Chapter 12

Food and Agricultural Data Base

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One of the main features of the GTAP data base is a detailed sectoral classification of agricultural and food products. Twelve sectors within agriculture and eight sectors within the area of food, beverages, and tobacco are identified. This however creates a problem in data collection, since not all countries' input-output (I-O) statistics provide such fine sectoral detail.

To address this problem, the I-O data contributors for some countries undertook the agricultural and food disaggregation themselves. Table 12.1 lists the 38 regions for which I-O tables are available at the full GTAP version 5 sectoral classifications for food and agriculture. For the remaining countries/regions, the disaggregation was undertaken centrally. To support this centralized disaggregation process, the present author created a new multi-country agriculture and food products data set. This chapter documents that data set.

The agricultural and food products data set consists of two components. The first component consists of information on the quantities produced, imported, and exported, plus information on producer prices for a broad set of agricultural commodities for a variety of countries. This information is then used to determine the value of production and trade, at producer prices, for as many GTAP agricultural and food commodities as possible. The second component uses the above information, along with I-O tables supplied for the GTAP version 4 data base and for the pre-release of the GTAP version 5 data base, to develop an initial I-O table focused on the GTAP agricultural and food commodities for each country/region listed in Table 12.1 that lack this detail. These initial I-O tables are then used as the starting point for the centralized disaggregation process.

12.1 Production, Trade, and Price Data

In the absence of an I-O table available at the GTAP version 5 level of aggregation, supplemental data are needed to provide guidance on how to disaggregate the agricultural and food commodities in the existing I-O table into the version 5 commodities. A first step in the disaggregation process is to determine the relative magnitude of total sales of the GTAP commodities (for domestic uses and exports) produced in the region in question and the relative magnitude of total imports of the GTAP commodities into that region. In terms of an I-O table, one can think of these values as row sum targets. Only relative magnitudes are required because the existing I-O table contains the appropriate absolute magnitudes of agricultural and food sales and imports for the region in question. The goal of the disaggregation process is to determine how to allocate the values reported in the existing I-O table to individual GTAP commodities. Assuming no changes in the stocks of agricultural and food commodities, total sales of a GTAP commodity produced within a given region are equal to the value of domestic production. By subtracting the value of exports, one can obtain the value of commodity sales for domestic uses.

Because information on value of production and trade is needed across many regions, the supplemental data should come from a data base with consistent commodity definitions across regions, rather than data for individual countries. The Food and Agricultural Organization (FAO) of the United Nations provides data bases on commodity balances and producer prices that meet these criteria. The FAO commodity balance data base provides information on the quantity of a commodity produced, imported and exported for a given country. The FAO producer price data base provides information on producer prices for selected commodities by country.[1] Unfortunately, the FAO producer price data base does not contain prices for all processed food products. Thus, prices for various vegetable oil and meal products, sugar, other sweeteners, cotton, dairy products, and meat by-products were obtained from a variety of other sources, which are documented in table 12.2.

The dollar values of production, imports, and exports at producer prices are then calculated by multiplying the appropriate quantity, producer price, and exchange rate together. For some countries, producer prices are not available for all FAO commodities. For example, a producer price for wheat is not available for Vietnam. In these instances, a production quantity weighted average price,

[1] The commodities in the FAO data bases are more disaggregate than the GTAP version 5 commodity definitions. A concordance between the FAO commodities and GTAP version 5 commodities is given in table 12.2 in the longer version of this chapter available on the GTAP web site and in the CD-ROM that accompanies the documentation.

computed using all countries with a reported producer price, is used to compute the value of production, imports, or exports.

The commodity balance data for livestock only reports quantities of meat products produced and traded. Because of a lack of data on live weight, or farm-level quantities, the value of production for livestock products are computed using the dressed (wholesale level) weight multiplied by a farm-level price (defined as "biological" in the FAO producer price data). As such, the value of production of livestock products will be underestimated at the farm-level. However, the relative value of production shares for livestock commodities, which are most important when disaggregating existing I-O tables, are not affected. This underestimation will only be a problem if the existing I-O table does not identify a total value of livestock production.

