

Chapter 9

Processing of Input-Output Data

A Agricultural Production Targeting

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A.1 Background

In GTAP parlance, agricultural production targeting (APT) is a procedure applied to a country's I-O tables before the main data construction phase. Except for its agricultural orientation, it is unrelated to the agricultural I-O data disaggregation. Rather, it arises from concerns that arose with the GTAP 5 Data Base, that in the data for European Union (EU) member countries, there were considerable inaccuracies in levels and international distribution of agricultural production, and, consequently, in the budgetary cost of assistance. This led to problems in the analysis of EU agricultural reform.

Investigation revealed that these inaccuracies largely reflected discrepancies between the representation of agriculture in the contributed I-O tables for EU member countries (Leeuwen 2002) and EUROSTAT production data relied upon by EU stakeholders. These arose partly from differences in reference years (the I-O data being older), but more from basic data differences.

In response, a special version of the GTAP 5 Data Base was prepared for the exclusive use of GTAP Consortium members, in which the agricultural production levels in EU member countries were revised. The revisions were made not within the database construction procedure itself but as adjustments to the I-O tables entering into the procedure. In GTAP 6 Data Base, this targeting was incorporated for the first time into a public data release. Since then, Consortium members interested in agricultural policy analysis have pressed for the extension of the targeting to non-EU countries.

The EU tables processed in the initial application provided full GTAP sectoral detail, and the original implementation of the procedure relied on such provision. We now find ourselves applying it to regions whose contributed tables require dis-aggregation. Rather than enhance the procedure to remove this limitation, we work around it by performing a partial run of the main GTAP data construction procedure, up to and including I-O table fitting, input the fitted tables

into the production targeting procedure. The tables input into the production targeting procedure are therefore fully dis-aggregated, as well as cleaned and fitted. That they are fitted is not strictly necessary, but we hope that it may minimize the deviations from the production targets within the main build, discussed in sections A.2 and A.5 below. The tables output from the targeting procedure are then fed into a complete and final run of the main construction procedure.

A special release of GTAP 10 Data Base further expanded the set of countries that are subject to agricultural production targeting based on data from the Food and Agricultural Organization (Chepeliev 2020). Apart from expansion in country coverage, the FAO agricultural output data also eases the incorporation nutritional accounts in the GTAP Data Base, thereby reducing inconsistencies between GTAP and FAO agricultural accounting (Chepeliev 2022).

The GTAP 11 Data Base targets agricultural production data for all 141 individual countries, using data from EUROSTAT (Boulanger, Philippidis, and Jensen 2023) for EU countries and from Food and Agriculture Organization (FAO) of the United Nations 2022 for the remaining countries. The APT procedure is not applied to the composite regions in the GTAP Data Base. The input data for agricultural output targets for FAO-covered countries follows the procedures developed in Chepeliev 2020. The targeting covers twelve agricultural sectors (Table 9.1).

Table 9.1: Commodities Subject to Agricultural Production Targeting

Code	Description	Code	Description
PDR	Paddy rice	C_B	Sugar cane, sugar beet
WHT	Wheat	OCR	Crops n.e.c.
GRO	Cereal grains n.e.c.	CTL	Bovine cattle, sheep and goats, horses
OSD	Oil seeds	OAP	Animal products n.e.c.
V_F	Vegetables, fruit, nuts	WOL	Wool, silk-worm cocoons
PFB	Plant based fibers	RMK	Raw Milk

Note: n.e.c. stands for not elsewhere classified.

A.2 Overview

The purpose of the procedure is to adjust the I-O tables to match the agricultural production targets. But circumstances complicate the situation. The adjustment is done before the data base construction procedure, but parts of that procedure, especially I-O table fitting (chapter 15) affect agricultural production levels in the I-O tables. In some cases, the agricultural production targets are incompatible with other data targets, more specifically, with export targets. And since the procedure was originally designed to deal with raw I-O tables that have not undergone the cleaning procedures described in chapter 8, it contains safeguards against anomalous conditions that could abort processing.

In the data base construction process, there are many steps that affect agricultural production levels in the I-O data, but the main step is the fitting of I-O tables to international data-sets.

There are many factors that affect agricultural production levels, but three are dominant: the targeting of GDP, exports, and production taxes. GDP targeting is achieved in effect by re-scaling the whole I-O table, so it affects production levels for all commodities. Changes in exports entail corresponding changes in production levels. Changes in production tax rates imply changes in either input or output values; an increase in the production tax rate, for instance, can be achieved either by increasing the money value of output or by reducing the money values of the intermediate and factor inputs. In practice, it is achieved by a combination of the two, leaning toward output value changes for domestically-oriented sectors and input value changes for export-oriented sectors.

