Chapter 6

Data Base Summary: Input-Output Multipliers

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For many purposes it is useful to know the answer to the following question: "If the final demand for a given commodity rises by $1 million, what will be the impact on the profile of factor demands?" This chapter aims to answer this question by providing a summary of the direct and total requirements coefficients. This information is generated from the GTAP 5 data base without formal simulation of the GTAP model. In the book version of this chapter, we report only data for the world aggregate. Data on I-O multipliers for individual GTAP regions may be found in the version of this chapter on the GTAP web site and on the CD-ROM data base documentation package that accompanies this document.

6.1 Direct Requirements Coefficients

Table 6.2 reports the direct requirements coefficients, whereby demand is attributed to both domestic intermediate inputs and the "primary" factors of production.[1] The columns in table 6.1 correspond to domestic intermediates, imported intermediates, unskilled labor, skilled labor, capital, natural resources, land, and indirect taxes. These coefficients sum to 100, since sectoral revenue must equal

[1] For the purposes of this calculation, "primary" factors include not only the conventional primary factors, labor, capital, and land, but also indirect taxes and imports, which are external to the one region I-O model.

cost (inclusive of taxes) in the balanced GTAP data base. Rows in the table correspond to “sectors”, or columns in the input-output (I-O) table. This includes the activities in final demand, including private and government consumption, investment and exports.

The direct requirements coefficients indicate that a $100 million increase in the sales of sugar (processed) to final demand in the world would increase the demand for domestic intermediates by $65.8 million, imported intermediates by $6.3 million, unskilled labor by $8.3 million, skilled labor by $2.3 million, and capital by $15 million. $2.4 million of indirect taxes will also be generated. There will be no increase in the demand for land and natural resources since land is only a direct requirement in the agricultural sectors and natural resources is a direct requirement only in the extractive sectors. (Recall the discussion in chapters 2 and 3.)

The splits for the other primary factors in agriculture are almost identical. This is by construction, since we only have primary factor splits for the aggregate agricultural sector (see chapter 17.4).

The next point to note about the global direct requirements coefficients is that the final demand activities — consumption, investment and exports — do not employ primary factors of production. This follows from I-O accounting. Furthermore, the domestic, import and tax intensities of these final demands also differ widely. Investment is the most import-intensive of the final demand activities, while government consumption is very intensive on domestic inputs. Private consumption is the most heavily taxed (4.7 percent direct consumption taxation), whereas government consumption is typically not taxed at all or lightly taxed.

Turning to the productive sectors of the economy, we see that the food processing and the manufacturing sectors show high shares of intermediate inputs, while extractive sectors, services and primary agriculture show relatively low shares. Primary agriculture and services are also quite intensive in total labor. The private and government service sectors show the highest intensity for skilled labor. In terms of direct requirements coefficients, the sectors which show the highest coefficients for capital are forestry, oil and gas, services and dwellings. The latter absorbs capital at almost 80 percent of total costs. Finally, we note from the last column that beverages and tobacco products are the most highly taxed on a global basis while wheat, other grains, oilseeds, and cattle/sheep are highly subsidized, as indicated by the large negative tax rates.

Data on direct requirements coefficients by GTAP region are available in tables 6.3.1 - 6.3.66 in the version of this chapter on the GTAP web site and on the CD-ROM.

6.2 Total Requirements Coefficients

Table 6.2 reports the total requirements coefficients, whereby all derived demands are attributed only to the "primary" factors of production. Here, a $100 million increase in the sales of sugar (processed) to final demand in the world is shown to increase the demand for imports by $12.8 million, unskilled labor by $30.8 million, skilled labor by $8.2 million, capital by $35.9 million, and indirect taxes by $2.8 million. Additionally, it will increase the demand for land by $8.9 million and for natural resources by $0.5 million.

Because labor intensive activities also demand some capital intensive intermediates, and vice versa, the factor intensities in table 6.2 tend to be somewhat less diverse than those in table 6.1. This is particularly noticeable in the case of land. Here, the direct requirements are zero outside primary agriculture, but because other sectors, such as processed rice, meat products, and milk products, use a great deal of agricultural inputs, they exhibit significant total requirements for land. The same is true in the case of taxes. The direct requirements tax rate for a number of the agricultural sectors was negative in table 6.1, indicating the presence of a subsidy. The total requirements tax rates in table 6.2 are also negative for these agricultural sectors indicating that the derived demand for taxed intermediates did not generate sufficient revenue to offset these subsidies.