Because the FAO commodity balance data base is focused more on agricultural commodities than processed food products, it is not possible to compute the value of production, imports, and exports for the GTAP version 5 commodities food products, n.e.c. and beverages and tobacco products. For some of the processed food products included in food products, n.e.c., such as grain milling products (*i.e.*, flour, breakfast cereals), bakery products (bread), and sugar confectionery, the FAO commodity balance data base has converted production of these processed food products into their agricultural commodity primary equivalence. The same is true for tobacco. In other cases, such as alcoholic beverages (*i.e.*, wine, beer, distilled alcoholic beverages), there are available data. But this leaves a gap for all non-alcoholic beverages, such as soft drinks, which likely constituents a significant portion of production and trade for the GTAP commodity beverage and tobacco products in many regions. As documented in the next section, the values of production, imports, and exports for the GTAP commodities food products, n.e.c. and beverages and tobacco products are estimated econometrically using available data from the FAO data bases and gross domestic product (*GDP*).

The FAO commodity balance data base does not contain information for two of the GTAP version 5 regions, i.e., China and Singapore. For China, production, import, and export data are obtained from the USDA Economics and Statistics System, which has compiled time series data on Chinese agriculture from a variety of sources. The FAO producer price data base does contain producer price information for China and this is used to compute value of production of the GTAP commodities for China. The agricultural trade data for China is reported in dollar values. No data are available on agricultural production in Singapore. Thus, the I-O table for Hongkong in the GTAP version 5 data was adapted for Singapore.

12.2 Developing Initial Agricultural and Food I-O Tables

The agricultural and food I-O table consists of two tables: uses of domestically produced agricultural and food commodities and uses of imported agricultural and food commodities. Using the values of production and imports identified from the FAO data as row totals, the next step is to determine how to allocate the row totals across the elements in each row of the agricultural and food I-O tables. This process requires identification of where the non-zero elements will occur within each row and the magnitude of each non-zero element. In the domestic use table, the non-zero elements represent intermediate uses, such as inputs to processed food products, sales to consumers, and exports. In the import use table, the non-zero elements represent intermediate use of imports by domestic firms and purchases of imported agricultural and food products by domestic households.

12.2.1 Identification of Key Non-zero Elements

The identification of the key non-zero elements in the domestic and import use tables is based on observed patterns in the I-O tables supplied for the GTAP version 4 data base and for the pre-release of the GTAP version 5 data base that have the full GTAP version 5 food and agricultural sectoral classifications. The regions with full sectoral disaggregation in their I-O tables for the pre-release GTAP version 5 data base are listed in Table 12.1. The regions with full sectoral disaggregation in their I-O tables in the GTAP version 4 data base are: Australia, New Zealand, United States, European Union, United Kingdom, Denmark, Colombia, Venezuela, Peru, Uruguay, India, Indonesia, Thailand, and Taiwan. The non-zero elements are identified in four major blocks (or sub-matrices) within the domestic use table: sales of agricultural and food commodities within the agricultural sector, sales of agricultural commodities to the food processors and textiles, sales of processed food commodities within the food processing sector, and consumption and exports.

Table 12.3 identifies the location of the non-zero elements that represent sales of agricultural and food commodities within the agricultural sector. There are three main types of entries in table 12.3. First, is the own-use of each GTAP agricultural commodity by firms that produce that commodity. For the crop commodities, this could represent the withholding of some production for seed usage in the next growing season, or for livestock commodities, the need to withhold some livestock as replacements for the breeding herd. Having non-zero own-use entries are typical in most existing I-O tables. The second type of non-zero elements is the sale of crop commodities to the livestock industries. This may be thought of as representing feed usage. Since all grains and oilseeds have the potential of being feed to livestock, non-zero entries are allowed for these commodities.

Because the GTAP commodity crops, n.e.c. contains forages and straw, the potential for positive sales to the livestock industries are also allowed. Also sales from the GTAP commodity food products, n.e.c. to the GTAP livestock industries are allowed to account for prepared animal feed sales. Finally, the third main type of sales occurs from the GTAP livestock sector to the GTAP crop sector. These sales may represent the use of manure as fertilizer in crop production.

