Food Balance Sheets

Sugar

Now, let us consider the full process for creating a food balance sheet for sugar. We start off with an empty table:

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Sugar Beet	-	-	-	-	-	-	-	-	-	-	-
Sugar Cane	-	-	-	-	-	-	-	-	-	-	-
Sugar and Syrups	-	-	-	-	-	-	-	-	-	-	-
Raw sugar	-	-	-	-	-	-	-	-	-	-	-
Refined sugar	-	-	-	-	-	-	-	-	-	-	-
Molasses	-	-	-	-	-	-	-	-	-	-	-

Production

For production data, we first fill in the table with any available official figures. In this case, the production quantity is known for all the primary products and thus no imputation is done. If we were to have missing quantities, we would impute data as described in chapter two and as shown in the wheat example.

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Sugar Beet	**26,210,000**	-	-	-	-	-	-	-	-	-	-
Sugar Cane	**26,510,000**	-	-	-	-	-	-	-	-	-	-
Sugar and Syrups	**-**	-	-	-	-	-	-	-	-	-	-
Raw sugar	**-**	-	-	-	-	-	-	-	-	-	-
Refined sugar	**-**	-	-	-	-	-	-	-	-	-	-
Molasses	**-**	-	-	-	-	-	-	-	-	-	-

Trade

Please reference chapter 2 and the wheat example for a thorough description of the trade processing. For this example, we simply insert the available trade figures.

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Sugar Beet	26,210,000	**194,500**	**300**	-	-	-	-	-	-	-	-
Sugar Cane	26,510,000	**9,700**	**860**	-	-	-	-	-	-	-	-
Sugar and Syrups	-	**359,000**	**2,438,300**	-	-	-	-	-	-	-	-
Raw sugar	-	**10**	**194,800**	-	-	-	-	-	-	-	-
Refined sugar	-	**1,275,200**	**111,200**	-	-	-	-	-	-	-	-
Molasses	-	**464,200**	**236,500**	-	-	-	-	-	-	-	-

Stock Changes

Generally, stocks will be held for a select number of primary level products (such as wheat or rice). However, in the case of sugar, it is not uncommon for countries to hold stocks for processed commodities such as raw or refined sugar. The stock change in the table will ideally be a quantity measured within the country, but in almost all cases this is not possible. Thus, the stock change quantity must be imputed, and we do this imputation via the linear regression model on historical stock change data described more thoroughly in chapter 2.

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Sugar Beet	26,210,000	194,500	300	**0**	-	-	-	-	-	-	-
Sugar Cane	26,510,000	9,700	860	**0**	-	-	-	-	-	-	-
Sugar and Syrups	-	359,000	2,438,300	**0**	-	-	-	-	-	-	-
Raw sugar	-	10	194,800	**0**	-	-	-	-	-	-	-
Refined sugar	-	1,275,200	111,200	**79,500**	-	-	-	-	-	-	-
Molasses	-	464,200	236,500	**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. Recall that the "Food" variable is only reported at the primary level as the "Food Processing" variable is estimated by standardizing the "Food" quantities for all the processed commodities. Also, sugar is a special case in that the food balance is not done at the level of the sugar crops (i.e. sugar cane and sugar beet) but rather at the level of raw sugar. Thus, when we later refer to the "primary level" for sugar, we will really mean the raw sugar commodity. Now, the "Food" and "Food Processing" variables are filled in for raw sugar.

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Sugar Beet	26,210,000	194,500	300	0	-	-	-	-	-	-	-
Sugar Cane	26,510,000	9,700	860	0	-	-	-	-	-	-	-
Sugar and Syrups	-	359,000	2,438,300	0	-	-	-	-	-	-	-

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Raw sugar	-	10	194,800	0	**1,513,800**	**9,795,900**	-	-	-	-	-
Refined sugar	-	1,275,200	111,200	79,500	-	-	-	-	-	-	-
Molasses	-	464,200	236,500	0	-	-	-	-	-	-	-

Losses

Losses are estimated using the methodology described in chapter 2, unless losses quantities are measured by the country. We estimate losses only for sugar beet and sugar cane.