It is also interesting to compare the primary factor intensity of total requirements for final demand. The high domestic input intensity of government consumption in table 6.1 translates to high skilled and unskilled labor intensity, higher than that for private consumption. Private consumption is the most capital-intensive of the final demand activities. Exports are more intensive in capital, skilled labor and natural resources than investment.

Data on total requirements coefficients by GTAP region are available in tables 6.4.1 - 6.4.66 in the version of this chapter on the GTAP web site and on the CD-ROM.

In summary, examination of the direct and total requirements coefficients and can give the reader some important insights into the structure of the GTAP data base, and hence the likely outcomes when the data base is used in model simulation.

Table 6.1 Direct Requirements Coefficients, World (percent)

	Domestic Products	Imported Products	Unskilled Labor	Skilled Labor	Capital	Natural Resources	Land	Indirect Tax
Paddy rice	31.1	2.6	31.2	0.3	12.0	0.0	23.9	-1.2
Wheat	40.1	5.7	28.1	1.0	17.7	0.0	33.9	-26.6
Other grains	37.4	5.5	28.6	1.0	18.4	0.0	34.7	-25.6
Vegetables, fruit	29.7	3.6	32.2	0.8	15.2	0.0	17.3	1.1
Oil seeds	31.2	3.9	29.3	1.0	20.2	0.0	32.6	-18.2
Sugar cane	29.9	3.8	29.0	0.8	17.1	0.0	20.6	-1.2
Plant-based fibers	45.0	5.8	21.7	0.4	9.5	0.0	16.4	1.2
Other crops	27.5	4.8	32.9	1.3	16.6	0.0	15.9	1.1
Cattle, sheep	57.5	4.6	18.8	0.8	19.8	0.0	9.0	-10.5
Animal products	59.2	4.1	18.2	0.5	8.1	0.0	9.9	0.1
Raw milk	49.6	4.1	23.4	1.0	12.6	0.0	11.8	-2.5
Wool	42.1	9.7	24.6	0.5	10.9	0.0	9.6	2.6
Forestry	32.5	2.6	20.9	0.7	35.1	7.0	0.0	1.2
Fishing	33.9	4.7	16.2	0.5	18.8	22.7	0.0	3.1
Coal	31.6	5.7	19.3	3.3	15.2	24.1	0.0	0.8
Oil	21.7	6.3	7.6	2.5	34.1	24.8	0.0	3.1
Gas	21.6	6.5	7.5	1.9	31.1	23.1	0.0	8.3
Other minerals	46.9	6.0	14.1	3.8	19.6	6.5	0.0	3.1
Cattle, sheep meat	79.4	4.0	6.9	1.7	7.3	0.0	0.0	0.6
Other meat	75.6	5.0	8.7	2.2	7.6	0.0	0.0	0.9
Vegetable oils	60.9	14.2	7.4	2.0	12.0	0.0	0.0	3.5
Dairy products	69.7	4.5	8.5	2.2	14.2	0.0	0.0	1.0
Processed rice	78.4	2.4	4.9	1.0	11.8	0.0	0.0	1.5
Sugar	65.8	6.3	8.3	2.3	15.0	0.0	0.0	2.4
Other food	56.1	10.4	11.0	3.6	15.5	0.0	0.0	3.4
Beverages, tobacco	45.8	6.2	8.9	2.9	22.9	0.0	0.0	13.4
Textiles	53.7	14.0	13.9	3.1	12.3	0.0	0.0	3.0
Wearing apparel	50.3	13.4	17.1	3.5	12.6	0.0	0.0	3.0
Leather products	51.9	14.0	15.7	3.0	12.4	0.0	0.0	3.0
Wood products	52.6	10.5	17.0	4.1	14.2	0.0	0.0	1.5
Paper, publishing	49.5	9.0	16.2	7.5	15.8	0.0	0.0	2.0
Petroleum	47.1	41.5	2.3	1.1	6.3	0.0	0.0	1.8
Chemicals, rubber	50.1	13.8	10.9	5.9	14.9	0.0	0.0	4.4
Mineral products	50.6	7.8	16.2	5.0	17.0	0.0	0.0	3.4
Ferrous metals	60.8	11.4	11.9	3.7	9.8	0.0	0.0	2.4
Other metals	54.3	18.2	11.0	3.6	10.4	0.0	0.0	2.4
Metal products	50.0	10.1	19.4	6.8	11.8	0.0	0.0	2.0
Motor vehicles	58.5	15.6	11.7	5.4	7.6	0.0	0.0	1.2
Transport equipt	45.5	16.8	17.5	8.8	9.6	0.0	0.0	1.9
Electronic equipt	44.7	22.2	12.1	7.7	11.5	0.0	0.0	1.8
Machinery, equipt	45.8	13.5	15.9	10.0	13.2	0.0	0.0	1.7
Other manufactures	48.7	12.8	14.5	4.4	16.0	0.0	0.0	3.5