It would be futile to target production levels in the incoming I-O tables if these were then altered drastically by the GDP, export, and production tax targeting. We therefore anticipate these adjustments in the production level targeting: we adjust not the production levels only but GDP, exports, and production taxes also. The tables going into the FIT process should therefore require little adjustment in these variables; we may then hope that the FIT process will have little effect on agricultural production levels.

Even though agricultural production targeting is done outside and before the main data construction procedure, it uses the same macroeconomic and protection data as those used in the final GTAP 11 Data Base construction. Since GTAP 11 Data Base, the trade data used agricultural production targeting and the final data construction is slightly different due to adjustments for fossil fuel exports in the latter procedure.

The attempt to anticipate the FIT export adjustments exposes another problem. In some cases, the export and agricultural production targets are simply incompatible. We encounter both hard inconsistencies, where the export target exceeds the production target, and soft inconsistencies, where the export target is lower than the production target, but still leaves very little domestic product available to the domestic market. Since the trade data are central to the whole data reconciliation process, in these cases, it is the production targets, not the export targets, that must give way. Accordingly, in such cases, we adjust the production targets before applying them to the I-O data.

To operationalize the concept of soft inconsistency, we deem a soft inconsistency to exist if the production target is less than the export target plus one quarter of the initial level of domestic absorption. But it would be meaningless to use the absorption level from the initial table, since that table may have any scale. So before testing for inconsistencies, we scale the I-O tables to match the GDP target. Having identified the inconsistencies, we then adjust the inconsistent production targets to exports plus one quarter of initial domestic absorption. In other words, we permit the production targeting to remove no more than three quarters of initial domestic absorption.

The general outline of operations is therefore:

- Clean the I-O tables.
- Adjust the tables to match the GDP targets.
- Identify inconsistencies between export and production and export targets; adjust the production targets.

- Adjust the tables to match export, output subsidy, and agricultural production targets.

We discuss the handling of export-production inconsistencies further in section A.3, and the production adjustments themselves in section A.4. Finally, in section A.5, we see how well the production targets are maintained in the database construction program. In the discussion that follows we focus primarily on the 2017 reference year of the GTAP 11 Data Base.

A.3 Export-Production Inconsistencies

For the 2004 reference year, 853 targets for individual countries are adjusted which is about 50 percent of the total. These include 351 adjustments for hard inconsistencies and 502 for soft. An example of hard inconsistency is the Canadian Wheat sector; here the production target of \$2,916 million is insufficient to cover exports of \$2,921 million. An example of soft inconsistency is the US wheat sector: with production of \$7,337 million, we can accommodate exports of \$5,284 million but domestic absorption of \$9,669 million is not possible.

The number of inconsistencies increased for the 2007 base year to reach 912 or around 54 percent of the total. The total number of hard target adjustments is 353, while the number of soft inconsistencies increased to 559. For the 2011 base year, the number of inconsistencies is 902 (53 percent of the total) with 358 hard target adjustments and 544 soft target adjustments. For 2014 the number of hard target adjustments is 353 and soft target adjustments is 577. For 2017 the numbers are 359 for hard target and 604 for soft target adjustments. For the latter year the share of adjusted targets is around 57 percent of the total.

Although many of the targets are adjusted, the targets for a majority of large sectors undergo no adjustment. The total target, summed over sectors and countries, is increased by 1.9 percent for 2004, 2.1 percent for 2007, 2 percent for 2011, 2.5 percent for 2014 and 2.7 percent for 2017 base years. Although the adjustments are quite severe in some cases, overall the targets are well maintained.

Table 9.2 reports some of the notable adjustments for the 2017 base year. Here, we select the items for which changes or differences are more significant than others, where the criterion for “most significant” takes into account both the absolute magnitude of the item and the relative magnitude of the change or difference. We see that adjustments are more prevalent among non-EU countries, and for the commodities vegetables and crops nec (ocr), vegetable, fruit and nuts (v_f), and oil seeds (osd).