Table 12.4 identifies the key sales of agricultural commodities to food processors and textiles. Paddy rice is sold to rice processors and to beverages and tobacco to account for its potential use in beverages, such as beer. Wheat and cereal grain, n.e.c. are sold to food products, n.e.c., whose firms perform all grain milling activities, and to beverages and tobacco to account for grain use in beverages, such as beer or distilled alcoholic beverages. Vegetables, fruit, nuts are sold to food products, n.e.c., whose firms produce prepared and preserved vegetables, fruits, and nuts, as well fruit and vegetable juices, and to beverages and tobacco to account for vegetables use (*e.g.*, grapes) in beverages (*e.g.*, wine). Oilseeds are sold to firms that produce vegetable oils and fats and to firms that produce animal feeds (*e.g.*, food products, n.e.c.). Sugar cane and sugar beets are sold to sugar processors. Plant-based fibers and wool are sold to textile manufacturers. Sales of crops, n.e.c. to beverage and tobacco represents the sales of tobacco leaf and beverage and spice crops to be processed into cigarettes (or other manufactured tobacco products) and beverages. Based on the GTAP commodity definitions, bovine cattle, sheep and goat, horses are sold to bovine cattle, sheep and goat, horse meat products, and animals products, n.e.c. are sold to meat products, n.e.c. Finally, the only processing use of raw milk is in the manufacture of dairy products.

The key sales of processed food products to food processing and other manufacturing firms are listed in Table 12.5. All food processors are assumed to use some of their own product as an intermediate input. The same is true for beverage and tobacco firms. Food products, n.e.c. use all other processed food products as intermediate inputs (*e.g.*, processed meats are used in frozen entries, vegetable oils and sugar are used in the preparation of processed foods, and rice and dairy products, such as cheese, are used in prepared entries). Animal hides from meat processing (*cmt* and *omt*) are used to produce leather products. Also, animal fats and vegetable oils may be refined into chemicals or plastics. Thus, the possibility of sales from meat processors (*cmt* and *omt*) and vegetable oils and fats to chemical, rubber, and plastic products (*crp*). Firms that produce beverages and tobacco products purchase intermediate inputs from processed rice (for use in beverages such as beer), sugar (for use in a variety of beverages, such as soft drinks), and food products, n.e.c. (*e.g.* grain mill products, such as malted barley, for use in beer or distilled alcoholic beverages). Finally, most of the existing I-O tables have food products, n.e.c. sales to all other food processing industries.

The last groups of non-zero row elements are purchases by the domestic household (*e.g.*, consumption) and exports. While all agricultural and food products may be purchased by the household, expenditures on paddy rice, sugar cane and sugar beets, plant-based fibers, and livestock products should be small in most regions. As will be discussed below, direct consumption of these

agricultural commodities is related to the level of GDP within a given region. Exports of paddy rice, sugar cane and sugar beets, and raw milk are assumed to be zero for all regions because of their relatively low value when compared to transportation costs. With the exception of livestock commodities, export data from the FAO commodity balance data base determines whether a region exports the remaining GTAP agricultural or food commodities. Because the FAO commodity balance data base reports only exports of meat products, whether a region exports livestock is based on predicted livestock export values, which are discussed in more detail below.

The non-zero elements in the import use table are assumed to be the same as the domestic use table, with the following two exceptions. First, because paddy rice, sugar cane and sugar beets, and raw milk are assumed to be non-traded, there are no intermediate uses or purchases of these commodities by the domestic household. Second, there are no intermediate uses of imported livestock products by the crop sectors. Otherwise, the structure of the import use table is the same as the domestic use table.

12.2.2 Determining the Magnitude of Non-zero Elements

The magnitude of sales for each non-zero element identified in the previous section is predicted using data from the existing I-O tables with full GTAP food and agricultural sectoral disaggregation and per-capita GDP. Sales values in the existing I-O tables for each non-zero element are related to total sales (or value of production), computed as the sum of the value of all domestic uses and exports of the GTAP commodities in the existing I-O table and to per capita GDP using a linear model:

$$Sales_{ij} = \beta_0 + \sum_{k=1}^{m} \beta_k FSales_{ik} + \delta PGDP_i + e_{ij} \qquad (1)$$

where $Sales_{ij}$ is the values of sales from the *i*th region for the *j*th non-zero element in the domestic use or import use table, $FSales_{ij}$ is total sales of the *k*th GTAP commodity in the *i*th region, $PGPD_i$ is the per-capita GDP for the *i*th region, e_{ij} is an error term corresponding to the *i*th region and *j*th non-zero element, and $\hat{a}_o, \hat{a}_k$ and $\ddot{a}$ are unknown parameters to be estimated. The choice of independent variables is dictated by the information that will be available for all regions that do not have an existing I-O table with full GTAP agricultural and food disaggregation. In the most aggregated case, there will be only a single row and column for agricultural and food processing. Thus, the only data available for all regions are the value of production, imports, and exports from the FAO data base and per-capita GDP. Note that the value of the index *m* is allowed to vary across non-zero elements.

