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Forecasting the Romanian sectoral economy using the input-output method

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Abstract: *The purpose of this paper is to forecast the sectoral output in 2013 based on the input-output structure of Romanian economy in 2010. Considering that the economic linkage mechanisms do not easily change during certain time periods, the forecasting is possible, even if not in the sequence of the time passing. Using the technical matrix of the sectoral structure described for year 2010 and some known indicators of the economic sectors, as the value added for each sector in 2013, the sectoral output is projected for 2013. The Romanian GDP in 2013 is estimated based on the input-output model. From a managerial perspective, this study is useful to forecast the sectoral output and to understand the sectoral behaviour, based on the input-output analysis of the value added, the compensation for employees and the final demand, which were considered here.*

Key-words: *input-output analysis, forecasting, output multipliers, backward linkage, forward linkage*

1. Methodology

The European System of Accounts (ESA95) has established as compulsory the transmission of National Accounts to Eurostat, and more precisely in the field of Supply, Use and Input-Output tables, for each Member State of the European Union.

The data transmission has envisaged three types of tables: annually - the Supply and Use tables (SUT) and every five years - the Symmetric Input-Output tables (SIOT), in a standardized format for 64 industries (NACE rev.2) and 64 products (CPA 2008).

The purpose is to aggregate the national Supply and Use tables at basic prices of all EU Member States into a consolidated *European Supply and Use tables* and an *Input-Output table*, for each year. The Supply, Use and Input-output tables for the European Union and for the euro area were released for the first time in October 2012, for the year 2008. Since then, the European tables in NACE Rev2 were made

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by Eurostat for every year, establishing the transmission deadline for EU States as three years after the end of the reference year.

Starting with September 2014, the European transmission program of National Accounts applies the European System of Accounts 2010 (ESA 2010), a development of the System of National Accounts 2008. The first mandatory transmission of the national accounts according to ESA 2010 is for the year 2010.

According to the new methodology of ESA 2010, the Member States of the European Union would send their Supply, Use and Input-Output tables by the end of 2014, for the years 2010 and 2011.

The set of tables for each EU Member State comprises the following ten tables: five official tables and five additional tables. The official tables are expressed either at basic prices and/orpurchasers' prices, having yearly or 5-yearly frequency of transmission.

The official tables are:

- *Supply table* at basic prices (SUPbp) with a transformation into purchaser's prices – yearly;
- *Use table* at purchasers' prices (USEpp) – yearly;
- *Symmetric input-output tables at basic prices for product by product* (SIOT), 5-yearly;
- *Symmetric input-output table for domestic output at basic prices (product by product)* (SIOTdom) - 5-yearly;
- *Symmetric input-output table for imports at basic prices (product by product)* (SIOTimp) - 5-yearly.

The additional tables are: *Use table* at basic prices (USEbp), *Use table for domestic output* at basic prices (USEdombp), *Use table for imports* at basic prices (USEimpbp), emphasizing the *imports intra EU and/or intra EA* and *imports extra EU/extra EA*, *Trade and Transport Margins* table (TTM), and *Taxes Less Subsidies* on products table (TLS).

The ESA 2010 methodology established an extension of the consolidated tables for environment. Environmental input-output tables by industries and private households include eight types of air emissions: Carbon dioxide (CO_2), Nitrous oxide (N_2O), Methane (CH_4), Sulphur oxides (SOx), Nitrogen oxides (NOx), Ammonia (NH_3), Carbon monoxide (CO), Non-methane volatile organic compounds (NMVOC) (“*Technical Documentation on the European consolidated tables for years 2010 and 2011*”, 2014, European Commission, Luxembourg, http://epp.eurostat.ec.europa.eu).

In the estimation process for the year 2010, the EU countries belong to different cases defined for the taxonomy of the best practices in the European transmission program of National Accounts. Case 0 describes the situation in which all required tables are available for their validation. The cases from 0 to 4 classify the EU countries by the accomplishing degree of the transmission process. Romania is in the group of case 0. Until July 2014, Romania was one of the 13 countries

which transmitted the set of tables for 2010, based on ESA 1995. Out of the five countries, which sent the 2011 tables, only Finland finished all the required tables. In 2015, updated European consolidated tables for the years 2010 and 2011 were published (*„Technical Documentation on the European consolidated tables for years 2010 and 2011"*, 2014, European Commission, Luxembourg, http://epp.eurostat.ec.europa.eu).

