

14.5

Denmark

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14.5.1 Introduction

The purpose of this chapter is to document the method and considerations underlying the construction of the Danish input-output (I/O) table contained in the GTAP data base (version 4). Emphasis is given to the principles and methods used in constructing the Danish agricultural-specific I/O table for the year 1992. It will be demonstrated that the method applied, to a large extent complies with the underlying assumption behind the I/O method, and furthermore, that the method used is fairly general².

The approach taken involves a disaggregation of the data underlying the official Danish I/O table produced by Statistics Denmark (SD). This requires, first, splitting the detailed commodity accounts in the national account system, and thereafter, applying the method recommended by the UN to construct the final agricultural-specific I/O table. This method ensures an accurate description of the supply and cost structures in each agricultural sub-sector.

To disaggregate the sectors in the I/O tables, we use estimates of production shares or the I/O coefficients from another representative I/O table, depending on the problem at hand. The clear advantage of these approaches is in their simplicity. However, their usefulness depends entirely upon

¹ The author thanks Søren E. Frandsen and Chantal Pohl Nielsen for their comments on an earlier draft.

² Refer to Jacobsen (1996) for a detailed description of the methods used by the Danish Institute of Agricultural and Fisheries Economics (DIAFE) for constructing I/O tables with highly detailed level of disaggregation of the agricultural sector.

whether the disaggregated sectors can indeed be approximated by the same production structure or in the second case, on how “representative” the representative I/O table is.

The paper is organized as follows. Section 2 covers some theoretical considerations involved in disaggregating a single sector. Section 3 describes the principles behind the disaggregation of the 117-sector I/O table supplied by Statistics Denmark into the 132 sectors covered by the I/O table that is used by DIAFE. Section 4 describes the disaggregation and aggregation procedures used to produce the 50-sector table supplied to the GTAP data base.

14.5.2 Theoretical considerations

One of the crucial assumptions underlying the conventional I/O method is that each sector is characterized by a Leontief production technology with constant returns to scale and limitational inputs related to output in fixed proportions.

The 117-sector I/O table provided by Statistics Denmark (hereafter SD) has only one primary agricultural sector. This one sector aggregation is insufficient for analyzing most agricultural policy issues and hence the need for disaggregation.

There are numerous ways to disaggregate a sector, some demanding a lot of data and computational work and others that are fairly simple. One of the less data demanding methods is to split a sector into subsectors based on each subsector’s share of total production in the aggregate sector. The advantage of this procedure is of course that it is simple and the relevant data are usually easily accessible. On the other hand, this method relies on the validity of the assumption of Leontief technology, since it is assumed that each subsector is described by the same production function.

Using this simple method in the case of Danish agriculture would create serious problems when evaluating agricultural policy issues. The reason is that production in the various agricultural subsectors is characterized by very different technologies. The production of grain and roughage, for example, both use land as an input. However, while the former uses a lot of machinery (capital) the latter does not since, in many cases, the cattle simply graze the land. The disaggregation method described above does not account for the fact that the agricultural sector consists of subsectors with very different supply cost-structures. Thus, the simplicity attribute may be outweighed by consideration of the skewed description of the production structures of the individual subsectors.

When using I/O tables for policy analysis, DIAFE has a detailed agricultural focus. In view of the points just mentioned, this makes it necessary to construct a disaggregated I/O table that to a greater extent satisfies the basic assumption behind the I/O method.

The I/O tables provided by SD only takes into account commodities that pass through the market. But, in the agricultural sector, there are important inputs that do not go through the market and therefore are not accounted for. For example, grains produced and used for fodder on a single

farm. In the DIAFE I/O table this is recorded as supply from the grain sector to the various animal sectors. Likewise the table takes the supply and input of manure and roughage into account.

The construction of detailed agricultural subsectors that completely satisfy all the underlying assumptions is not an easy task. However, an acceptable classification of sectors can be achieved by classifying commodities into either production sectors that are characterized by the same input structure (technology) or by being produced in fixed proportions.

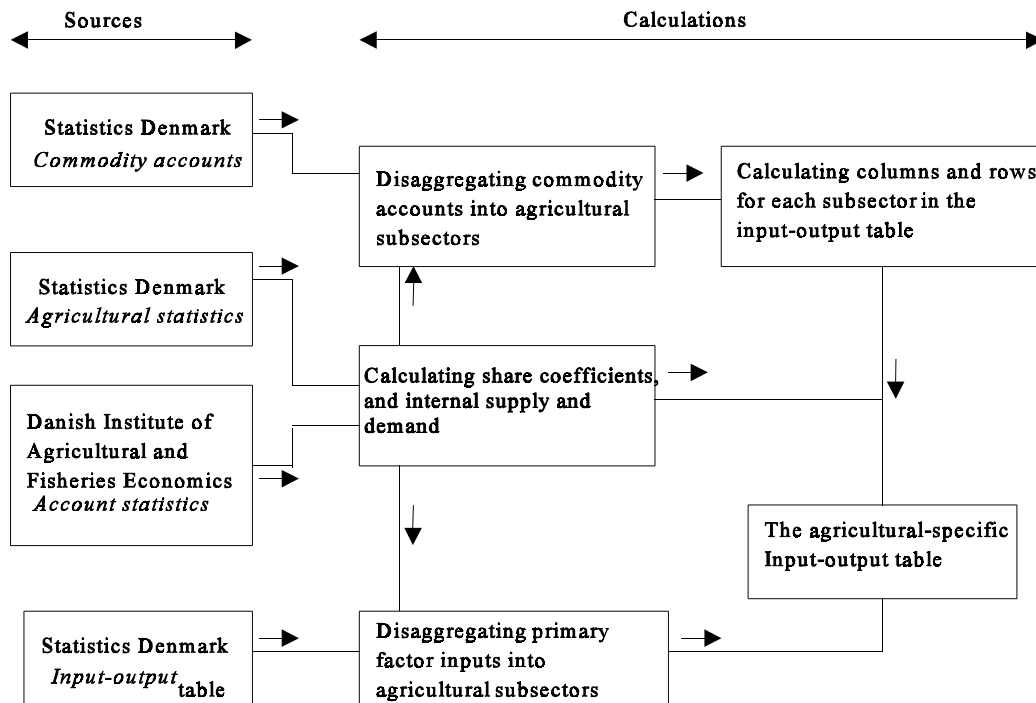
Since the I/O table constitutes the basis for CGE models (or I/O models), it is important that the scope of the model (i.e. the classification of sectors and commodities and the definition of agents and households etc.) is defined in such a way that the corresponding coefficients become representative for the pertinent policy issues. This means that even though it is possible to construct a table with a limited number of sectors that can fulfill the assumptions mentioned above, there are advantages to be gained by using a fairly general method that disaggregates a sector into as many subsectors as the available data allow for. The reason is that it gives the modeler some freedom in the modeling effort, for example, by changing the number of sectors, commodities, households etc., and since it is much easier to aggregate than to disaggregate.