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Sugar Beet	26,210,000	194,500	300	0	-	-	-	-	-	-	**200,500**
Sugar Cane	26,510,000	9,700	860	0	-	-	-	-	-	-	**208,400**
Sugar and Syrups	-	359,000	2,438,300	0	-	-	-	-	-	-	**0**
Raw sugar	-	10	194,800	0	1,513,800	9,795,900	-	-	-	-	**0**
Refined sugar	-	1,275,200	111,200	79,500	-	-	-	-	-	-	**0**
Molasses	-	464,200	236,500	0	-	-	-	-	-	-	**0**

Seed

Seed use for sugar beet is assumed to be approximately zero **WHY???**. However, an allocation for seed from sugar cane should be done. In this case, it is usually not actual seed usage but rather that some of the sugar cane plants are cut and replanted, thus resulting in a slightly smaller harvest than would have occurred if all plants had been harvested. While this is not technically seed usage, it simplifies the food balance sheet to allocate this "utilization" under seed usage.

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Sugar Beet	26,210,000	194,500	300	0	-	-	-	**0**	-	-	200,500
Sugar Cane	26,510,000	9,700	860	0	-	-	-	**1,572,200**	-	-	208,400
Sugar and Syrups	-	359,000	2,438,300	0	-	-	-	**0**	-	-	0
Raw sugar	-	10	194,800	0	1,513,800	9,795,900	-	**0**	-	-	0
Refined sugar	-	1,275,200	111,200	79,500	-	-	-	**0**	-	-	0
Molasses	-	464,200	236,500	0	-	-	-	**0**	-	-	0

Industrial Utilization

As with the wheat example, few of the sugar commodities are used for industrial use. However, bagasse, a byproduct in the processing of sugar cane into raw sugar, can be utilized in industry. This allocation will be made later when we convert the sugar cane quantities into its processed products.

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Sugar Beet	26,210,000	194,500	300	0	-	-	-	0	-	**-**	200,500
Sugar Cane	26,510,000	9,700	860	0	-	-	-	1,572,200	-	**-**	208,400
Sugar and Syrups	-	359,000	2,438,300	0	-	-	-	0	-	**-**	0
Raw sugar	-	10	194,800	0	1,513,800	9,795,900	-	0	-	**0**	0
Refined sugar	-	1,275,200	111,200	79,500	-	-	-	0	-	**-**	0
Molasses	-	464,200	236,500	0	-	-	-	0	-	**-**	0

Tourist Consumption

As with the wheat example, we see a negative tourist consumption amount. This indicates that more calories are available in the country (a decrease in utilization is mathematically equivalent to an increase in supply) because inhabitants consumed calories abroad.

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Sugar Beet	26,210,000	194,500	300	0	-	-	-	0	**0**	-	200,500
Sugar Cane	26,510,000	9,700	860	0	-	-	-	1,572,200	**0**	-	208,400
Sugar and Syrups	-	359,000	2,438,300	0	-	-	-	0	**0**	-	0
Raw sugar	-	10	194,800	0	1,513,800	9,795,900	-	0	**-3,200**	0	0
Refined sugar	-	1,275,200	111,200	79,500	-	-	-	0	**0**	-	0
Molasses	-	464,200	236,500	0	-	-	-	0	**0**	-	0

Feed

We note that, in order to determine feed estimates for raw sugar, we must first deduct from our total feed requirements all the commodities which are allocated entirely (or assumed to be allocated entirely) to feed. Thus, we must deduct the bran produced in the processing of wheat as well as the molasses produced in the processing of sugar beet and sugar cane. This is an important note: when compiling the food balance sheets, the quantities allocated to feed for all feed commodities must be computed before generating feed estimates for the wheat/raw sugar/etc. commodities. Thus, food balance sheets cannot be compiled one commodity tree at a time.

