699,300	258,900	2,343,700	0	-	-	3,614,500	0	0	-	0

Since wheat starch is a derived by-product of wheat flour (as is wheat bran), we would first need to ensure the wheat flour “Food Processing” can cover any deficits of wheat starch. However, since wheat starch imports, in this example, exceed exports, we do not have to worry here about this requirement. Therefore, we can now standardize all the processed product quantities back to the “Food Processing” variable of wheat. The standardized quantities will, of course, be in the primary commodity (in this case wheat) equivalents. For example, suppose that 100 tonnes of a primary commodity produces 50 tonnes of the processed product (a 50% extraction rate). Then, these 50 tonnes of the processed product would be standardised back as 100 tonnes of wheat equivalent.

Name	Production (processed)	Wheat Equivalent
Wheat flour	18,650,000	25,910,000
Bulgur	397,100	418,000
Breakfast cereals	0	0
Wheat bran	5,699,300	25,910,000

The main requirement is in the wheat flour and bran, and these “two” requirements are really just one (as we already ensured that the bran production is consistent with the wheat production). In this case, since flour production is an official estimate (and accounts for the vast majority of wheat usage), we should fix the “Food Processing” variable for wheat. Thus, the “Food Processing” variable of wheat is set to 26.3 million tonnes with a standard deviation of 0.

We now must ensure that we have generated all of the appropriate by-products in the processing of various commodities. For example, when processing wheat into flour, we must also create bran and germ. We must ensure that the production numbers for these processed products are in agreement.

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Wheat	54,420,000	1,999,100	32,790,000	-230,600	0	26,330,000	4,898,000	1,904,200	-39,800	0	560,300
Wheat flour	18,650,000	341,500	572,800	0	-	**0**	-	0	0	-	0

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Wheat germ	**1,554,300**	**0**	**0**	**0**	**-**	**0**	**-**	**0**	**0**	**-**	**0**
Bulgur	397,100	182,900	580,000	0	-	**0**	-	0	0	-	0
Breakfast cereals	0	312,500	217,300	0	-	**0**	-	0	0	-	0
Wheat starch	0	624,900	224,500	0	-	**0**	-	0	0	-	0
Wheat bran	5,699,300	258,900	2,343,700	0	-	**0**	3,355,500	0	0	-	0

Some of the SUA lines are not balanced, and this is because we haven't allocated utilizations in the case of excess supply. For these commodities, we should allocate the excess trade amount according to the variable which makes the most sense for that particular commodity (or, multiple variables if we know the split at which a commodity is utilized).

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Wheat	54,420,000	1,999,100	32,790,000	-230,600	0	26,330,000	4,898,000	1,904,200	-39,800	0	560,300
Wheat flour	18,650,000	341,500	572,800	0	**18,420,000**	0	0	0	0	0	0
Wheat germ	1,554,300	0	0	0	0	0	**1,554,300**	0	0	0	0
Bulgur	397,100	182,900	580,000	0	0	0	0	0	0	0	0
Breakfast cereals	0	312,500	217,300	0	**95,200**	0	0	0	0	0	0
Wheat starch	0	624,900	224,500	0	0	0	0	0	0	**400,400**	0
Wheat bran	5,699,300	258,900	2,343,700	0	0	0	3,614,500	0	0	0	0

The next step is to aggregate this full table back into the primary commodity equivalent (in this case wheat). The final quantity for wheat equivalent production is simply the current quantity for wheat production. This is because "production" of bulgur (or any other processed product) is really a conversion of wheat into bulgur and not actually a production of bulgur. Thus, the reported quantity for production will always just be the production at the primary product level.

To standardize imports and exports, we can aggregate the imports and exports of the derived/processed commodities up into their primary equivalent by dividing by the extraction rate. We add these primary equivalents to the current quantity of imports and exports of wheat, and we have our final, primary equivalent import and export quantities of wheat.

Food processing is not standardized. In fact, this variable is in the SUA simply to allocate quantities when one commodity is converted into another. Thus, we remove it entirely from the balance at this point.

Feed commodity quantities (such as bran quantities) are not standardized back into their primary (wheat) equivalent as they are feed products. Thus, they are not reported at all in the food balance sheet but are instead reported in the commodity balances under a category such as "brans." For the remaining variables, standardization follows the same process as for trade. We now have the following standardized table:

Name	Production	Imports	Exports	StockChange	Food	Feed	Seed	Tourist	Industrial	Loss
Wheat	54,420,000	3,999,600	34,780,000	-230,600	25,680,000	4,898,000	1,904,200	-39,800	654,300	560,300

Now, we must balance to satisfy the FBS equation of supply equals utilization. To do this, we need to extract the computed standard deviations of each variable. The table below shows the expected value and estimated standard deviation for each of the variables for wheat. The equation is not initially balanced, and it is balanced by adjusting figures according to their standard deviations. For example, a variable with a large standard deviation can be adjusted substantially (as we are not very confident in this figure) while a variable with zero standard deviation will not be adjusted at all (see more on this algorithm in chapter 2). Below is the unbalanced table.

Variable	Production	Imports	Exports	StockChange	Food	Feed	Seed	Tourist	Industrial	Loss
Mean	54,420,000	3,999,600	34,780,000	-230,600	25,680,000	4,898,000	1,904,200	-39,800	654,300	560,300
Standard Dev.	489,800	0	0	89,900	0	244,900	228,500	-39,800	0	56,000

After balancing, some quantities are updated (and some remain unchanged, if they have a standard deviation of zero). Therefore, we get the final table as below, now reported as “Wheat and Products” as it includes wheat and all of the processed products.

Variable	Production	Imports	Exports	StockChange	Food	Feed	Seed	Tourist	Industrial	Loss
Mean	60,850,000	3,999,600	34,780,000	-447,200	25,680,000	3,289,100	503,500	-82,200	654,300	476,100
Standard Dev.	489,800	0	0	89,900	0	244,900	228,500	-39,800	0	56,000

We can now calculate the calorie, fat, and protein content. We do this by applying the calorie/fat/protein content nutritive factors to all SUA items for a food quantity. These nutritive factors are obtained from national sources or from international standard tables. Note that a GJ is a measure of energy equal to a billion joules, or roughly 239,000 Calories; also, a Mg is one million grams.

Name	Quantity	kJ Energy/kg Wheat	g Protein/kg Wheat	g Fat/kg Wheat	Energy (GJ/day)	Protein (Mg/day)	Fat (Mg/day)
Wheat	0	14,200	123.40	18.65	0	0	0
Wheat flour	18,420,000	14,700	110.47	13.39	743,000	5,600	680
Breakfast cereals	95,200	NA	NA	NA	NA	NA	NA

Standardization of nutrients is now a simple last step: all the variables here (i.e. calories, fats, and proteins) are purely additive, so the standardized calories/fats/proteins are simply the sum of the total calories/fats/proteins for each commodity:

Commodity	Energy (GJ/day)	Protein (Mg/day)	Fat (Mg/day)
Wheat and Products	743,000	5,600	680

To convert these figures into something more meaningful, we may divide by the population of the country. If we assume this country has 600 million inhabitants, we have:

Commodity	Calories/person/day	g Protein/person/day	g Fat/person/day
Wheat and Products	296	9	1