

# *Ukraine*

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## **1. Introduction**

Contributed IO table for Ukraine is based on the Ukrainian State Statistic Service official release of the 2013 Input-Output table at basic prices, which can be found on the official web site of the State Statistics Service (SSS).<sup>2</sup> SSS also publishes input-output tables at consumer prices, but considering the GTAP construction framework it is more preferable to use IO tables at basic prices. Another possible choice was to apply the newer IO table release as long as for August 2016 the latest available year is 2014. But due to the significant production structure changes that started in 2014 as a result of the severe economic recession (in 2014 Ukrainian real GDP fall by 6.6%<sup>3</sup> compared to the 2013 level, while remaining unchanged in 2013 compared to 2012) the 2013 IO table was considered as more representative. Finally, it was possible to choose 2012 IO table, which can be also considered representative enough as in 2012 a slight economic growth had place (GDP has increased by 0.3%<sup>3</sup>). But comparison of mappings between 2012/2013 IO tables and GTAP sectoral disaggregation suggested that preference should be given to the 2013 IO table, as in the latter case the largest set of sectors to which both GTAP and Ukrainian IO table can be mapped equals 27, while in case of 2012 data this number reduces to 21.

## **2. Description of the IO table structure**

The source IO table uses the commodity by commodity approach and all flows are measured in local currency – millions of Ukrainian hryvnas (mn UAH). A source IO table has 42 sectors, which can be mapped to 27 GTAP sectors.

On the supply side Ukrainian IO table has separate representation of trade and transportation margins, as well as taxes and subsidies on goods (*Figure 1*). Trade and transportation margins are excluded from the intermediate consumption (from “Trade; repair of motor vehicles, household appliances and personal demand items” and “Activity of transport” respectively) and as a result the initial IO table is unbalanced – the column sums (for aforementioned trade and transport activities) exceeds corresponding rows sum exactly by the amount of trade and transportation margins.

The second quadrant of the Ukrainian IO table (Final use) includes Final consumption categories: households, non-profit institutions that serve households and general government (both collective and individual). There is also a gross capital formation category that includes gross fixed capital formation,

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<sup>2</sup> State Statistics Service of Ukraine: <http://www.ukrstat.gov.ua/> (Publications-> National accounts-> Ukraine’s Input-Output Table at Basic Prices)

<sup>3</sup> State Statistics Service of Ukraine: <http://www.ukrstat.gov.ua/> (Statistical Information-> National accounts-> The change of gross domestic product volume)

change in inventories and net acquisition of valuables. Finally, there are export and import columns, the latter one is with the minus sign (Figure 1).

Output Expenditures	Intermediate consumption by economic activities	Final use				Total used
		Final consumption expenditure	Gross capital formation	exports	Imports (-)	
Goods(services) at basic prices Transport margin on used goods Trade margin on used goods Taxes excluding subsidies on used goods <b>Total use at consumer prices</b>	<b>I<sup>st</sup> Quadrant</b>	<b>II<sup>nd</sup> Quadrant</b>				
Compensation of employees Other production related taxes excluding subsidies Gross operating surplus, mixed income <b>Gross value added</b>	<b>III<sup>rd</sup> Quadrant</b>					
<b>Output at basic prices</b>						

**Figure 1. Scheme of Ukrainian Input-output table at basic prices**

The third quadrant of the table (Gross value added) includes compensation of employees, other taxes, excluding other production subsidies and gross operating surplus, mixed income (Figure 1).

As an additional information Ukrainian IO table also includes matrix of taxes and subsidies, which allocates net taxes among different commodities as well as final consumption categories. Taxes and subsidies on imported commodities as well as import duties are included into this matrix and aggregated with domestic taxes. Another appendix of the Ukrainian IO table includes allocation of imports between intermediate and final consumption categories (matrix of imports).

### ***3. Processing of the source IO table***

#### ***3.1 Commodities disaggregation***

A source 2013 IO table has 42 commodities, which can be mapped to 27 GTAP sectors. As will be shown in the section 3, Ukrainian IO table has more detailed representation of services, while agricultural and production sectors are more aggregated than in GTAP. To handle this issue two approaches can be used: A) Ukrainian IO table can be submitted without any additional sectoral disaggregation with 27 sectors. In this case further disaggregation would be done by the Center using additional data for agricultural sector and world average IO table structure for other sectors. B) Further disaggregation of the Ukrainian IO table can be done using national IO tables for other years: a 2011 IO table can be used to separate natural gas and heat within energy as well as forestry and fishing from agriculture; additional disaggregation can be

provided using 2005 IO table, which has 82 sectors<sup>4</sup> with a more detailed representation of transport activities, manufacturing, food production etc.