In order to compute the total amount of molasses, we must compute the amount of sugar beet and sugar cane allocated to processing. This is rather straightforward: we simply deduct from the supply the small amount allocated to seed and losses to compute the amount of sugar beet and sugar cane

allocated to food processing.

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Sugar Beet	26,210,000	194,500	300	0	-	**26,200,000**	-	0	0	-	200,500
Sugar Cane	26,510,000	9,700	860	0	-	**24,730,000**	-	1,572,200	0	-	208,400
Sugar and Syrups	-	359,000	2,438,300	0	-	-	-	0	0	-	0
Raw sugar	-	10	194,800	0	1,513,800	9,795,900	-	0	-3,200	0	0
Refined sugar	-	1,275,200	111,200	79,500	-	-	-	0	0	-	0
Molasses	-	464,200	236,500	0	-	-	-	0	0	-	0

We now process forward all of the sugar beet and sugar cane quantities into raw sugar and the associated by-products. The production quantities of the sugar crops were officially reported, and after a minor allocation to seed and waste, these quantities are essentially allocated to production of the processed commodities. This production is therefore also considered official.

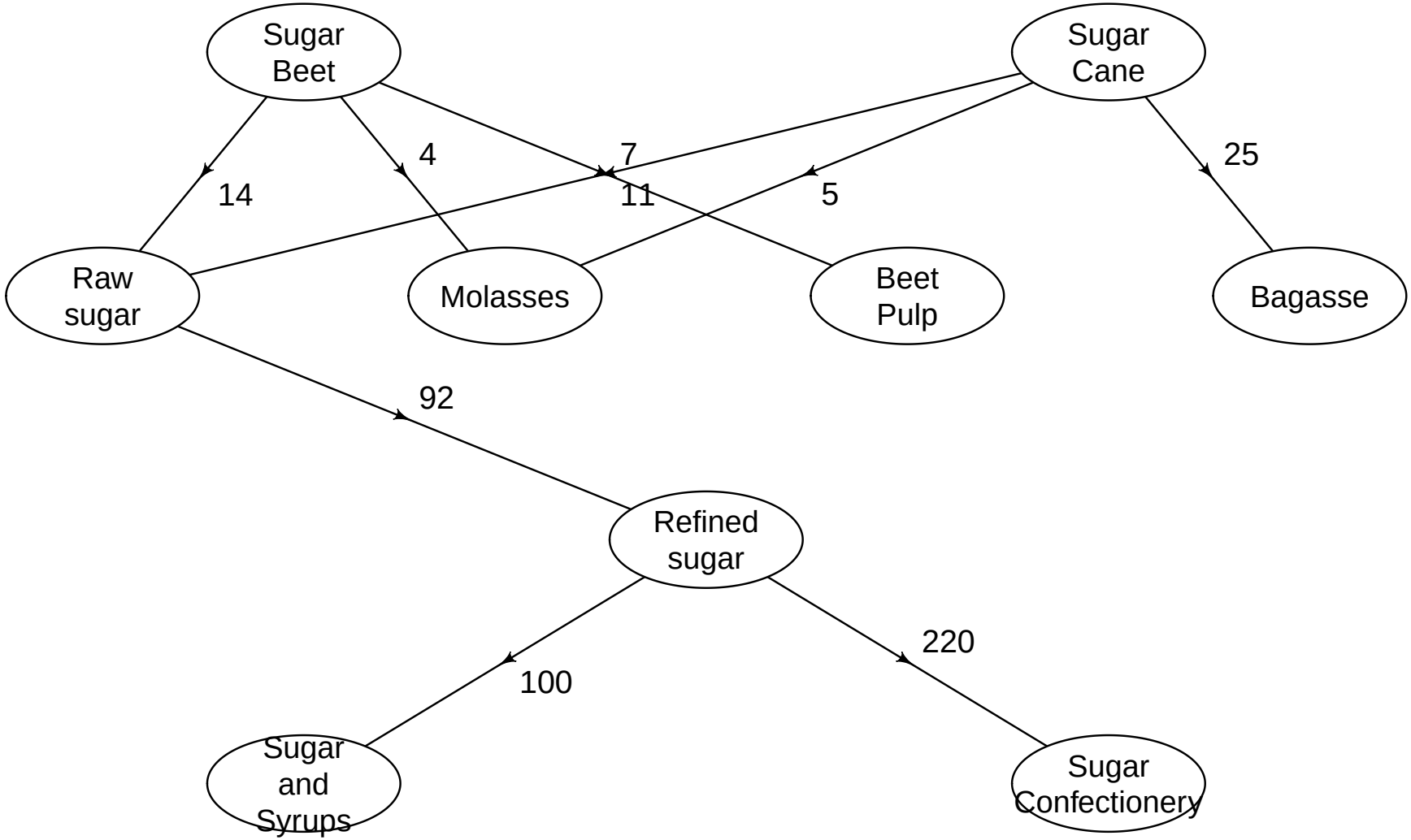
Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Sugar and Syrups	-	359,000	2,438,300	0	-	-	-	0	0	-	0
Raw sugar	**6,390,500**	10	194,800	0	1,513,800	9,795,900	-	0	-3,200	0	0
Refined sugar	-	1,275,200	111,200	79,500	-	-	-	0	0	-	0
Molasses	**2,285,300**	464,200	236,500	0	-	-	-	0	0	-	0
Beet Pulp	**1,834,500**	**0**	**0**	**0**	**-**	**-**	**-**	**0**	**0**	**-**	**0**
Bagasse	**6,184,900**	**0**	**0**	**0**	**-**	**-**	**-**	**0**	**0**	**-**	**0**