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Table 6.1 Direct Requirements Coefficients, World (percent) (Contd)

	Domestic Products	Imported Products	Unskilled Labor	Skilled Labor	Capital	Natural Resources	Land	Indirect Tax
Electricity	49.3	7.2	6.6	4.4	29.5	0.0	0.0	3.0
Gas distribution	35.5	6.5	16.3	9.3	28.2	0.0	0.0	4.2
Water	35.0	3.2	19.5	10.9	28.8	0.0	0.0	2.6
Construction	49.9	6.3	21.2	7.8	12.9	0.0	0.0	1.9
Trade	34.1	3.3	26.9	9.4	23.0	0.0	0.0	3.3
Other transport	38.1	4.7	25.1	8.5	20.0	0.0	0.0	3.6
Water transport	35.6	27.9	12.9	4.8	13.4	0.0	0.0	5.3
Air transport	44.1	15.5	17.7	5.4	11.6	0.0	0.0	5.6
Communication	29.3	4.6	14.0	14.9	35.7	0.0	0.0	1.4
Financial services	35.7	2.1	15.7	19.1	24.9	0.0	0.0	2.4
Insurance	43.5	2.5	18.6	20.2	13.1	0.0	0.0	2.2
Business services	31.4	2.3	11.1	12.5	39.0	0.0	0.0	3.6
Recreatl services	37.8	4.5	13.1	14.9	25.5	0.0	0.0	4.3
Education, health	27.0	3.3	28.2	30.5	11.7	0.0	0.0	-0.6
Dwellings	15.1	0.8	1.7	0.0	79.5	0.0	0.0	3.0
Private Consumption	87.6	7.7	0.0	0.0	0.0	0.0	0.0	4.7
Govt Consumption	96.8	2.9	0.0	0.0	0.0	0.0	0.0	0.2
Investment	83.2	13.7	0.0	0.0	0.0	0.0	0.0	3.1
Exports	99.7	0.0	0.0	0.0	0.0	0.0	0.0	0.3

Table 6.2 Total Requirements Coefficients, World (percent)