14.5.3 Constructing the Danish I/O table

The operational principle used by DIAFE has been to base the disaggregation of the single agricultural sector on a detailed description of agricultural production taking into account the large differences in technology underlying the production of individual agricultural commodities. The operational principle is illustrated in figure 14.5.1.

Data sources used in the calculations are shown on the left-hand side. First, relevant commodity accounts are selected; that is commodities that are either used in or produced by the agricultural sector. Using share coefficients calculated from the agricultural statistics and the account statistics, this information is disaggregated into subsectors and then used to calculate the columns and rows for the agricultural subsectors in the I/O table. These columns and rows are supplied with calculated supply and demand for commodities that are not included in the commodity accounts. To finalize the I/O table, the above information is linked to all the information on non-agriculture in the SD table as well as information on disaggregated primary factor input in each agricultural subsector.

Figure 14.5.1 Construction of the agricultural-specific I/O table.



It is apparent that the major source for the construction of the I/O tables is the detailed commodity flow system. This system contains commodity accounts for about 2,500 commodities. The commodity accounts constitute the basis for construction of both the national accounts tables as well as the I/O tables. The system and methods used by the SD are based on the recommendations of the 1968 revision of the United Nations system of national accounts (SNA).

On the supply side, the commodity accounts contain information on supplies from the 117 domestic sectors, imports, customs duty, and FEOGA³ payments for each of the 2,500 commodities. Demand is listed by the 117 domestic sectors and 13 final demands consisting of 2 consumption categories,⁴ 4 investment categories, 5 inventory categories and 2 export categories. The commodity account for animal fodder is shown as an example in table 14.5.1.

From the table it is possible to identify the difference between basic and purchaser prices as the sum of margins and commodity taxes/subsidies. For example, input of animal fodder in fur farming accounts for 172 million in basic prices. Adding 44 million in wholesale margins and a subsidy of 121 million leads to an input into fur farming of 95.5 million in purchaser prices.

³ Payments from the European Agricultural Guidance and Guarantee Fund.

⁴ Private consumption is further divided into 66 consumption categories.

Table 14.5.1 Commodity account for animal fodder 1992, 1.000 kr.

Supply and use		Basic price	Wholesale margins	Retail margins	Commodity taxes	Purchase price
Production	Other mining	24463	0	0	0	24463
	Fruits and vegetables	135	0	0	0	135
	Processing of fish	25	0	0	0	25
	Margarine manuf.	159	0	0	0	159
	Fish meal manuf.	699843	0	0	0	699843
	Sugar factories and refineries	105981	0	0	0	105981
	Manuf. of food product n.e.c.	2166	0	0	0	2166
	Manuf. prepared animal feeds	303968	0	0	0	303968
	Breweries	187	0	0	0	187
	Manuf. of basic industrial chemical	1405	0	0	0	1405
	Manuf. of drugs and medicine	284393	0	0	0	284393
	Manuf. of chemical n.e.c.	2617	0	0	0	2617
Import		334293	0	0	0	334293
Input use	Agriculture	891654	223387	0	0	1115041
	Fur farming, etc.	172439	44022	0	-120933	95528
	Fishing and fish farming	243	50	0	0	293
	Manuf. of drugs and medicine	17523	1955	17	0	19495
	Recreational and cultural services	5312	1374	0	0	6686
	Producers of government services	10396	480	2931	0	13807
Private consumption	Other recreational goods	257335	45899	100824	0	404058
Increase in stocks ⁵		-143	-589	0	0	-732
Export		398279	116493	0	-14930	499842
Re-export		6597	1928	0	0	8525

In table 14.5.2 the information for the entire 2,500 commodities is illustrated using matrix notation. Each column in the U matrix which corresponds to an industry, shows the input use of each commodity in each row.

Table 14.5.2 The commodity accounts, basic values

	Supply of 2500 commodities	Input into 117 sectors	Final demand		Total
			11 groups	2-export category	
Use of 2500 commodities		U	F	X	q + b
Domestic production by 117 sectors	V				
Import	b'				
Total	q' + b'				

Note: Uppercase is used for matrices and lowercase for vectors, ' indicates a transposition.