Because the sales values in the existing I-O tables can and do take on a value of zero for some regions, equation (1) is estimated using a Tobit estimation procedure. Using a Tobit procedure avoids

possible sample selection bias in the parameter estimates. If all sales values in the sample are positive, then the Tobit procedure yields the same parameter estimates as Ordinary Least Squares (OLS).

To provide a specific example of the econometric models utilized, consider the sales of agricultural commodities to food and fiber processors. In general, the sales of agricultural commodities to food and fiber processors is posited to be a linear function of the total sales of the agricultural commodity in question and per-capita GDP. For example, the sale of paddy rice (*pdr*) to the processed rice industry (*pcr*) is a linear function of the total sales of paddy rice and per-capita GDP. One would expect that an increase in agricultural sales, and therefore agricultural production, should lead to an increase in the usage of that agricultural commodity by food and fiber processors. This expectation is confirmed in the parameter estimates reported in table 12.6. Also, consumers in regions with higher per-capita GDP may purchase more processed food and fiber products, implying a larger input demand for agricultural commodities by food and fiber processors in those regions. The parameter estimates in table 12.6 show that sales of wheat, sugar cane and beets, bovine cattle, animal products, n.e.c., and raw milk to food processors do increase as per-capita GDP increases.[2]

The econometric models used to predict the value of non-zero elements for the import use table are slightly different than the models used to predict the non-zero elements in the domestic use table. The main difference is that the value of total imports of the GTAP commodities is used as an additional independent variable in the econometric models. For example, the own-use value of imported agricultural commodities is specified as a linear function of the total sales of that agricultural commodity, total value of imports of that commodity, and per-capita GDP. The rationale for including the total import value is that the value of each non-zero element may increase as the value of total imports into a region increases. For example, an increase in the value of total wheat imports may also increase the value of wheat imports purchased by food products, n.e.c. A second difference is that the intermediate use of imported agricultural commodities by food and fiber processors is assumed to be a linear function of the total value of imports of the agricultural commodity, total sales of the processing industry that purchased the imported agricultural commodity, and per-capita GDP. Thus, the difference is the use of the sales of the processing industry rather than the sales of the agricultural commodity. The rationale for this difference is that the usage of imported agricultural commodities likely depends more on the level of production, and thus sales, of the processing industry that purchases that imported commodity rather than on the magnitude of sales of domestic agricultural producers.

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[2] A complete discussion of the econometric models utilized and the parameters estimates is available in the GTAP web site and CD-ROM version of this chapter in the GTAP version 5 documentation.

12.2.3 Determining the Magnitude of Value Added

Table 12.7 provides a partial listing of the parameter estimates used to predict the magnitudes of land, skilled labor, unskilled labor, and capital factor payments for the agricultural and food I-O tables. For each of the primary factors, factory payments are posited as a function of the total sales of each commodity and per-capita GDP. Because the data in the existing I-O tables indicated positive factor payments for all GTAP agricultural and food commodities in all regions, an OLS estimation procedure is utilized. In most cases, a linear model performed well with relatively high adjusted R^2 values and *F*-values. However, there are several instances when a log-linear model performed significantly better than the linear model.

Land factor payments are positively related to the total sales of the GTAP commodity but negatively related to per-capita GDP. Skilled labor payments are also positively related to the total sales of the GTAP commodity and to per-capita GDP as well (the exceptions being plant-based fibers, crops, n.e.c., processed rice, food products, n.e.c., and beverages and tobacco where the parameter estimates was not significantly different than zero). Unskilled labor payments are positively related to total sales of the GTAP commodity, but the effect of per-capita GDP is mixed. For the majority of agricultural and food commodities, per-capita GDP has no significant effect on unskilled labor payments. However, for wheat and vegetable oils and fats, per-capita GDP is positively related to unskilled labor payments while for vegetables, fruits, and nuts, plant-based fibers, crops, n.e.c., and processed rice, per-capita GDP is negatively associated with unskilled labor payments. Finally, capital factor payments are also positively related to total sales of the GTAP commodity. But similar to unskilled labor payments, the effect of per-capita GDP on capital payments is mixed, with no significant effect for the majority of the agricultural and food commodities.