2. Objectives

The main objective is to forecast the sectoral structure of the Romanian output in 2013, based on the input-output structure of the Romanian economy, already known from 2010, from the study *„Sectoral structure of Romanian economy"* (Duguleană C., Duguleană L., 2016), describing the six Romanian economic sectors: *Agriculture, Manufacturing, Construction, Trade, Business services* and *Other services*. (http://webbut.unitbv.ro/Bulletin/Series%20V/BULETIN%20I/27_ Duguleana %20C-L.pdf)

The economic diffusion of sectors is characterized by economic linkage mechanisms. The intersectoral relationships do not easily change during certain periods. The economy is a complex system which is not very sensitive to changes. The behaviour conservatism of consumers is due to certain social and economic conditions, education, habits, religious, customs and traditions, which make them accept changes in a moderate rhythm. Producers have some technological reasons of their physical capacities and investments, their legal restrictions of financing credits and banking rules, legal matters of their partnerships contracts, which make them have the same production behaviour in the long term, keeping their already existent markets.

Based on the assumption of a constant structure in time of the economic sectors, the forecasting is possible, even if not in the sequence of the time passing.

The study uses the technical matrix of the sectoral structure described for year 2010 (Duguleană C., Duguleană L., 2016) and some already known economic sectoral indicators, as the value added for each sector in 2013, in order to project the sectoral output for 2013.

The Romanian GDP in 2013 is estimated based on the input-output model. From a managerial perspective, this study is useful to forecast the sectoral output and to understand the sectoral behaviour, based on the input-output analysis of the value added, the compensation for employees and the final demand, which were considered here.

The analysis of the GDP evolution is presented from the very beginning, establishing that the GDP value in 2013 should be greater than GDP in 2010, either in constant prices 2010 or in current prices.

3. Results and discussions

3.1. Evolution of Romanian GDP during the period 2010-2014

The evolution of the Romanian GDP, expressed in millions euro current prices and 2010 constant prices, during the period 2010-2014, is presented in Table 1 and Figure 1.

Years	Romanian GDP (mill. Euro, constant prices 2010)	Romanian GDP (mill. Euro, current prices)
2000	82976.6	40796.8
2001	87616.6	45503.5
2002	92158.8	48810.4
2003	97249.9	52931
2004	105378.7	61404
2005	109775	80225.6
2006	118618	98418.6
2007	126759.6	125403.4
2008	137482.2	142396.3
2009	127766.5	120409.2
2010	126746.4	126746.4
2011	128085.2	133305.9
2012	128906.2	133511.4
2013	133458.6	144253.5
2014	137165.3	150018.5

Source: GDP and main components (nama_10_gdp), http://ec.europa.eu/eurostat/data/database

Table 1. *Evolution of the Romanian GDP during the period 2000-2014*

The economic crisis begun at the end of year 2008 is obviously seen on the chart from Fig. 1, when GDP decreased in 2009, changing the slope of the trend evolution forever.

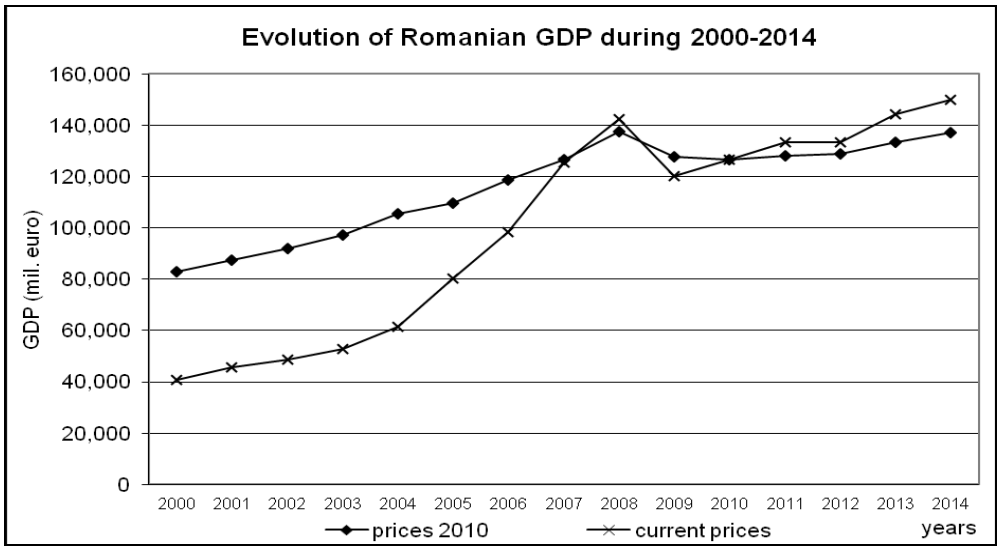

Fig. 1. *Real and nominal Romanian GDP during the period 2000-2014*

The upward trend of GDP was deeply changed starting with year 2009, when the four- year stagnation was followed by a slow growth from 2012 until 2014.

