TREATMENTS APPLIED TO THE ROMANIAN INPUT/OUTPUT TABLE: A METHODOLOGICAL NOTE[1]

by

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1. Introduction

Among the 96 regions defined by GTAP 6 database, Romania constitutes a separate entity. The most recent release of the database included the Romanian component, an input/output table derived from a 1997 version provided by Henrichsmeyer, W., J. Köckler, A. Quiring and T. Möllmann (1999).

Funded by the "Agricultural Trade Agreements (TRADEAG)", a European Commission VI Research Framework project, the authors have undertaken to provide updated data using as reference a 2002 base year input/output table compiled by the National Statistical Agency of Romania. The present paper describes the methodology used to adjust the above mentioned table in order to make it compatible with the GTAP framework and by doing so making it available in a "standard" format for a global network of researchers conducting CGE analysis.

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2. The source

The source IO table dates back to 2002. It is presented in a symmetric format of 105 commodities (rows) and 105 industries (columns) using a classification compatible with NACE Rev.3, while from a methodological point of view, it has been built based on the requirements of the European System of Accounts (ESA). The table has been compiled at current prices, with valuation in basic prices and purchasers' prices for different components.

The original four sub-tables are the following:

- the supply table: contains information on production (evaluated at basic prices), imports (CIF prices), and adjustments elements for transforming the passage into purchasers' prices: taxes on products including VAT, customs duties, subsidies on products and imports and trade margins.
- intermediate consumption: valued at purchasers' prices of the industries, excluding deductible VAT.
- final demand: split into final consumption expenditure of private households and government, gross fixed capital formation, changes in inventories and exports.
- the primary IO table: contains the elements of value added, i.e. compensation of employees, other taxes on production, other subsidies on production and gross operating surplus.

This relatively high level of sectoral breakdown and data abundance of the source IO table has allowed us to construct a mapping table without further disaggregation for most of the sectors. However, there are certain elements (among which the disaggregation of agricultural sectors) that require particular attention.

3. Our treatment

To ensure reproducibility and transparency, all of our treatments have been carried out using GAMS (General Algebraic Modeling System). The code describing and implementing the whole methodology can be made available for those interested.

Given that the original table has been expressed in national currency, a conversion to USD has been implemented at the official rate of the National Bank of Romania for 2002 at 33,055.46 ROL/USD.

The first step of the transformation procedure into GTAP format involves the definition of a correspondence table between the sectors of the national IO table and the sectors defined by GTAP. Based on this mapping table, one could find that some of the sectors of the national classification need aggregation, some disaggregation (see Table 1). In making further adjustments we adhere to the methodology described by the GTAP Consortium (see Huff, McDougal, Walmsley "*Contributing Input-Output tables to the GTAP Data Base*", 2000 and Banse, Walmsley "*Central and Eastern Europe*").

Along the applied transformation procedure, we have encountered the following difficulties that should be tackled with great attention:

1. The level of aggregation for agricultural and food processing sectors
2. The treatment of trade/transport margins
3. Elimination of re-exports
4. Domestic vs. imported split
5. Splitting value added into its components

3.1. Disaggregating agricultural and food processing sectors

In spite of the fact that on the overall the Romanian IO table could be considered as a highly disaggregated one (105 sectors), agricultural and food processing data is mainly comprised in 7 sectors – as opposed to the 20 described by GTAP. Consequently, the adoption of a certain disaggregating procedure depends on data availability constraints:

a. In an ideal case, there is a national IO table focused on agriculture (or a subset of agriculture products) coming from another source that could be integrated to the general IO table through a simple scaling procedure.

b. A second rank possibility is to obtain an existing, detailed IO table of a representative region of the given country/ or the IO table of a similar country. This allows the use of a relevant description of technology of production in spite of a pure proportional splitting (see below). Given this information, a cross-entropy method can be used to match production/consumption levels by sector at the national level. Production and Consumption data for detailed agricultural sectors could come from FAO or Eurostat statistics.

c. Last solution (least information required), the production levels of detailed sectors are used to build a pure "proportional" IO block for agricultural sectors. Broadly speaking[2], starting from a C_{VV}, intermediate consumption of product V (vegetal) by sector V, we use the share shP_i of product i in overall production of V. Then, the computed intermediate consumption of a product i by sector j is

[2] The effective computation is a little bit more complex since we have several sectors (Vegetal, Animal, General services) to ventilate simultaneously.