⁵ This group is an aggregate of five groups.

14.5.3.1 Operational procedure

The operational procedure used to construct the DIAFE I/O table involves three steps:

- Splitting the information in the commodity accounts into the agricultural subsectors and then using the same method as employed by the SD.
- Correcting the internal agricultural demand and supply for commodities that do not pass through the market.
- Splitting the primary factor inputs into the agricultural subsectors and calculating the gross operating surplus (payments to capital and land).

The basis for the disaggregation of the commodity accounts is to calculate a matrix of subsector share coefficients for those commodities that are either used or produced by the agricultural sector. In 1992 there was input to the agricultural sector of 197 commodities in the commodity account system, but only 40 input shares are calculated. This is partly because of lack of data and the fact that many of the commodities are similar, whereby the same shares can be used to split them.

On the output side, the commodity accounts distinguish 25 commodities. The function of the output shares is simply to direct the production of a commodity to a single subsector.⁶

Expanded matrices for the production and use of commodities can now be calculated. Let U_A be the agricultural column in the U matrix in table 3.2, and let V_A be the agricultural row in the V matrix and U_A the agricultural column in the U matrix. Let $\hat{U}$ and $\hat{V}$ be the U and V matrices from table 14.5.2 with the agricultural sector disaggregated into subsectors and are calculated as

$$\hat{U} = (\hat{U}_A * N^I : U_o)$$

and

$$\hat{V} = \frac{N^o * \hat{V}_A}{V_o},$$

where U_o and V_o are the original matrices for all the non-agricultural sectors, N^I and N^o are matrices of the share coefficients, an $\wedge$ indicates a matrix with the original vector in the diagonal, and dotted lines indicate a horizontal or vertical linking of matrices .

This procedure has ensured that all information about production and input in the original single agricultural sector has been disaggregated into the selected agricultural subsectors.

The usual procedure is then used to construct the sector-specific supply and demand. This involves three essential assumptions⁷:

⁶ In fact these shares actually split the production out on 12 regions, because in the most disaggregated table constructed by DIAFE the agricultural sector is divided further into 12 regions.

⁷ In SNA terminology this means that the resulting table is an industry-by-industry table based on the assumption of an industrial technology.

- Each sector has a fixed market share for each commodity it produces.
- The share of imports is fixed in all uses.
- The foreign sector market shares are identical to the domestic shares.

Let M be a matrix with the import shares placed in the diagonal, and let D denote a matrix of market shares⁸. Applying these assumptions by using the D and M matrices, the supply and demand can be calculated as shown in table 14.5.3. There are no market shares for commodities that are not produced domestically. These commodities are allocated (through the D matrix) to a single foreign sector on an ad hoc basis, taking into account the nature of the commodity.

So far the method has ensured that all information on commodity flows in basic prices has been accounted for. The margins from wholesale and retail are aggregated for every sector and accounted for as supply from a wholesale sector and a retail sector.

The commodity taxes in table 14.5.3 are calculated in a similar manner as the inputs and outputs of commodities in basic prices. In the U , F and X matrices the basic prices have been replaced by the information on commodity taxes from the commodity accounts.

The dark grey area in the table indicates the adjustment of internal supply and demand in the agricultural sector due to commodities that do not pass the market place. The calculation of this matrix is described in section 14.5.3.2.3.

To complete the I/O table, it is necessary to disaggregate information that is not based on the commodity accounts. This includes the special import groups, VAT, taxes that are linked to production and wages. The method used is to disaggregate the figures from the SD I/O table in various ways. When these entries have been allocated to the appropriate sectors, the gross operating surplus can be calculated in the traditional way as the residual between the total supply from a sector and all the inputs to the sector.

The special import groups are allocated together with the VAT to the agricultural subsectors in proportion to each of the subsector's total input of commodities and services.⁹

Other taxes linked to production cover property taxes, taxes on cars and most importantly for the agricultural sector, general subsidies. The disaggregation of the single figure in the SD I/O table is based on the calculation of share coefficients. This calculation and the computation of the shares for disaggregating wages are described in section 14.5.3.2.2.

It should be mentioned that the procedure used actually calculates a composite sector for cattle meat, milk and wool. The reason is that wool practically does not have any significance in Danish agriculture. Therefore it is added to the cattle/dairy sector since this is the sector that best describes the production structure.¹⁰ The reason for milk and cattle meat to be described by the same input structure is that the majority of the Danish cattle meat production comes from the slaughtering of dairy cows. The splitting of these sectors is therefore done afterwards and the supply is allocated to

⁸ The import shares are calculated from the commodity account by the share of import used domestically out of total domestic use. The market share for each sector and commodity is calculated as a sector's production out of the total domestic production of that commodity, that is each element in the $\hat{V}$ matrix is divided by the column sum.

⁹ This is because the VAT rate is a uniform rate levied on all commodities and services. The entries for agriculture for the special import groups are negligible and therefore they are allocated in the same way due to lack of better information.

¹⁰ The GTAP sectoral classification is the reason for representing wool as a single sector.

using industries according to the information in the commodity accounts. The input structure is calculated by splitting out the input structure of the composite cattle, milk and wool sector by production shares.

The described method has ensured that all the necessary information to set up the final I/O table has been computed. In the current version of the DIAFE I/O table the following 15 agricultural subsectors are identified for the year 1992.¹¹

Table 14.5.3 Supply and demand by sectors.