Thus, we can now determine the quantity of molasses and beet pulp (byproducts of the sugar processing) feed that we have produced. This would then inform the amount of feed that we could allocate to the commodity that we are balancing (i.e. raw sugar). However, raw sugar is rarely used as a feed product, and thus in this case we will only allocate feed usage for the two processed commodities beet pulp and molasses.

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Sugar and Syrups	-	359,000	2,438,300	0	-	-	**-**	0	0	-	0
Raw sugar	6,390,500	10	194,800	0	1,513,800	9,795,900	**0**	0	-3,200	0	0
Refined sugar	-	1,275,200	111,200	79,500	-	-	**-**	0	0	-	0
Molasses	2,285,300	464,200	236,500	0	-	-	**2,513,000**	0	0	-	0
Beet Pulp	1,834,500	0	0	0	-	-	**1,834,500**	0	0	-	0
Bagasse	6,184,900	0	0	0	-	-	**-**	0	0	-	0

Standardization and Balancing

Now, suppose we have the following commodity tree:



We have already eliminated the sugar cane and sugar beet commodities, and thus we are mainly interested in the task of rolling up processed sugar commodities into raw sugar. Again, here is our initial table:

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Sugar and Syrups	-	359,000	2,438,300	0	-	-	-	0	0	-	0
Raw sugar	6,390,500	10	194,800	0	1,513,800	9,795,900	0	0	-3,200	0	0
Refined sugar	-	1,275,200	111,200	79,500	-	-	-	0	0	-	0
Molasses	2,285,300	464,200	236,500	0	-	-	2,513,000	0	0	-	0
Beet Pulp	1,834,500	0	0	0	-	-	1,834,500	0	0	-	0
Bagasse	6,184,900	0	0	0	-	-	-	0	0	-	0

The next step in this process is to balance the processed commodities by creating production quantities. The standardization of these required production quantities would then be compared to our estimate for the quantity of food processing for the raw sugar commodity to ensure we have enough to cover supply/utilization deficits. However, we do not have any trade deficits, nor do we have official production of the main use of raw sugar (recall, however, in the wheat case we had official production of wheat flour). In order to maintain consistency between our "Food Processing" variable and the production of our processed commodities, we allocate the "Food Processing" of raw sugar into Production of refined sugar.