$c_{ij} = \frac{shP_i \times shP_j}{\sum_{i,j} shP_i \times shP_j} C_{VV}$, $\forall i, j \in V$. No information about effective IO relations is used (that could lead to abnormal figures such as Rice production using Maize…). Finally, a cross-entropy minimization process should apply to check rows/columns constraints i.e. $shP_j \times C_{VV} = \sum_i c_{ij}$ and $shP_i \times C_{VV} = \sum_i c_{ij}$

The lack of available data for Romania has driven us to apply the last of the presented procedures. The corresponding shares have been built by using FAO's utilization accounts (production data) for the year 2002. As a result the following sectors of the national classification have been disaggregated: vegetal production (GTAP 1–8), breeding (GTAP 9-12), auxiliary services (spread along GTAP 1-12), meat production and processing (GTAP 19+20), production of vegetal and animal oil and fat (GTAP 20+21), production of milling products, starch (GTAP 23+25), manufacture of fodder (GTAP 24+25). Moreover, for imports and exports we can rely on highly disaggregated data (HS6 level). Using this information we can define a more accurate splitting coefficient matrix for traded goods.

3.2. The treatment of trade and transport margins, CIF/FOB adjustments

The supply table of the Romanian national classification contains certain adjustment elements which allow a transformation of the passage from basic prices (production) and CIF price (imports) into purchasers' prices (uses). During the treatment of these adjustment elements the subsequent corrections have been made:

Trade and Transport margins. Although there has been a growing attention oriented towards the treatment and incorporation of domestic margins into the GTAP model, as opposed to international margins, there is no well defined methodology for this kind of treatment yet.

Since the treatment made in the original SAM implies an increase of the supply of goods using trade/transports and a reduction of the available production of these sectors, we use cross entropy methodology to change the supply side matrix in order to match the existing demand on each market. Broadly speaking, intermediate uses and value added of the trade/transports sectors are reduced (that drives a fall in production of these sectors) and intermediate uses and value added of the other sectors are increased according to the amount of the margins linked to these sectors (Total Intermediate uses by product and total value added by factor are kept constant). Here we reach the equilibrium by reducing the production of the Trade/Transports sectors.

CIF/FOB adjustments on imports: in order to eliminate CIF/FOB corrections, we adjust export values to maintain market clearance for every sector.

3.3. Elimination of re-exports

The GTAP framework requires the elimination of re-exports from both exports and imports data. Sectors for which the value of exports was exceeding production (or imports were exceeding total demand) in the original national classification format are presented in Table 2. As a further step, a pro-rata system has been implemented for the removal of re-exports. For all the given seven sectors, the magnitude of the correction is significant (ranging from 11.3% to 61.9% of total exports). Nevertheless, by taking a

closer look at the nature of these sectors, one could explain the presence of re-exports due to the presence of *"lohn"*-type operations that characterize so well the Romanian textile industry.

3.4. Domestic vs. imported split

For carrying out the domestic/imported split we have first used a pro-rating method based on the available imports column vector as described in the GTAP documentation. However we have taken this treatment one step further, by correcting these initial matrices taking into account real trade flows. Indeed, since we use a different splitting vector for domestic goods and imported ones, we could not apply a uniform domestic/imported ratio for the different components of an aggregated sector from the initial SAM.

3.5. Splitting Value Added into its components

It is very difficult to obtain a good ventilation of the Value Added generated by the agricultural activities in particular and for other sectors in general. First, the split between labor income and "profits" is dependent on the hypothesis made on self employment in the sector. Second, "profits" should be shared between Capital and Land income.

With the information originating from the IO table and the share of land in "Profits" from GTAP6, the land component of value added for the agricultural sectors using land has been determined (sectors 1 to 12).