On the one hand application of country-specific data for disaggregation can be regarded as a more representative, while on the other 2005 data can be considered outdated and not relevant enough. For these reasons a combined approach was applied: 2010 IO table was used to split forestry, fishing, natural gas and heat supply activities, while further disaggregation was expected to be done using Center's methodology.

For the most part 2013 and 2011 IO tables are similar, having almost the same sectoral mapping, except for one. 2011 table has a non-diagonal intermediate consumption matrix as it includes an additional column of "Financial intermediation services indirectly measured". This activity represents a difference between interest, received by financial institutions under credits, and paid under deposits<sup>5</sup>. In the 2011 IO table, because of the impossibility to depict distribution by activity, it is included into intermediate consumption as a separate column in the "Finance" row, and shown with minus sign in the "Gross operational surplus, mixed income" row. In order to move to the diagonal make matrix "Financial intermediation services indirectly measured" were divided between other economic activities proportional to value added shares.

After that a 2011 IO table was applied to disaggregate the 2013 data, including IO table, matrix of import and matrix of taxes and subsidies. This resulted in the IO table with 46 commodities. One issue that emerged during the disaggregation was that the 2011 IO table contained negative value of "Gross operational surplus, mixed income" for "Steam and hot water supply" commodity. Due to the high level of consumer subsidies, which were eliminated only during 2015-2016, "Steam and hot water supply" activity displayed losses for five years in a row and the most recent IO table with the profit is for 2006. For energy sector's "Gross operational surplus, mixed income" disaggregation in 2013 IO table shares from the 2006 IO table were applied.

After the sectoral split some small imbalances aroused between row and column sums for the newly created activities. Deviations did not exceed 0.3-8.9% of corresponding commodities output for agriculture and 2-10.9% for energy sector. They were eliminated by redistribution within disaggregated activities, as the sum for each disaggregated cell would be the same as in the source 2013 IO table.

### ***3.2 Data rearrangement***

As noted in the section 1.2 an initial IO table is not balanced as long as trade and transportation margins are separated from the corresponding sectors. The first step of the data rearrangement process included aggregation of trade margins with "Trade; repair of motor vehicles, household appliances and personal demand items" sector and transport margin with "Activity of transport".

Another issue is that commodity taxes in the source IO table are represented in the IIIrd quadrant, while within the GTAP framework they should be included into IInd quadrant. Furthermore, commodity taxes for final consumption categories in Ukrainian IO table are excluded from final consumption.

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<sup>4</sup> This is the only year when State Statistics Service of Ukraine issued an experimental disaggregated IO table with 82 sectors

<sup>5</sup> State Statistics Service of Ukraine (2012) Ukrainian Input-Output Table at Consumer Prices for 2010. Kiev. <http://www.ukrstat.gov.ua/> (Publications-> National accounts-> Ukraine's Input-Output Table at Consumer Prices)

Commodity taxes were distributed between final consumption categories according to the tax matrix and added with the minus sign to the commodity taxes column in the II<sup>nd</sup> quadrant. GTAP data format also requires if available information on tariffs and other import taxes. In Ukrainian IO table these kinds of taxes are included into commodity taxes. Firstly, total value of import duties, based on the National Ukrainian budget data for 2013<sup>6</sup>, was extracted from these taxes and distributed among industries based on the import flows. While secondly, the remaining taxes were divided into domestic and import related based on the matrixes of import flows and domestic production.

Further data rearrangement also included transition to net taxes (taxes excluding subsidies), aggregation of final household's consumption expenditure and final consumption expenditure of non-profit institutions serving households, as well as aggregation of changes in inventories and net acquisition of valuables.

Matrix of taxes and subsidies included a separate row of taxes as a part of trade and transport margins. These values were redistributed among commodities proportional to the volumes of trade and transport margins.