	Demand by sectors	Final demand		Total
		X groups	Export	
Domestic supply				
	$D * ((I - M) * \tilde{U})$	$D * ((I - M) * F)$	$D * X_d$	$G = D * q$
Foreign Supply				
	$D * M * \tilde{U}$	$D * M * F$	$D * X_r$	
Commodity taxes on domestic use	$D * ((I - M) * \tilde{U}_p)$	$D * ((I - M) * F_p)$	$D * X_{dt}$	
Commodity taxes on import use	$D * M * \tilde{U}_t$	$D * M * F_t$	$D * X_{rt}$	
3 special import groups				
VAT				
Wages				
Other taxes linked to production				
Gross operating surplus				
Total	G'			

Note: the light grey area indicates that DIAFE only calculates the I/O information that has to do with agriculture, the rest is taken directly from SD. The dark grey area (internal supply and demand in Danish agriculture) indicates the adjustment for internal supply and demand of commodities that does not pass the marketplace.

Table 14.5.4 Agricultural sub-sectors.

1. Wheat	9. Roughage
2. Rye	10. Cattle meat
3. Barley	11. Milk
4. Oats	12. Wool
5. Oilseeds	13. Pigs
6. Seeds for sowing	14. Chickens for slaughtering
7. Potatoes	15. Eggs
8. Sugar beats	

¹¹ Each of the 15 sub-sectors is in fact disaggregated further into 12 regions.

14.5.3.2 Calculating the share coefficients and internal supply and demand

In section 14.5.3.1 above the method for constructing the DIAFE I/O table detailing agricultural data was described taking all the share coefficients as given. In this section the computation of these share coefficients is described.

Share coefficients used for splitting the commodity accounts

On the input side 40 share coefficients are calculated for disaggregating the information on the agriculture sectors' input use in the commodity accounts. The point of this section is not to document the calculation of every share coefficient but to show some of them to get the general idea. The 40 input shares are tabulated in the table 14.5.5.

The first 13 groups are commodities that are only used as fodder in the animal sectors. The share coefficients are calculated from statistics on the use of fodder concentrates, which are found in the Agricultural Statistics of the SD.

Table 14.5.5 Input shares

i1. Wheat and rye for fodder	i15. Veterinarians	i29. Seeds of rape for sowing
i2. Barley and oats for fodder	i16. Control associations	i30. Seeds of mustard for sowing
i3. Maize	i17. Minerals	i31. Seed potatoes
i4. Pulses and bran	i18. Maintenance, equipment	i32. Pulses for sowing
i5. Lucern meal and grass meal	i19. Maintenance, buildings	i33. Pollination of fields by bee keeping
i6. Cereal substitutes	i20. Costs of cars	i34. Wire of iron and steel
i7. Meat and bone meal	i21. Insurance's	i35. Seeds of root crops for sowing
i8. Whole milk	i22. Miscellaneous	i36. Vegetables for sowing
i9. Skimmed milk	i23. Chemicals	i37. Saddlery for animals
i10. Skimmed milk powder	i24. Contract operations	i38. Day-old chickens
i11. Whey	i25. Electricity & other energy	i39. Hens and other poultry for breeding
i12. Oil cakes	i26. Motor fuel	i40. Wholesale, retail & haulage contractor services
i13. Compound additives	i27. Seeds of beets for sowing	
i14. Fertilizer	i28. Seeds of grass & green fodder for sowing	

Table 14.5.6 Use of fodder concentrates mil. feed units, 1992

	Cattle	Pork	Poultry
a. Wheat	40,0	1550,1	171,8
b. Rye	100,8	55,8	0,0
c. Barley	371,4	2525,9	29,5
d. Oats	14,9	39,2	10,2
e. Maize	2,3	21,8	3,7
f. Pulses and bran	145,6	149,8	19,5
g. Soya, crushed and cakes	192,5	1168,1	118,6
h. Cotton seed, crushed and cakes	308,6	0,0	0,0
i. Sunflower, crushed and cakes	97,7	0,0	0,0
j. Rape, crushed and cakes	97,6	218,2	183,4
k. Coconut-cakes	92,0	0,0	0,0
l. Other cakes and meal	42,1	0,0	0,0
m. Lucern meal, grass meal	23,5	27,1	3,1
n. Mash and draft	49,6	96,5	76,5
o. Tapioca	155,8	179,9	2,6
p. Meat- and bone meal	20,0	206,7	25,0
q. Milk	10,2	0,0	0,0
r. Skim milk	6,8	6,0	0,0
s. Skim milk powder	1,2	19,0	0,0
Total fodder concentrates	1772,6	6264,1	643,9

Source: Agricultural Statistics 1992 and 1993.

Note: Calculated as the average between crop year 1991/92 and 1992/93.

Fodder-groups e to j is weighted together by the price of each type. Groups l and m are aggregated by a simple average. After the aggregation, the data can be used to calculate 12 share coefficients according to the first 12 groups in table 14.5.5.

The information on poultry in table 14.5.6 is further divided into fodder use in the production of eggs and chickens for slaughtering by the standard fodder norms per production unit multiplied by the total number of units in 1992.

The input shares i14 to i26 are calculated on the basis of full cost accounts of agricultural enterprises (26 in all) from DIAFE which states the cost of each input item in terms of process units (per ha., per sow, per year, per baconer etc.). Coupled with statistics on the total number of process units from SD, the use of various inputs in each enterprise can be calculated. Aggregating the 26 enterprises to the subsector aggregation provides the data for calculating the share coefficients.