Table 9.2: Production Target Adjustments for 2017: Selected Cases (US\$ million)

GTAP Region	Sector	Domestic Absorption	Exports	Initial Production Target	Adjusted Production Target
nld	ocr	2212	8336	897	8889
aus	ocr	10059	578	34	3093
ind	ocr	75150	3580	10832	22368
irq	v_f	23237	152	1178	5961
nld	osd	114	1240	4	1269
nga	ocr	6798	603	181	2302
nld	v_f	913	11008	4961	11237
bra	wol	4310	24	20	1102
irq	ocr	3798	2	15	951
isr	ocr	694	189	0	363
col	ocr	3280	4123	1719	4943
nga	gro	21011	1	2012	5254
irq	oap	6323	18	187	1599
usa	wht	28853	6388	8007	13602
irq	wht	13588	0	1040	3397
ken	osd	4787	3	99	1200
deu	ocr	8421	2400	1714	4505
nga	pdr	11259	1	771	2815
irq	gro	5600	0	187	1400
per	ocr	7829	1046	956	3003
sdn	ocr	3080	49	42	819
nga	osd	11221	262	1033	3067
sgp	ocr	11	174	0	177
are	v_f	5199	737	518	2037
can	ocr	298	934	115	1009

A.4 Production Adjustments

Table 9.3 shows the effects of the production adjustments for the 2017 base year. We compare the production level after GDP scaling (third column) to the adjusted production targets (fifth column). We also report the production levels obtained without the export and production subsidy adjustments being applied (fourth column).

Table 9.3: Production Adjustments for 2017: Selected Cases (US\$ million)

GTAP Region	Sector	Scaled	Without Production Adjustments	With Production Adjustments
chn	v_f	171045	461043	461043
chn	osd	142961	42478	42478
chn	gro	183608	70677	70677
ind	ocr	75770	10832	22368
nga	v_f	60251	17586	17586
chn	wht	108801	49481	49481
idn	pdr	24666	58227	58227
chn	wol	23047	5569	5583
grc	osd	270	7560	7560
irq	v_f	23350	1178	5961
ind	pdr	43032	80583	80583
vnm	v_f	14235	37610	37610
bra	oap	11491	32857	32857
nga	gro	21014	2012	5254
fra	v_f	7624	25056	25056
usa	ctl	101819	61829	61829
rus	v_f	36827	15390	15390
ind	ctl	24799	8192	8192
usa	wht	33068	8007	13602
chn	ocr	59843	32649	32649

The results suggest that the largest adjustments are concentrated in a few countries – China, India, the United States, and Nigeria. Large adjustments are especially common for vegetables, fruit and nuts (v_f), other crops (ocr) and oil seeds (osd). Although there are some upward adjustments (for example, v_f, in China in 2017), for the 2017 reference year, most adjustments are downward. Overall, in the countries subject to targeting, agricultural production increased by 1.8 percent for 2004 base year; 0.2 percent for the 2007 base year, 8.1 percent for the 2011 base year, and decreased by 4.5 and 10.4 percent for the 2014 and 2017 base years, respectively.

A.5 Deviations from Targets in the Main Data Base Construction Program

As noted above, the production adjustment is performed before the main data construction program. The adjusted targets are attained quite accurately within the adjustment program itself, but nothing in the main program guarantees that they will be maintained through the regular I-O processing. In table 9.4 therefore, we examine the largest deviations between the production targets and the final data.

Table 9.4: Deviations from Production Targets for 2017: Selected Cases (US\$ million)

GTAP Region	Sector	Target	Final
arg	oap	4039	8882
jpn	ctl	13466	7995
tcd	c_b	15	474
sdn	ctl	4093	2294
sdn	v_f	4370	2512
ken	rmk	3493	1888
usa	gro	53716	61234
ken	ctl	3590	1990
tur	ctl	11799	8814
usa	v_f	62263	69281
arg	ctl	16929	13697
usa	osd	44860	50529
dza	v_f	14045	11175
sdn	rmk	2487	1377
ind	wht	30321	26164
vnm	v_f	37610	33014
vnm	oap	10803	8464
irq	v_f	5961	7835
tcd	ctl	1834	2840
sdn	gro	1831	1068

Overall, deviations from the target are not extreme. Key deviations in 2017 are in the United States, Sudan, Algeria and Vietnam. In terms of commodities, the sectors with large number of deviations include vegetables, fruit and nuts (v_f), cattle (ctl), raw milk (rmk) and oil seeds (osd). Bearing in mind that the differences presented are those considered most serious, we may say that the targets are well maintained. There is a slight general downward bias in the errors with overall agricultural production for the targeted countries below target by only 3.5 percent for 2004, 2 percent in 2007, 1.3 percent in 2014 and 2011, and 0.7 percent for 2017.

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