12.2.4 Balancing the Initial I-O Table

All non-zero elements in the domestic use and import use tables previously identified are predicted using the parameter estimates, along with estimates of the value of production (or total sales), exports, and imports from the FAO data bases, plus estimates of per-capita GDP. This is done for all regions listed in the second column of table 12.1.

The initial agricultural and food I-O table for each region is then balanced using the following procedure. First, for each commodity, the predicted row sum in the domestic use table, plus predicted household purchases, plus the value of exports from the FAO data base is compared with the estimated value of production from the FAO data base. Adjustments are made in individual row elements in the domestic use table and in household purchases in order to equate the predicted value of production with the estimate from the FAO data. Second, the predicted row sum of the import use

table plus predicted household purchases of imports is compared with the estimated value of imports from the FAO data. Again, adjustments are made in the individual row elements in the import use table or in household purchases such that the predicted value of imports equals the target value for each commodity. Finally, for each commodity, the column sum in the domestic use table, plus the sum of all factor payments, plus the column sum in the import use table is compared with the target value of production (or total sales). This ensures that all receipts are exhausted on intermediate inputs and primary factors. When possible, the adjustments are made in value added to avoid having to rebalance the row sum and row target value.

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Table 12.1 Regions With and Without Full Agricultural and Food Sectoral I-O Data

Regions with Full Sectoral I-O Data	Regions without Full Sectoral I-O Data
Australia	China
New Zealand	Hong Kong
Japan	Malaysia
Korea	Philippines
Taiwan	Singapore
Indonesia	Vietnam
Thailand	Sri Lanka
Bangladesh	Canada
India	Mexico
United States	Argentina
Colombia	Brazil
Peru	Chile
Venezuela	Rest of Central European Associates
Uruguay	Former Soviet Union
Austria	Turkey
Belgium	Morocco
Denmark	Uganda
Finland	
France	
Germany	
United Kingdom	
Greece	
Ireland	
Italy	
Luxembourg	
Netherlands	
Portugal	
Spain	
Sweden	
Switzerland	
Hungary	
Poland	
Botswana	
Malawi	
Mozambique	
Tanzania	
Zambia	
Zimbabwe	

Table 12.2 Non-FAO Producer Prices Utilized and their Source

FAO Commodity	Price ($/mt)[a]	Source	Description
Soybean Oil	591	USDA, Oil Crops Yearbook	Crude, tank cars, *f.o.b.* Decatur
Groundnut Oil	916	USDA, Oil Crops Yearbook	Peanut Oil, crude, tank cars, *f.o.b.* Southeastern mills
Sunflower seed Oil	604	USDA, Oil Crops Yearbook	Crude, Minneapolis
Rape & Mustard Oil	1145	USDA, Oil Crops Yearbook	Refined, denatured, tanks, N.Y.
Cottonseed Oil	625	USDA, Oil Crops Yearbook	PBSY, Greenwood, MS
Palm Kernel Oil	695	FAO, Value of Exports[b]	
Palm Oil	728	USDA, Oil Crops Yearbook	Refined, *c.i.f.*, bulk, U.S. ports
Coconut Oil	750	USDA, Oil Crops Yearbook	Crude, tank cars, N.Y.
Sesame seed Oil	2385	FAO, Value of Exports	
Olive Oil	2425	USDA, Oil Crops Yearbook	
Rice Bran Oil	755	FAO, Value of Exports	
Corn Oil	588	USDA, Oil Crops Yearbook	Crude, tank cars, Chicago
Other Oil[c]	1100		
Castor Oil	992	USDA, Oil Crops Yearbook	No. 1, Brazilian tanks, N.Y.
Safflower Oil		USDA, Oil Crops Yearbook	Tanks, N.Y.
Linseed Oil		USDA, Oil Crops Yearbook	Raw, tank cars, Minneapolis
Tung Oil		USDA, Oil Crops Yearbook	Imported, drums, f.o.b., N.Y.
Soybean Cake	192	USDA, Oil Crops Yearbook	49% Protein, Decatur
Groundnut Cake	142	USDA, Oil Crops Outlook	Peanut Meal, 50% Protein SE Mills
Sunflower Cake	80	USDA, Oil Crops Yearbook	28% Protein
Rape & Mustard Cake	125	FAO, Value of Exports	
Cottonseed Cake	136	USDA, Oil Crops Yearbook	41% protein, solvent, Memphis
Palm Kernel Cake	90	FAO, Value of Exports	
Copra Cake	100	FAO, Value of Exports	
Sesame seed Cake	490	FAO, Value of Exports	
Other Oilseed Cake	125		
Sugar, non-centrifugal	100		
Refined Sugar	397	USDA, Sugar & Sweetener Yearbook	Contract No. 5, London Daily Price, *f.o.b.* Europe, spot.
Other Sweeteners[d]	330		
Glucose Syrup	319	USDA, Sugar & Sweetener Yearbook	U.S. Wholesale list price, Midwest, dry
HFCS-42	345	USDA, Sugar & Sweetener Yearbook	U.S. spot price, Midwest, dry
Cotton	1887	USDA, Cotton and Wool Yearbook	Average price of U.S. cotton, c.i.f. Northern Europe
Milled Rice[e]	330		
Thailand	341	USDA, Rice Yearbook	100% Grade B, f.o.b., Bangkok
SW Louisiana	320	USDA, Rice Yearbook	Long grain, U.S. No. 2
Houston, Texan	324	USDA, Rice Yearbook	Long grain, U.S. No. 2