Input share coefficients i27 to i39 are more easily handled because they all represent commodities that are only used in a single agricultural subsector, with the exception of the first two groups which are used in two subsectors. These are distributed according to the area sowed with the corresponding crop.

The last input share coefficient is haulage contractor services. This share is calculated from the distribution of wholesale and retail margins, which as mentioned earlier was distributed among the agricultural subsectors according to the input share coefficients i1 through i39. This reflects an assumption of proportionality between trade and transport services.

The source shares used to disaggregate the commodity accounts into subsectors on the output side are much easier to construct since each of the 25 agricultural commodities in the commodity accounts can be allocated to a single sector.

Other share coefficients

Entries for non-commodity taxes and wages in the agricultural sector are disaggregated into subsectors by using the account statistics from DIAFE and the agricultural statistics from SD. From the account statistics the information on subsidies and property per process unit is multiplied by the total number of process units in each subsector obtained from the agricultural statistics. The resulting figures are then used as the basis for the distribution of the single entry in the I/O table.

The wages are distributed among agricultural subsectors according to their labor input. The input of labor hours is also calculated from the account statistics (labor hours per process unit) and the agricultural statistic (number of process units) from DIAFE and SD.

Calculating internal demand and supply

As mentioned before, there are important supplies from the agricultural sector to the sector itself that do not pass the marketplace and therefore are not accounted for in the national accounting system. To finalize the I/O table it is necessary to take account of the internal supply and demand in the agricultural sectors. This implies accounting for:

- Production and use of grains
- Production and use of roughage
- Production and use of manure
- Internal supply and demand that is present in the commodity accounts

Four types of grains are used either as fodder in the animal sectors or for sowing in the four grain sectors. The total use of grains is obtained from the agricultural statistics specification of the use of grains for fodder and sowing. The specification is in volumes and the value is obtained by multiplying with the price of the corresponding grain type. The total use of imports is then deducted by utilizing the import shares and commodity accounts as mentioned earlier.

The total use of domestic produced grains for fodder is distributed among the animal sectors according to the first four input shares in table 14.5.5. The input of grains for sowing in the crop sectors is calculated according to the distribution of land sowed with the corresponding grain.

In calculating the supply and use of roughage there is a problem of missing prices since the production and usage of roughage usually take place on the same farm. To overcome this problem DIAFE has decided to calculate the value of roughage as being equal to the total production cost. The total cost per hectare is obtained from the account statistics from DIAFE. The costs of producing the various roughage products are then multiplied by the area sowed with the corresponding type of roughage.

The supply of manure is obtained in a similar manner. The account statistics have information on the value of manure per process unit in the various animal enterprises. The total value of manure is calculated by multiplying the value by the number of process units. The use of manure is distributed among crop sectors according to the input shares for fertilizer.

There are only four commodities in the commodity accounts that are both produced and used in the agricultural sector. The computed input and output shares are used to disaggregate these commodities.

The internal supply and usage can now be added up for each sector and inserted into the I/O structure indicated by the dark grey area in table 14.5.3.

Processing industries

In the table provided by the SD, the slaughtering of pigs, cattle etc. is treated as a single sector. To secure independence between the production of cattle and pork meat both in agriculture and in the processing industries, this sector is divided into two functionally defined sectors:

- Slaughtering of cattle and manufacturing of cattle meat
- Slaughtering of pigs and manufacturing of pork meat

The calculation of the input and output structures of these two sectors closely follows the principle behind the disaggregation of the agricultural sector, yet because of lack of data the calculation of the share coefficients is of a more summarized character.

14.5.3.3 Summary

In section 2 some of the theoretical and methodological aspects involved in the disaggregation of a single agricultural sector have been discussed. One of the crucial assumptions underlying the conventional I/O method is that each sector is characterised by a Leontief production technology with constant return to scale and fixed I/O proportions. In section 3 it is argued that by classifying commodities into subsectors that are characterised by similar input structure (technology), or by fixed proportions can lead to an acceptable aggregation of sectors.

It has been demonstrated that if the necessary data are available it is possible to construct share coefficients that can be used to disaggregate the commodity accounts, that is, to calculate the subsector-specific input and output of each commodity.

It is also argued that to describe the production structure precisely, it is also necessary to take into account the supply and use of those agricultural commodities in the agricultural sector that have not been accounted for in the national system of account.

Various supplementary statistics are used to disaggregate the information that is not based on commodity accounts, i.e. input of taxes/subsidies that are linked to production, the special import groups and input of labour.

Having calculated all this, the procedure recommended by the UN is then used to produce the final I/O table with a description of the agricultural subsectors that to a great extent complies with the underlying assumptions.

14.5.4 The GTAP aggregation

The Danish I/O table supplied to the GTAP project consists of 50 sectors. These 50 sectors are mostly created by relevant aggregation of sectors in the national DIAFE I/O table. But there are a few sectors in the GTAP aggregation, which are characterised by activities that make up only some parts of one or more DIAFE sectors. Therefore, it is necessary to disaggregate some of the DIAFE sectors. Due to lack of detailed cost statistics for these industries the method used is simpler than the method described in the previous sections.

The method used for disaggregating the relevant sectors applies information on the share of production in the relevant sectors, and uses these shares to split the input column and the supply from the domestic sectors. This means that it is implicitly assumed that each sector is characterised by identical production structures for all its activities. The split of the supply from foreign sectors is based on the import share of the relevant commodities.