3.2. Estimation of Romanian Sectoral Output in 2013

The input-output model has already been built for year 2010 in the study *"Sectoral structure of Romanian economy"* by C. Duguleană and L. Duguleană, (2016, http://webbut.unitbv.ro/Bulletin/Series%20V/BULETIN%20I/27_Duguleana%20C-L.pdf), describing the Romanian economic sectors: *Agriculture, Manufacturing, Construction, Trade, Business services* and *Other services*. This sectoral structure was used by Eurostat to describe the European Union economy by the Supply and Use Tables of EU27 for the year 2000 at current prices, millions euro. (http://ec.europa.eu/eurostat/cache/metadata/Annexes/naio_esms_an1.pdf).

The matrices of input and output coefficients for the same sectoral structure has already been described for year 2010, in our previous study about the "Sectoral Structure of Romanian Economy" (2016).

3.2.1. Multipliers of Romanian Sectoral Linkages in 2010

The input-output table of the Romanian sectoral economy contains in quadrant I the production of economic sectors on rows as entries for themselves and for each sector *j* and their consumption on columns from each other sector *i*.

The column sum for sector *j* represents its output as sum of the inputs of the production activities of all sectors. The input coefficients, calculated as relative parts in the row sums, have the meaning of cost structure of sectoral production for each sector.

The row sum of each sector *i* represents its output as sum of all revenues obtained by selling its production. The output coefficients are calculated by dividing each entry of the rows by the corresponding row total. In quadrant I of the Input-Output table, there are the output coefficients for domestic intermediates, and quadrant II allows the calculation of sectoral output coefficients for the categories of final uses, being defined as: $o_{ij} = x_{ij}/x_i$, where:

o_{ij} = output coefficient of domestic goods and services of sector *i* from sector *j* (i=1,6; j=1,6)

x_{ij} = flow of domestic commodity of sector *i* to sector *j*

x_i = output of sector *i*.

The *backward linkages* are the coefficients calculated as the column sums of the inverse Leontief matrix $(I - A)^{-1}$, where *A* is the technological matrix of input coefficients. The backward linkages represent the direct and indirect requirements for the domestic intermediate production of economic sectors showing the supply of row sectors as inputs to be purchased by the column sectors.

The *output multipliers* which describe the backward linkages of the Romanian sectoral economy in 2010 are presented in the last row of Table 2.

Inverse Leontief matrix $(I-A)^{-1}$	**Agriculture**	**Manufacturing**	**Construction**	**Trade**	**Business services**	**Other services**
Agriculture	1.3793	0.1625	0.0524	0.0327	0.0195	0.0165
Manufacturing	0.1463	1.2562	0.3433	0.2404	0.1468	0.1170
Construction	0.0259	0.0466	1.1380	0.0874	0.0487	0.0502
Trade	0.1287	0.1788	0.1795	1.2172	0.1076	0.0954
Business services	0.0218	0.0374	0.0346	0.0770	1.0976	0.0365
Other services	0.0614	0.0737	0.0704	0.1459	0.1314	1.1081
Output multiplier	1.7633	1.7553	1.8182	1.8007	1.5517	1.4236

Source: *Calculations in "Sectoral Structure of Romanian Economy" (Duguleana C, Duguleana L., 2016)*

Table 2. *Backward direct and indirect requirements for domestic intermediates, in 2010*

The *forward linkages* are the coefficients calculated as the row sums of the elements of inverse matrix $(I - B)^{-1}$, where *B* is the matrix of output coefficients. The forward linkages characterize the offer of the row economic sectors sold to the column sectors.

In the Input-Output table, the sectoral output being the supply on the bottom of column sectors is equal with the same value, being sold to the end of the row sectors. The forward linkage, in the last column of Table 3, shows the direct and indirect effects of their output through the final uses.

Inverse $(I- B)^{-1}$	**Agriculture**	**Manufacturing**	**Construction**	**Trade**	**Business services**	**Other services**	**total**
Agriculture	1.3793	0.6966	0.0844	0.0777	0.0134	0.0421	2.2936
Manufacturing	0.0340	1.2556	0.1288	0.1331	0.0236	0.0697	1.6448
Construction	0.0159	0.1230	1.1369	0.1280	0.0208	0.0792	1.5038
Trade	0.0540	0.3220	0.1215	1.2171	0.0313	0.1028	1.8488
Business serv	0.0314	0.2312	0.0805	0.2643	1.0975	0.1351	1.8399
Other serv.	0.0241	0.1243	0.0446	0.1365	0.0358	1.1090	1.4743

Source: *Calculations in "Sectoral Structure of Romanian Economy" (Duguleana C, Duguleana L., 2016)*

Table 3. *Forward direct and indirect effects of sectoral output in 2010*

The backward and forward inter-linkages are constant for a certain period of time because the sectoral inter-relationships are based on existing technical equipment and conditions, on existing economic contracts, on existing markets, consumer customs and behaviour. For these reasons, the two matrices can be used to forecast the sectoral outputs in 2013.