3.6. Other assumptions and treatments

- for splitting sectors 30 and 96 of the national classification (Manufacture of leather and fur clothes, Financial, banking and insurance services, respectively) into their corresponding GTAP components, shares from GTAP 6 have been utilized.
- FISIM correction: the original intermediate consumption table apart from the symmetric 105/105 sector matrix, includes one column referred to as FISIM – containing information about financial services. Basically, it can be regarded as a fictitious branch, not having other intermediate consumption only the one referring to financial intermediation, i.e. sector 96 Financial, banking and insurance services. It mainly reflects activities consisting in collecting and distributing the financial availability. [3] When dealing with this in fact fictitious sector, there are two available alternatives: it is possible either to increase the intermediate consumption of the corresponding sector and then adjust for the value added components, or to increase the intermediate consumption of the rest of the sector based on a proportional split and again adjust for then VA components. The chosen treatment is the first from the ones described above – however it is important to mention that this treatment has lead to a significant fall of 46% of value added for sector 96 Financial, banking and insurance services.
- Existing negative investments have been set to zero, by using the "Changes in stocks" component.

[3] For more detailed information see Eurostat's Input Output Manual, Luxemburg, July 2001

- Intermediate consumption is valued at purchasers' prices of the industries, excluding deductible VAT. This is assumed basic to correspond to the pre-commodity tax usage matrix (UF). Furthermore, tariffs are assumed to be included in UF.

4. Comparing IO tables using entropy

We have examined differences that arise between the newly generated Romanian IO table and the one existing in the GTAP by employing an entropy measure developed in Walmsley and McDougall (2004). The method mainly consists in generating a measure of inconsistency between the shares represented in the two tables that are then used as a tool for determining sectors with the highest level of discrepancy. As expected, we find the most significant differences for agricultural sectors, for which in fact we have undertaken a new method of disaggregation. In decreasing order, the biggest differences are found for the following GTAP sectors: 1, 12, 7, 5, 6, 11, 4, 9, 10 and 14.

5. Conclusion

The success and quality of the GTAP database relies mainly on information provided by each and every contributor. Nevertheless, building and transforming IO tables for this purpose represents several challenges. The present paper described the methodology used to adjust the Romanian Input/Output (IO) table in order to make it compatible with the GTAP framework and by doing so making it available in a "standard" format for a global network of researchers conducting CGE analysis.

Table 1: National Classification-GTAP sectors mapping

National Classification		NACE	GTAP sector
01	*Vegetal production	01.1 ; 01.3	1 - 8
02	*Breeding	01.2 ; 01.3	9 - 12
03	*Auxiliary services	1.4	1 - 12
04	Forestry and hunting	02.0 ; 01.5	13
05	Logging	2	13
06	Fishing and aquaculture	5	14
07	Coal mining and processing (including bituminous shale)	10	15
08	Extraction of petroleum (including auxiliary services)	11.1 ; 11.2	16
09	Extraction of natural gas (including auxiliary services)	11.1 ; 11.2	17
10	Radioactive ores quarrying and processing	12	18
11	Ferrous ores quarrying and processing	13.1	18
12	Non-ferrous ores quarrying and processing	13.2	18
13	Extraction of building material ores	14.1	18
14	Extraction of clay and sand	14.2	18
15	Extraction and processing of chemical ores	14.3	18
16	Extraction and processing of salt	14.4	18
17	Other non-ferrous ores quarrying and processing	14.5	18
18	*Meat production and processing	15.1	19+20
19	Processing and preserving of fish and fish products	15.2	25
20	Processing and preserving of fruits and vegetables	15.3	25
21	*Production of vegetal and animal oil and fat	15.4	20+21
22	Production of milk products	15.5	22
23	*Production of milling products, starch	15.6	23+25
24	*Manufacture of fodder	15.7	24+25
25	Processing of other food products	15.8	25
26	Beverages	15.9	26
27	Tobacco products	16	26
28	Textile industry	17	27
29	Textile clothing	18.1 ; 18.2	28
30	*Manufacture of leather and fur clothes	18.3	28+29
31	Footwear and other leather goods	19	29
32	Wood processing (excluding furniture)	20	30
33	Pulp, paper and cardboard; related items	21	31
34	Publishing, printing and reproduction of recorded media	22	31