Finally, 3 out of 46 sectors had a negative value of capital income, although not all of them would represent separate commodities in the final GTAP database. Particularly, Manufacture of coke and Manufacture of chemical products would be aggregated with other sectors that have larger positive capital income. The only sector with negative capital payments, which would not be aggregated is Water supply activity. In order to move to the positive value, it was assumed that the rate of capital income for the water supply sector in 2013 is the same as in 2012. As the value of capital payment was increased the corresponding decrease was applied to the labor payments. The same rebalancing approach was also applied in other studies<sup>7</sup>.

### 3.3 Mapping

After the disaggregation an initial 2013 IO table (as well as tax matrix and matrix of imports) with 42 commodities was extended to 46 commodities, which were mapped to 30 GTAP sectors (Table 1).

**Table 1. Sectoral mapping**

No.	Ukrainian IO table Sectors	GTAP Codes	No.
1	Agriculture, hunting and related service activities	pdr, wht, Gro, v_f, Osd, c_b, Pfb, ocr, ctl, oap, rmk, wol	01-12
2	Forestry, logging and related service activities	frs	13
3	Fishing, fish farming and related service activities	frs	14
4	Mining of coal and lignite	coa	15
5	Extraction of crude petroleum and natural gas	oil, gas	16, 17
6	Mining of metal ores; other mining and quarrying; mining support service activities	omn	18

<sup>6</sup> State Treasury Service of Ukraine <http://www.treasury.gov.ua/>

<sup>7</sup> Rutherford T. and Paltsev S. (1999) From an Input-Output Table to a General Equilibrium Model: Assessing the Excess Burden of Indirect Taxes in Russia. Available at: <http://web.mit.edu/paltsev/www/docs/exburden.pdf>

Ukrainian IO table		GTAP	
No.	Sectors	Codes	No.
7	Manufacture of food products; beverages and tobacco products	cmt, omt, vol, mil, pcr, sgr, ofd, b_t	19-26
8	Manufacture of textiles, wearing apparel, leather and related products	tex, wap, lea	27-29
9	Manufacture of wood, paper, printing and reproduction	lum, ppp	30, 31
10	Manufacture of coke	p_c	32
11	Manufacture of refined petroleum products		
12	Manufacture of chemicals and chemical products	crp	33
13	Manufacture of basic pharmaceutical products and pharmaceutical preparations		
14	Manufacture of rubber and plastic products		
15	Manufacture of other nonmetallic mineral products	nmm	34
16	Manufacture of basic metals	i_s, nfm	35, 36
17	Manufacture of fabricated metal products, except machinery and equipment	fmp	37
18	Manufacture of computer, electronic and optical products	ele	40
19	Manufacture of electrical equipment	ome	41
20	Manufacture of machinery and equipment n.e.c.	ome	42
21	Manufacture of motor vehicles, trailers and semi-trailers	mvh	38
22	Manufacture of other transport equipment	otn	39
23	Manufacture of furniture; jewelry, musical instruments, toys; repair and installation of machinery and equipment	omf	42
24	Production and distribution of electricity	ely	43
25	Production and distribution of gas	gdt	44
26	Steam and hot water supply		
27	Water supply; sewerage, waste management and remediation activities	wtr	45
28	Construction	cns	46
29	Wholesale and retail trade; repair of motor vehicles and motorcycles	trd	47
30	Transport, warehousing	otp, wtp, atp	48, 49, 50
31	Postal and courier activities	cmn	51
32	Accommodation and food service activities	trd	47
33	Publishing, motion picture, video, television programs production; sound recording, programming and broadcasting activities	ppp	31
34	Telecommunications	cmn	51
35	Computer programming, consultancy, and information service activities	obs	54
36	Financial and insurance activities	ofi, isr	52, 53
37	Real estate activities	obs	54
38	Legal and accounting activities; activities of head offices; management consultancy activities; architectural and engineering activities; technical testing and research		
39	Scientific research and development		
40	Advertising and market research; other professional, scientific and technical activities; veterinary activities		
41	Administrative and support service activities		
42	Public administration and defense; compulsory social security	osg	56
43	Education		
44	Human health activities, residential care activities and social work activities without accommodation		
45	Arts, entertainment and recreation	ros	55
46	Other service activities	ros	55

#### **4. *Inconsistency checks***

According to the final check all required cells are positive, provided input-output table is balanced (total row/col differences is under 0.02, which is mainly due to the GEMPACK rounding error), there are no too-high taxes on domestic or imported products and income-expenditure GDP difference is 0.003.