In table 14.5.7 the industries affected by this splitting are indicated together with the associated shares and the corresponding GTAP sector which these activities belong to.

Table 14.5.7 Shares used to split the input and supply structure in the DIAFE I/O table

Sector	Split	Domestic production shares	Import shares
Coal, oil and gas (DIAFE 21)	Coal	0.0	47.42
	Oil	76.83	52.58
	Gas	23.17	0.0
Petroleum refineries (DIAFE 72)	LPG	2.0	0.5
	Other	98.0	99.5
Manuf. of asphalt and roofing material (DIAFE 73)	Briquettes	5.4	4.65
	Other	94.6	95.35
Grain mill products (DIAFE 35)	Processed rice	1	17.14
	Other		82.86
Margarine manufacturing (DIAFE 32)	Vegetable oil and fat	37.02	68.38
	Other	62.98	31.62
Railroad and automobile equipment (DIAFE 101)	Motor vehicles and parts	60.19	96.5
	Railroad equipment	39.81	3.5

Source: Statistics Service, Manufacturers sales of commodities, Series A through D 1992:4. Statistics Service, External trade by commodities and countries, 1992:4. Statistical News, Manufacturing industry and energy 1993:6 and 1993:9.

Special treatment is given to the supply of coal, oil and gas to petroleum refineries (DIAFE 72) and to gas manufacture and distribution (DIAFE 107) in that the total supply to the first is classified as oil and the latter as gas. This means that it is necessary to calculate the share of domestic production again and use this to split the input side to make sure that total inputs equal total supply in the coal, oil and gas industries (GTAP 15-17).

Apart from these industries it is also necessary to split the agricultural services and the roughage sector since these activities are included in the other agricultural sectors in the GTAP aggregation. The inputs of these sectors are added to the other agricultural sectors in proportion to these sectors' use of roughage and services.

14.5.4.1 Other modifications

There is a need for some further modification of the I/O table before it complies with the GTAP specification. This involves the removal of some negative entries, re-exports and imputed financial services.

Re-exports

The GTAP specification does not allow for re-exports and therefore all information including taxes/subsidies on re-exports in the Danish case has been removed.

Negative entries

There were negative inputs to investment from domestic and imported *bovine cattle, sheep etc* (163 million in Danish currency). These arise because of negative entries in agricultural breeding stock (one out of five investment categories in the Danish I/O table)¹². I have moved these inputs as well as the taxes to *changes in stocks*.

Furthermore there were negative inputs to private consumption from domestic sector 38 *motor vehicles and parts* (28 million in Danish currency) and import from sector 47 *trade and transport* (96 million in Danish currency) these arise as a consequence of balancing the national account statistic at Statistics Denmark. I have moved these inputs as well as the taxes to *changes in stocks*.

Imputed financial services

The Danish I/O table has an artificial sector for imputed financial services consisting of the financial sectors interest earnings. I have moved these to *financial, business, recreational services* so they are accounted as an input to the sector from the sector itself.

¹² For example, there are negative entries for investment in bovine cattle, sheep etc. This entry arises from a decline in the agricultural breeding stock, which is one out of five investment categories in the Danish I/O system.

In table 14.5.A1 in the appendix the concordance between the DIAFE 132-sector I/O table and the 50 sector GTAP aggregations can be found. The DIAFE 132-sectoral classification is in table 14.5.A2.

14-5-5 Conclusion

This paper documents the construction of the Danish I/O table contained in the GTAP data base. It has been argued that disaggregating I/O sectors on the basis of, say, production shares or a representative I/O table sometimes fails to work properly. In these cases problems will arise if the disaggregated sectors use very different production methods or if the representative I/O table fails to describe one or more subsectors precisely.

One method to disaggregate sectors that ensures that they comply with the underlying assumptions of varying production methods or varying I/O structures has been described in section 3. The method uses accounting statistics and other relevant statistics to disaggregate the base data used in constructing the I/O tables.

Inputs of every commodity are allocated to each disaggregated subsector based on data for each subsector's use of each commodity. The supply of each commodity was also allocated to subsector.

Moreover it is argued that there is a need to take into account inputs and outputs of commodities that do not pass through the marketplace; especially if these commodities account for a relatively large fraction of inputs or outputs. Section 4 describes how the final version of the Danish I/O table is constructed according to the 50-sector GTAP classification. In most cases this has involved aggregating sectors but there has also been a need for disaggregating a few sectors. For these sectors, the simpler method of disaggregating according to production shares was considered sufficient.

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Appendix

Table 14.5.A1 Concordance between GTAP and DIAFE sectoral classification.

GTAP	DIAFE	Text	Remarks
1			
2		1 Wheat	
(P)	18	Agricultural services	Only on wheat
3		2 Rye	
		3 Barley	
		4 Oats	
(P)	18	Agricultural services	Only on cereal excl. wheat
4		16 Horticulture	
(P)	18	Agricultural services	Only on horticulture
5		5 Oilseeds	
(P)	18	Agricultural services	Only on oil seed
6		8 Sugar beet	
(P)	18	Agricultural services	Only on sugar beet
7			
8		6 Seeds for sowing	
		7 Potatoes	
		9 Roughage	Only seeds for sowing
(P)	18	Agricultural services	Only on potatoes and seeds for
9		10 Bovine cattle	
(P)	9	Roughage	Only on bovine cattle
(P)	18	Agricultural services	Only on bovine cattle
10		13 Pigs	
		14 Poultry	
		15 eggs	
		17 Fur farming, etc.	
(P)	18	Agricultural services	Only on pigs, poultry, eggs
11 (P)	9	Roughage	Only on milk production
		11 Milk	
(P)	18	Agricultural services	Only on milk production
12 (P)	9	Roughage	Only on wool production
		12 Wool	
(P)	18	Agricultural services	Only on wool production
13		19 Forestry and logging	
14		20 Fishing	
15 (P)	21	Extraction of coal, oil and gas	Only coal
(P)	73	Manuf. of asphalt and roofing mater.	Only Briquettes
16 (P)	21	Extraction of coal, oil and gas	Only oil
17 (P)	21	Extraction of coal, oil and gas	Only gas
(P)	72	Petroleum, refineries	Only LPG
18		22 Other mining	
19		23 Slaughtering etc. of cattle	
20		24 Slaughtering etc. of pigs	
		25 Poultry killing, dressing, packing	