	Imports	Unskilled Labor	Skilled Labor	Capital	Natural Resources	Land	Indirect Tax
Paddy rice	6.5	41.2	3.7	22.0	0.2	26.8	-0.4
Wheat	11.6	40.4	5.9	31.5	0.4	38.2	-28.1
Other grains	11.1	39.4	6.6	30.9	0.3	36.3	-24.7
Vegetables, fruit	7.8	41.0	4.8	25.2	0.3	18.7	2.3
Oil seeds	8.0	38.9	5.0	30.8	0.2	35.3	-18.2
Sugar cane	7.9	38.1	4.5	27.1	0.2	22.6	-0.4
Plant-based fibers	12.6	34.7	6.4	24.3	0.5	18.6	3.0
Other crops	8.5	41.1	5.2	26.1	0.2	16.9	2.1
Cattle, sheep	11.6	38.5	6.8	39.4	0.3	16.9	-13.6
Animal products	12.0	37.5	6.5	27.8	0.4	17.2	-1.5
Raw milk	10.3	39.7	6.4	29.1	0.4	18.0	-3.9
Wool	15.7	38.2	5.3	24.4	0.3	13.1	3.1
Forestry	6.3	30.8	5.7	46.9	7.7	0.3	2.3
Fishing	9.8	25.6	5.2	30.1	24.1	0.6	4.5
Coal	10.1	28.5	8.4	26.2	24.3	0.1	2.3
Oil	8.6	13.4	6.5	42.5	24.9	0.0	4.1
Gas	8.6	13.2	6.0	39.2	23.7	0.0	9.3
Other minerals	12.4	26.5	10.2	37.2	8.1	0.1	5.5
Cattle, sheep meat	13.1	35.9	8.6	37.0	0.4	10.5	-5.6
Other meat	14.0	35.7	8.8	31.3	0.4	9.5	0.4
Vegetable oils	21.3	27.3	8.2	32.5	0.7	8.8	1.3
Dairy products	12.2	32.9	9.0	37.2	0.3	7.7	0.7
Processed rice	8.7	34.8	6.1	32.1	0.8	15.5	2.1
Sugar	12.8	30.8	8.2	35.9	0.5	8.9	2.8
Other food	17.2	28.9	9.9	34.6	0.8	4.7	3.9
Beverages, tobacco	11.5	22.6	8.8	39.2	0.2	2.1	15.6
Textiles	23.6	29.5	9.6	30.0	0.3	1.3	5.8
Wearing apparel	22.7	31.8	9.7	29.4	0.2	0.5	5.8
Leather products	22.9	31.7	9.1	29.7	0.2	1.4	5.0
Wood products	17.7	32.9	10.6	33.7	1.0	0.2	3.8
Paper, publishing	15.8	30.2	15.1	34.0	0.4	0.2	4.4
Petroleum	47.6	10.1	5.1	24.8	8.5	0.0	3.8
Chemicals, rubber	22.6	23.7	13.1	32.4	0.6	0.3	7.2
Mineral products	14.8	30.6	12.2	35.3	0.9	0.1	6.1
Ferrous metals	22.1	28.9	11.7	30.7	0.8	0.1	5.7
Other metals	28.0	25.4	10.7	29.6	1.0	0.1	5.2
Metal products	18.6	33.9	13.9	28.6	0.3	0.1	4.5
Motor vehicles	27.3	28.4	14.2	25.9	0.2	0.1	3.9
Transport equipment	25.3	30.7	16.0	23.8	0.2	0.1	4.0
Electronic equipt	30.4	24.4	15.2	26.0	0.1	0.1	3.8
Machinery, equipt	21.2	28.9	17.3	28.6	0.2	0.1	3.9
Other manufactures	20.7	28.0	11.1	33.3	0.5	0.3	6.0

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Table 6.2 Total Requirements Coefficients, World (percent) (Contd)

	Imports	Unskilled Labor	Skilled Labor	Capital	Natural Resources	Land	Indirect Tax
Electricity	14.6	17.6	10.6	48.4	3.3	0.0	5.4
Gas distribution	10.2	26.5	15.3	41.1	0.8	0.1	6.0
Water	7.3	28.8	16.7	42.6	0.3	0.1	4.3
Construction	13.2	36.1	15.4	30.6	0.3	0.1	4.3
Trade	6.8	35.9	15.2	36.8	0.2	0.3	4.9
Other transport	10.2	35.5	14.6	33.8	0.5	0.1	5.4
Water transport	34.0	22.5	10.6	25.5	0.4	0.1	7.0
Air transport	22.9	29.6	12.6	26.5	0.7	0.1	7.7
Communication	7.4	21.5	20.6	47.7	0.1	0.0	2.7
Financial services	4.4	24.4	27.1	40.1	0.1	0.0	4.0
Insurance	5.5	29.7	30.2	30.3	0.1	0.1	4.2
Business services	5.4	19.1	18.3	51.9	0.1	0.1	5.0
Recreatl services	8.5	23.1	21.1	40.4	0.2	0.5	6.2
Education, health	6.4	35.5	35.5	21.8	0.1	0.2	0.6
Dwellings	2.1	6.0	3.1	85.1	0.0	0.0	3.6
Private Consumption	16.3	24.2	13.9	35.4	0.4	1.4	8.3
Govt Consumption	10.5	33.3	30.8	23.6	0.2	0.2	1.5
Investment	26.5	27.5	12.9	26.0	0.2	0.2	6.6
Exports	20.1	27.1	13.8	31.4	1.8	1.1	4.8