contd

Table 12.2 Non-FAO Producer Prices Utilized and their Source (continued)

FAO Commodity	Price ($/mt)[a]	Source	Description
Raw animal fats	510	FAO, Value of Exports	
Edible Offals	1390	FAO, Value of Exports	Value of fresh, edible offals
Meat Meal	295	FAO, Value of Exports	
Soft-fibers, Other	265	FAO, Value of Exports	Export value of Jute
Hard-fibers, Other	560	FAO, Value of Exports	Value of sisal and other agaves
Whole milk	550	FAO, Value of Exports	Value of fresh milk
Butter, Ghee	2900	FAO, Value of Exports	Value of butter
Cheese	4150	FAO, Value of Exports	Value of cheese & curd
Whey	790	FAO, Value of Exports	Value of dry whey
Cream	1960	FAO, Value of Exports	Value of fresh cream

[a] All prices are for 1995 to match time periods with the FAO producer prices.

[b] World value of exports divided by world quantity of exports, FAO Agriculture and Food Trade data base.

c The price of other oil is an average of the price of castor oil, safflower oil, linseed oil, and tung oil.

[d] The price of other sweeteners is an average of the price of glucose syrup and high fructose corn syrup, on a dry weight basis.

[e] The price of milled rice is an average of the prices of rice in the U.S. and Thailand.

Table 12.3 Sales of GTAP Agricultural and Food Commodities within GTAP Agricultural Sector

GTAP Commodity	pdr	wht	gro	v_f	osd	c_b	pfb	ocr	ctl	oap	rmk	wol
pdr	OU[a]	0	0	0	0	0	0	0	FEED[b]	FEED	FEED	FEED
wht	0	OU	0	0	0	0	0	0	FEED	FEED	FEED	FEED
gro	0	0	OU	0	0	0	0	0	FEED	FEED	FEED	FEED
v_f	0	0	0	OU	0	0	0	0	FEED	FEED	FEED	FEED
osd	0	0	0	0	OU	0	0	0	FEED	FEED	FEED	FEED
c_b	0	0	0	0	0	OU	0	0	0	0	0	0
pfb	0	0	0	0	0	0	OU	0	0	0	0	0
ocr	0	0	0	0	0	0	0	OU	FEED	FEED	FEED	FEED
ctl	MAN[c]	MAN	MAN	MAN	MAN	MAN	MAN	MAN	OU	0	0	0
oap	MAN	MAN	MAN	MAN	MAN	MAN	MAN	MAN	0	OU	0	0
rmk	MAN	MAN	MAN	MAN	MAN	MAN	MAN	MAN	0	0	OU	0
wol	MAN	MAN	MAN	MAN	MAN	MAN	MAN	MAN	0	0	0	OU
cmt	0	0	0	0	0	0	0	0	0	0	0	0
omt	0	0	0	0	0	0	0	0	0	0	0	0
vol	0	0	0	0	0	0	0	0	0	0	0	0
mil	0	0	0	0	0	0	0	0	0	0	0	0
pcr	0	0	0	0	0	0	0	0	0	0	0	0
sgr	0	0	0	0	0	0	0	0	0	0	0	0
ofd	0	0	0	0	0	0	0	0	FEED	FEED	FEED	FEED
b_t	0	0	0	0	0	0	0	0	0	0	0	0