35	Coking	23.1	32
36	Crude oil processing	23.2	32
37	Processing of nuclear combustibles	23.3	32
38	Basic chemical products	24.1	33
39	Pesticides and other agrochemical products	24.2	33
40	Dyes and varnishes	24.3	33
41	Medicines and pharmaceutical products	24.4	33
42	Soaps, detergents, cosmetics, perfumery	24.5	33
43	Other chemical products	24.6	33
44	Synthetic and man made fibres	24.7	27
45	Rubber processing	25.1	33
46	Plastic processing	25.2	33
47	Glass and glassware	26.1	34
48	Processing of refractory ceramics	26.2	34
49	Ceramic boards and flags	26.3	34
50	Brick, tile and other building material processing	26.4	34
51	Cement, lime and plaster	26.5	34
52	Processing of concrete, cement and lime items	26.6	34
53	Cutting, shaping and finishing of stone	26.7	34
54	Other non-metallic mineral products	26.8	34
55	Metallurgy and ferroalloys processing	27.1	35
56	Manufacture of tubes	27.2	35
57	Other metallurgy products	27.3	35
58	Precious metals and other non-ferrous metals	27.4	36
59	Foundry	27.5	35
60	Metal structures and products	28	37
61	Manufacture of equipment	29.1	41
62	Machinery for general use	29.2	41
63	Agricultural and forestry machinery	29.3	41
64	Machine tools	29.4	41
65	Other machines for special use	29.5	41
66	Armament and ammunition	29.6	42
67	Labour-saving devices and domestic machinery	29.7	41
68	Computers and office means	30	40
69	Electric machinery and appliances	31	41
70	Radio, TV-sets and communication equipment	32	40
71	Medical, precision, optical, watchmaking instruments	33	41

72	Means of road transport	34	38
73	Naval engineering and repair	35	39
74	Production and repair of railway transport means	35.1	39
75	Aircraft engineering and repair	35.2	39
76	Motorcycles , bicycles and other transport means	35.3	39
77	Furniture	35.4; 35.5	42
78	Other industrial activities	36.2 - 36.6	42
79	Electric power production and distribution	40.1	43
80	Gas production and distribution	40.2	44
81	Production and distribution of thermal energy	40.3	44
82	Water collection, treatment and distribution	41	45
83	Construction	45	46
84	Wholesale and retail	50 - 52	47
85	Hotels	55.1 ; 55.2	47
86	Restaurants	55.3 - 55.5	47
87	Railway transport	60.1	48
88	Road transport	60.2	48
89	Pipe-line transport	60.3	48
90	Water transport	61	49
91	Air transport	62	50
92	Auxiliary transport activities and travel agencies	63.1 ; 63.2	48
93	Tourism agencies and assistance	63.3	48
94	Post and mail	64.1	51
95	Telecommunication	64.2	51
96	*Financial, banking and insurance services	65 - 67	52+53
97	Real estate activities	70	54
98	Computer and related activities	72	54
99	Research and development	73	54
100	Architecture, engineering and other technical services	74.2	54
101	Other business activities	71 ; 74.1 ; 74.3 - 74.8	54
102	Public administration and defence, compulsory social assistance	75	56
103	Education	80	56
104	Health and social work	85	56
105	Other services (collective, social and personal services)	90 - 99	55

* Indicates sectors which required splitting

Table 2: Commodities for which re-exports have been removed

National Classification		Applied correction	
		% of Production	% of Exports
29	Textile clothing	12.8	11.3
31	Footwear and other leather goods	88.5	47.0
57	Other metallurgy products	142.1	58.7
62	Machinery for general use	61.8	38.2
70	Radio, TV-sets and communication equipment	79.0	44.1
76	Motorcycles , bicycles and other transport means	162.3	61.9
90	Water transport	122.0	55.0

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