3.2.2. Finding the sectoral output and final demand in 2013

Knowing the weights of different indicators and for the economic sectors, in the Romanian GDP for year 2013, the data in Table 4 show the value added for each sector and the entire value added in 2013.

(mill. Euro)

Sectors	**Agricul-ture**	**Manufac-turing**	**Construc-tion**	**Trade**	**Business services**	**Other services**	**Total**
Value ad - ded basic prices	7,870	34,330	9,451	30,312	27,293	18,016	127,272

Source: *http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG/countries*

Table 4. *Sectoral value added in Romania in 2013*

Considering that the inter-linkages between the industries of the analysed sectors remain constant, the matrix of output coefficients can be used in the quantity model ("Eurostat Manual of Supply, Use and Input-Output Tables", Eurostat, 2008 Edition, p. 480, 481-485, 497, http://ec.europa.eu/eurostat) in order to find the output of sectors in 2013:

$$(I - B')^{-1}Z = X,$$

where

B – matrix of output coefficients of inter-sectoral relations in 2010, in Table 5;
B' – transposed matrix of output coefficients for intermediates;
I – unit matrix;
(I - B') – Leontief matrix of transposed matrix of output coefficients for intermediates;
$(I - B')^{-1}$ – inverse of Leontief matrix;
Z – value added of sectors in 2013, in Table 4;
X – output of sectors, to be determined.

Table 5 contains the sectoral output coefficients calculated for year 2010.

matrix B of output coeff.	**Agriculture**	**Manufacturing**	**Construction**	**Trade**	**Business services**	**Other services**
Agriculture	0.265	0.407	0.008	0.001	0.000	0.002
Manufacturing	0.016	0.161	0.083	0.075	0.013	0.038
Construction	0.005	0.058	0.102	0.079	0.012	0.052
Trade	0.027	0.191	0.065	0.139	0.017	0.060
Business serv.	0.010	0.108	0.030	0.175	0.078	0.087
Other services	0.010	0.056	0.018	0.089	0.026	0.082

Source: Calculations in "Sectoral Structure of Romanian Economy" (Duguleana C, Duguleana L., 2016)

Table 5. *Sectoral output coefficients in matrix B for 2010*

Table 6 presents the calculation of vector *X* of sectoral output by multiplying the inverse of the transposed matrix B with the column vector *Z* of value added.

$(I - B')^{-1}z = x$	**Agriculture**	**Manufacturing**	**Construction**	**Trade**	**Business services**	**Other services**	**Value added, *Z***	**Output *X***
Agriculture	1.379	0.034	0.016	0.054	0.031	0.024	7,870	**15,103**
Manufacturing	0.697	1.256	0.123	0.322	0.231	0.124	34,330	**68,058**
Construction	0.084	0.129	1.137	0.122	0.080	0.045	9,451	**22,514**
Trade	0.078	0.133	0.128	1.217	0.264	0.137	30,312	**52,957**
Business serv.	0.013	0.024	0.021	0.031	1.097	0.036	27,293	**32,659**
Other serv.	0.042	0.070	0.079	0.103	0.135	1.109	18,016	**30,255**
Total (mill. euro)							127,272	**221,547**

Table 6. *Romanian sectoral output in 2013*

Using the quantity model with input coefficients $(I - A)X = Y$, where A is the matrix of input coefficients and the vector X is the sectoral output just found above in Table 6, the theoretic final demand Y in 2013 can be calculated, as in Table 7.