[a] Own-use of agricultural commodity.

[b] Feed use of crop commodities for livestock production.

[c] Sales of livestock products to crop sectors. Most likely represents sales of manure for fertilizer use.

Table 12.4 Sales of GTAP Agricultural Commodities to GTAP Food Processing Industries and Textiles

GTAP Commodity	cmt	omt	vol	mil	pcr	sgr	ofd	b_t	tex
pdr	0	0	0	0	NZ	0	0	NZ	0
wht	0	0	0	0	0	0	NZ	NZ	0
gro	0	0	0	0	0	0	NZ	NZ	0
v_f	0	0	0	0	0	0	NZ	NZ	0
osd	0	0	NZ	0	0	0	NZ	0	0
c_b	0	0	0	0	0	NZ	0	0	0
pfb	0	0	0	0	0	0	0	0	NZ
ocr	0	0	0	0	0	0	0	NZ	0
ctl	NZ[a]	0	0	0	0	0	0	0	0
oap	0	NZ	0	0	0	0	0	0	0
rmk	0	0	0	NZ	0	0	0	0	0
wol	0	0	0	0	0	0	0	0	NZ

[a] Represents a non-zero element in matrix.

Table 12.5 Sales of GTAP Processed Food Commodities to GTAP Food Processing Industries and Other Manufacturers

GTAP Commodity	cmt	omt	vol	mil	pcr	sgr	ofd	b_t	lea	crp
cmt	OU[a]	0	0	0	0	0	NZ[b]	0	NZ	NZ
omt	0	OU	0	0	0	0	NZ	0	NZ	NZ
vol	0	0	OU	0	0	0	NZ	0	0	NZ
mil	0	0	0	OU	0	0	NZ	0	0	0
pcr	0	0	0	0	OU	0	NZ	NZ	0	0
sgr	0	0	0	0	0	OU	NZ	NZ	0	0
ofd	NZ	NZ	NZ	NZ	NZ	NZ	OU	NZ	0	0
b_t	0	0	0	0	0	0	0	OU	0	0

[a] Own-use of GTAP commodity.

[b] Represents a non-zero element in matrix.

Table 12.6 Parameter Estimates used to predict Agricultural Commodity Sales to Food and Fiber Processors

Independent	GTAP Commodities					
Variables	pdr to pcr	pdr to b_t	wht to ofd	wht to b_t	gro to ofd	gro to b_t
Intercept	-1175.70 (0.12)[b]	-271.75 (0.0007)	-363.79 (0.03)	-8.16 (0.58)	15.76 (0.75)	-10.54 (0.71)
GDP	0.061 (0.12)	0.0038 (0.32)	0.027 (0.02)	0.00049 (0.51)	0.00067 (0.81)	0.0020 (0.20)
Total Sales[a]						
pdr	0.62 (0.0001)	0.029 (0.0001)				
wht			0.19 (0.0001)	0.0075 (0.06)		
gro					0.13 (0.0001)	0.015 (0.0001)
Log Likelihood	-311.91	-85.13	-268.57	-152.73	-256.47	-195.62
Variables	v_f to ofd	v_f to b_t	osd to vol	osd to ofd	c_b to sgr	pfb to tex
Intercept	-157.03 (0.24)[b]	-93.81 (0.06)	-372.76 (0.08)	-316.19 (0.03)	-27.77 (0.81)	-213.27 (0.44)
GDP	-0.0019 (0.80)	0.0039 (0.17)	0.011 (034)	0.0013 (0.87)	0.018 (0.004)	-0.0081 (0.61)
Total Sales[a]						
v_f	0.12 (0.0001)	0.024 (0.0001)				
osd			0.095 (0.07)	0.10 (0.0001)		
c_b					0.12 (0.0005)	
pfb						0.10 (0.08)
vol[c]			0.14 (0.0002)			
Log Likelihood	-300.10	-229.89	-287.03	-148.15	-273.00	-201.41
Variables	ocr to ofd	ocr to b_t	ctl to cmt	oap to omt	rmk to mil	wol to tex
Intercept	77.17 (0.66)[b]	-122.79 (0.06)	-499.19 (0.009)	-652.18 (0.02)	-1111.70 (0.03)	-157.33 (0.01)
GDP	-0.0026 (0.80)	-0.00089 (0.81)	0.029 (0.007)	0.062 (0.0002)	0.090 (0.003)	0.0029 (0.32)
Total Sales[a]						
ocr	0.075 (0.001)	0.094 (0.0001)				
ctl			0.64 (0.0001)			
oap				0.47 (0.0001)		
rmk					0.55 (0.0001)	
wol						0.21 (0.001)
tobacco sales[d]		0.22 (0.04)				
Log Likelihood	-296.41	-242.71	-322.35	-337.01	-335.22	-116.50