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Table 14.5.A1 Concordance between GTAP and DIAFE sectoral classification (continued)

GTAP	DIAFE Text	Remarks
(P)	31 Oil mills	
(P)	32 Margarine manufacturing	Excl. vegetable oil
21	31 Oil mills	
(P)	32 Margarine manufacturing	Only vegetable oil
22	26 Dairies	
	27 Processed cheese, condensed milk	
	28 Ice cream manufacturing	
23 (P)	35 Grain mill products	Only processed rice
24	38 Sugar factories and refineries	
25	29 Processing of fruit and vegetables	
	30 Processing of fish	
	33 Fish meal manufacturing	
(P)	34 Grain mill products	Excl. processed rice
	35 Bread factories	
	36 Cake factories	
	37 Bakeries	
	39 Chocolate and sugar confectionery	
	40 Manufacture of food product n.e.c.	
	41 Manuf. of prepared animal feeds	
26	42 Distilling and blending spirits	
	43 Breweries	
	44 Tobacco manufactures	
27	45 Spinning, weaving etc. textiles	
	46 Manuf. of made-up textile goods	
	47 Knitting mills	
	48 Cordage, rope and twine industries	
28	49 Manufacture of wearing apparel	
29	50 Manufacture of leather products	
	51 Manufacture of footwear	
30	52 Manuf. of wood products, excl. furnit.	
	53 Manuf. of wooden furniture, etc.	
31	54 Manuf. of pulp, paper, paperboard	
	55 Manuf. of paper containers, wallpaper	
	56 Reproducing and composing services	
	57 Book printing	
	58 Offset printing	
	59 Other printing	
	60 Bookbinding	
	61 Newspaper printing and publishing	
	62 Book and art publishing	
	63 Magazine publishing	
	64 Other publishing	
32 (P)	72 Petroleum, refineries	Excl. LPG
(P)	73 Manuf. of asphalt and roofing mater.	Excl. Briquettes
33	65 Manuf. of basic industrial chemicals	
	66 Manuf. of fertilisers and pesticides	

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Table 14.5.A1 Concordance between GTAP and DIAFE sectoral classification (continued)

GTAP	DIAFE Text	Remarks
	67 Manuf. of basic plastic materials	
	68 Manuf. of paints and varnishes	
	69 Manufacture of drugs and medicines	
	70 Manufacture of soap and cosmetics	
	71 Manuf. of chemical products n.e.c.	
	74 Tyre and tube Industries	
	74 Tyre and tube Industries	
	75 Manuf. of rubber products n.e.c.	
	76 Manuf. of plastic products n.e.c.	
34	77 Manuf. of earthenware and pottery	
	78 Manuf. of glass and glass products	
	79 Manuf. of structural clay products	
	80 Manuf. of cement, lime and plaster	
	81 Concrete products and stone cutting	
	82 Non-metallic mineral products n.e.c.	
35	83 Iron and steel works	
	84 Iron and steel casting	
36	85 Non-ferrous metal works	
	86 Non-ferrous metal casting	
37	87 Manufacture of metal furniture	
	88 Manuf. of structural metal products	
	89 Manuf. of metal cans and containers	
	90 Manuf. of other fabr. metal products	
38 (P)	101 Railroad and automobile equipment	Excl. railroad equipment
39	100 Ship building and repairing	
(P)	101 Railroad and automobile equipment	Only railroad equipment
	102 Manufacture of cycles, mopeds, etc.	
40	96 Manuf. of telecommunication equip.	
41	91 Manuf. of agricultural machinery	
	92 Manufacture of industrial machinery	
	93 Repair of machinery	
	94 Manufacture of household machinery	
	95 Manuf. of refrigerators, accessories	
	97 Manuf. of electrical home appliances	
	98 Manuf. of accumulators and batteries	
	99 Manuf. of other electrical supplies	
	103 Professional and measuring equip.	
42	104 Manufacture of jewelry, etc.	
	105 Manuf. of toys, sporting goods, etc.	
43	106 Electric light and power	
44	107 Gas manufacture and distribution	
	108 Steam and hot water supply	
45	109 Water works and supply	
46	110 Construction	
47	111 Wholesale trade	
	112 Retail trade	
	113 Restaurants and hotels	

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Table 14.5.A1 Concordance between GTAP and DIAFE sectoral classification (continued)

GTAP	DIAFE Text	Remarks
	114 Railway and bus transport, etc.	
	115 Other land transport	
	116 Ocean and coastal water transport	
	117 Supporting services to water trsp.	
	118 Air transport	
	119 Services allied to transport, etc.	
	120 Communication	
	128 Repair of motor vehicles	
48	121 Financial institutions	
	122 Insurance	
	124 Business services	
	127 Recreational and cultural services	
	129 Household services	
	130 Domestic services	
49	125 Education, market services	
	126 Health, market services	
	131 Private non-profit institutions	
	132 Producers of government services	
50	123 Dwellings	