Name	Production	Imports	Exports	StockChange	Food	Food Processing	Feed	Seed	Tourist	Industrial	Loss
Sugar and Syrups	-	359,000	2,438,300	0	-	0	-	0	0	-	0
Raw sugar	6,390,500	10	194,800	0	1,513,800	9,795,900	0	0	-3,200	0	0
Refined sugar	**9,012,200**	1,275,200	111,200	79,500	-	0	-	0	0	-	0
Molasses	2,285,300	464,200	236,500	0	-	0	2,513,000	0	0	-	0
Beet Pulp	1,834,500	0	0	0	-	0	1,834,500	0	0	-	0
Bagasse	6,184,900	0	0	0	-	0	-	0	0	-	0

Some of the SUA lines are not balanced, and this is because we have not 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
Sugar and Syrups	-	359,000	2,438,300	0	-2,079,300	0	0	0	0	0	0
Raw sugar	6,390,500	10	194,800	0	1,513,800	9,795,900	0	0	-3,200	0	0
Refined sugar	9,012,200	1,275,200	111,200	79,500	**10,100,000**	0	0	0	0	0	0
Molasses	2,285,300	464,200	236,500	0	0	0	2,513,000	0	0	0	0
Beet Pulp	1,834,500	0	0	0	0	0	1,834,500	0	0	0	0
Bagasse	6,184,900	0	0	0	0	0	0	0	0	**6,184,900**	0

The next step is to aggregate this full table back into the primary commodity equivalent (in this case raw sugar). We follow the same aggregation/standardization process as outlined in the wheat example. We should note here that molasses, beet pulp, and bagasse are standardized to a different primary equivalent in the commodity balances and thus are not considered here.

Name	Production	Imports	Exports	StockChange	Food	Feed	Seed	Tourist	Industrial	Loss
Raw sugar	6,390,500	1,776,300	2,966,000	86,400	10,230,000	0	0	-3,200	0	0

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. These standard deviations are determined by the data source (i.e. for official data, a standard deviation of 0 is applied. For semi-official data, a higher standard deviation is used; and for estimated quantities an even larger standard deviation is used). In this case, production and trade quantities are official while all other quantities are estimated.

Variable	Production	Imports	Exports	StockChange	Food	Feed	Seed	Tourist	Industrial	Loss
Mean	6,390,500	1,776,300	2,966,000	86,400	10,230,000	0	0	-3,200	0	0
Standard Dev.	0	0	0	24,200	1,203,600	0	0	-3,200	0	0

After balancing the above tables, we have with the following quantities. Note that the "Food" variable is the variable that receives most of the adjustment because it has a substantially higher variability.

Variable	Production	Imports	Exports	StockChange	Food	Feed	Seed	Tourist	Industrial	Loss
Mean	6,390,500	1,776,300	2,966,000	84,300	5,119,700	0	0	-3,300	0	0
Standard Dev.	0	0	0	24,200	1,203,600	0	0	-3,200	0	0

After balancing, some quantities are updated (and some remain unchanged, if they have a standard deviation of zero). In the example of wheat, the aggregated table was placed directly into the food balance sheet. In this case, sugar is not a commodity at the FBS level; instead, it is reported under "Sugar & Sweeteners". Thus, balances must also be performed for the other commodities (i.e. honey and artificial sweeteners) and added to this balance to create the final FBS row.

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 with a non-zero food quantity. However, note that our food quantity for the standardized commodity was adjusted down. In order to ensure consistency, we must adjust all our SUA food quantities by the same percentage. As with the wheat example, 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	g Protein/kg	g Fat/kg	Energy (GJ/day)	Protein (Mg/day)	Fat (Mg/day)
Raw sugar	903,600	NA	NA	NA	NA	NA	NA

Name	Quantity	kJ Energy/kg	g Protein/kg	g Fat/kg	Energy (GJ/day)	Protein (Mg/day)	Fat (Mg/day)
Refined sugar	6,026,600	17,000	0	0	280,600	0	0
Caloric beverages	142,200	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)
Sugar	280,600	0	0

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
Sugar	112	0	0