[a] Total sales refer to value of domestic production. [b] Values in parentheses are *p*-values.
[c] Value of sales for vegetable oils and fats. [d] Value of production of tobacco.

Table 12.7 Parameter Estimates used to predict Primary Factor Payments for GTAP Agricultural and Food Commodities

Independent	GTAP Commodities					
Variables	pdr	wht	gro	v_f	osd	c_b
Land						
Intercept	394.29	-27.00	82.42	438.11	15.37	-4.08
	(0.06)[b]	(0.25)	(0.19)	(0.03)	(0.66)	(0.90)
GDP	-0.024	-0.0045	-0.0075	-0.035	-0.0095	-0.0056
	(0.04)	(0.05)	(0.03)	(0.007)	(0.005)	(0.004)
Total Sales[a]	0.23	0.25	0.17	0.16	0.28	0.29
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
F Value	82.89	144.50	693.62	34.66	328.09	255.79
R Squared	0.8157	0.8913	0.9726	0.6332	0.9437	0.9375
Skilled Labor						
Intercept	-12.54	-10.67[c]	-12.59	-7.21[c]	-7.99[c]	-9.60[c]
	(0.05)	(0.0001)	(0.03)	(0.0001)	(0.0001)	(0.0001)
GDP	0.0010	0.78[c]	0.00085	0.54[c]	0.45[c]	0.69[c]
	(0.0001)	(0.0001)	(0.07)	(0.0001)	(0.0001)	(0.0001)
Total Sales[a]	0.0028	0.83[c]	0.016	0.68[c]	0.79[c]	0.73[c]
	(0.02)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
F Value	24.21	54.13	217.98	72.60	30.83	56.01
R Squared	0.6155	0.7685	0.9195	0.7860	0.6172	0.7693
Unskilled Labor						
Intercept	-177.65	-43.18	93.80	311.52	29.14	9.08
	(0.17)	(0.22)	(0.002)	(0.03)	(0.27)	(0.69)
GDP	0.0078	0.0091	0.0014	-0.015	-0.0019	-0.000024
	(0.16)	(0.005)	(0.77)	(0.02)	(0.54)	(0.98)
Total Sales[a]	0.31	0.26	0.21	0.26	0.27	0.26
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
F Value	644.77	33.53	258.02	110.34	296.87	323.07
R Squared	0.9721	0.6438	0.9295	0.8487	0.9382	0.9471
Capital						
Intercept	-263.21	-86.45	-94.65	-187.05	-79.17	-27.99
	(0.03)	(0.06)	(0.01)	(0.04)	(0.16)	(0.06)
GDP	0.014	0.0068	0.0016	-0.0018	0.0031	0.0015
	(0.04)	(0.02)	(0.58)	(0.74)	(0.41)	(0.11)
Total Sales[a]	0.16	0.15	0.20	0.17	0.17	0.13
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
F Value	142.73	44.92	1269.38	97.41	97.00	178.74
R Squared	0.8873	0.7151	0.9849	0.8318	0.8312	0.9104

[a] Total sales of GTAP commodity.

[b] Values in parentheses are *p*-values.

[c] Independent variables are in natural logarithms.