Table 14.5.A2 The DIAFE sectoral classification

1	10101	Wheat	67	35130	Manuf. of basic plastic materials
2	10102	Rye	68	35210	Manuf. of paints and varnishes
3	10103	Barley	69	35220	Manufacture of drugs and medicines
4	10104	Oats	70	35230	Manufacture of soap and cosmetics
5	10105	Oil seeds etc.	71	35290	Manuf. of chemical products n.e.c.
6	10106	Seed for sowing	72	35300	Petroleum, refineries
7	10107	Potatoes	73	35400	Manuf. of asphalt and roof mater.
8	10108	Sugar beets	74	35510	Tyre and tube industries
9	10109	Roughage	75	35590	Manuf. of rubber products n.e.c.
10	10110	Cattle	76	35600	Manuf. of plastic products n.e.c.
11	10111	Milk	77	36100	Manuf. of earthenware and pottery
12	10112	Wool	78	36200	Manuf. of glass and glass products
13	10113	Pigs	79	36910	Manuf. of structural clay products
14	10114	Chickens for slaughtering	80	36920	Manuf. of cement, lime and plaster
15	10115	Eggs	81	36993	Concrete products and stone cutting
16	11103	Horticulture	82	36998	Non-metallic mineral products n.e.c.
17	11109	Fur farming, etc.	83	37101	Iron and steel works
18	11200	Agricultural services	84	37102	Iron and steel casting
19	12000	Forestry and logging	85	37201	Non-ferrous metal works
20	13000	Fishing	86	37202	Non-ferrous metal casting
21	20099	Extraction of coal, oil and gas	87	38121	Manuf. of metal furniture
22	29000	Other mining	88	38138	Manuf. of structural metal products
23	31113	Slaughtering etc. of cattle	89	38191	Manuf. of metal cans and containers
24	31114	Slaughtering etc. of pigs	90	38198	Manuf. of other fabr. Metal products
25	31117	Poultry killing, dressing, packing	91	38220	Manuf. of agricultural machinery
26	31121	Dairies	92	38238	Manuf. of industrial machinery
27	31123	Processed cheese, condensed milk	93	38280	Repair of machinery
28	31124	Ice cream manufacturing	94	38293	Manuf. of household machinery
29	31130	Processing of fruit and vegetables	95	38298	Manuf. of refrigerators, accessories
30	31140	Processing of fish	96	38320	Manuf. of telecommunication equip.
31	31151	Oil mills	97	38330	Manuf. of elec. home appliances
32	31152	Margarine manufacturing	98	38392	Manuf. of accumulators & batteries
33	31153	Fish meal manufacturing	99	38398	Manuf. of other electrical supplies
34	31160	Grain mill products	100	38410	Ship building and repairing
35	31171	Bread factories	101	38438	Railroad and automobile equipment
36	31173	Cake factories	102	38498	Manufacture of cycles, mopeds, etc.
37	31174	Bakeries	103	38500	Professional and measuring equip.
38	31180	Sugar factories and refineries	104	39010	Manufacture of jewelry, etc.
39	31190	Chocolate and sugar confectionery	105	39098	Manuf. of toys, sporting goods, etc.
40	31210	Manufacture of food products n.e.c.	106	41010	Electric light and power
41	31229	Manuf. of prepared animal feeds	107	41020	Gas manufacture and distribution
42	31310	Distilling and blending spirits	108	41030	Steam and hot water supply
43	31338	Breweries	109	42000	Water works and supply
44	31400	Tobacco manufactures	110	50000	Construction
45	32118	Spinning, weaving etc. Textiles	111	61000	Wholesale trade
46	32120	Manuf. Of made-up textile goods	112	62000	Retail trade
47	32130	Knitting mills	113	63000	Restaurants and hotels
48	32158	Cordage, rope and twine industries	114	71118	Railway and bus transport, etc.
49	32200	Manufacture of wearing apparel	115	71138	Other land transport
50	32300	Manufacture of leather products	116	71210	Ocean and coastal water transport
51	32400	Manufacture of footwear	117	71230	Supporting services to water trsp.

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Table 14.5.A2 The DIAFE sectoral classification (continued)

52	33100	Manuf. of wood products, excl. Furnit.	118	71300	Air transport
53	33200	Manuf. of wooden furniture, etc.	119	71509	Services allied to transport, etc.
54	34110	Manuf. of pulp, paper, paperboard	120	72000	Communication
55	34128	Manuf. of paper containers, wallpaper	121	81000	Financial institutions
56	34210	Reproducing and composing services	122	82000	Insurance
57	34221	Book printing	123	83110	Dwellings
58	34222	Offset printing	124	83509	Business services
59	34223	Other printing	125	93109	Education, market services
60	34230	Bookbinding	126	93300	Health, market services
61	34240	Newspaper printing and publishing	127	94000	Recreational and cultural services
62	34291	Book and art publishing	128	95130	Repair of motor vehicles
63	34292	Magazine publishing	129	95299	Household services
64	34293	Other publishing	130	95400	Domestic services
65	35110	Manuf. of basic industrial chemicals	131	97099	Private non-profit institutions
66	35120	Manuf. of fertilizers and pesticides	132	98099	Producers of government services