(I-A)X=Y	**Agricul-ture**	**Manufac turing**	**Construc-tion**	**Trade**	**Busi-ness services**	**Other ser-vices**	**Output *X***	**Final demand *Y***
Agriculture	0.735	-0.095	-0.005	-0.001	0.000	-0.001	15,103	**4,486**
Manufactur ing	-0.068	0.838	-0.222	-0.135	-0.080	-0.063	68,058	**39,343**
Constructio	-0.008	-0.022	0.897	-0.054	-0.028	-0.033	22,514	**13,837**
Trade	-0.064	-0.106	-0.096	0.861	-0.058	-0.056	52,957	**31,705**
Business services	-0.007	-0.017	-0.013	-0.051	0.922	-0.023	32,659	**25,120**
Other services	-0.027	-0.033	-0.028	-0.095	-0.095	0.919	30,255	**16,404**
Total (mill. euro)							221,547	**130,894**

Table 7. *Finding the final demand in 2013*

Applying the quantity model with endogenous private consumption, $(I - A)^{-1} Y = X$, the input coefficients for *Compensation of employees*, can be considered in the last row of matrix A and the input coefficients of *Private consumption* in last column of matrix A. Considering the final demand found above in Table 7, the new output of sectors can be simulated, in Table 8.

$(I-A)^{-1}Y=X$	Agri-culture	Manu-fac-turing	Con-struc-tion	Trade	Busi-ness services	Other services	Private consump-tion	Final demand *Y*	Output *X (mil. eur)*
Agriculture	1.435	0.202	0.085	0.083	0.068	0.071	0.145	4,486	21,040
Manufac-turing	0.362	1.409	0.469	0.436	0.334	0.331	0.566	39,343	91,200
Construc-tion	0.070	0.078	1.164	0.128	0.087	0.094	0.117	13,837	27,287
Trade	0.268	0.277	0.260	1.343	0.228	0.233	0.365	31,705	67,880
Business services	0.069	0.071	0.062	0.120	1.139	0.083	0.124	25,120	37,726
Other ser-vices	0.219	0.185	0.162	0.289	0.268	1.264	0.413	16,404	47,130
Compensa-tion of employees	0.510	0.362	0.297	0.463	0.443	0.506	1.338	0	**54,730**

Table 8. *New sectoral output and compensation of employees in 2013*

The declared effective value in 2013, for *Compensation of employees* was 45,451 million euro, while the theoretical value was 54,730 million euro, if the technical matrix *A* had been the same as in 2010.

3.2.3. Diffusion of economic sectoral effects, in Romania, in 2013

Considering that the multipliers of inter-sectoral linkages of the Romanian economy in 2010, presented in Table 2 and Table 3 would remain the same for the year 2013, then the direct and indirect effects of the final demand in 2013 are calculated and presented in Table 9.

Calculating the absolute values corresponding to the relative backward and forward effects of the theoretic final demand in 2013, the potential output of sectors can be estimated as being their direct and indirect absolute effects, either forward or backward. For each sector, the backward and forward direct and indirect effects are presented in Table 9. The direct effects are comprised in the direct and indirect effects.

Year	Effects	Agric.	Manufact.	Constr.	Trade	Business services	Other services	Total
2010	Backward linkage	1.7633	1.7553	**1.8182**	1.8007	1.5517	1.4236	
	Forward linkage	**2.2936**	1.6448	1.5038	1.8488	1.8399	1.4743	
2013 Theoretic results (mill.euro)	Final demand	4486	39343	13837	31705	25120	16404	130894
	Backward linkage	7910	69059	25158	57091	38979	23353	221548
	Forward linkage	10288	64711	20808	58616	46218	24185	224825
	Calculated output, X	**15103**	**68058**	**22514**	**52957**	**32659**	**30255**	**221547**
2013 Reviewed results (mill.euro)	Final demand	***5178***	***42292***	***11941***	***71254***	***39453***	***47704***	***217821***
	Backward linkage	*9130*	*74235*	*21712*	*128307*	*61219*	*67911*	*362513*
	Forward linkage	*11876*	*69562*	*17957*	*131734*	*72589*	*70330*	*374048*
	Effective output, X	**18527**	**86488**	**26239**	**105903**	**52638**	**72718**	**362513**

Table 9. *Relative and absolute direct and direct effects of economic sectors*

The sum of *backward direct and indirect effects* is equal with the sum of calculated sectoral output, *X*, in Table 6. The difference of 1 unit resulted from the rounded number of decimals. The sum of *forward* values of *direct and indirect effects* is greater than the sum of *backward direct and indirect effects*.

In the Input-output table of Romanian economy in 2010, there were some differences between the values of row outputs and column outputs for certain sectors; the results could have been affected by this fact, because the output coefficients are calculated based on row output of sectors, for the forward linkage and the input coefficients are based on column outputs for the backward linkage.

Usually the forward linkage should be higher than the backward linkage for a sector, in order to be considered as an efficient one. For the sectors of *Manufacturing* and *Construction*, in 2010, the forward linkages were less than their backward linkages.

Using again the quantity model $(I - A)X = Y$, where A is the matrix of input coefficients and the vector X is the effective sectoral output, recorded from data sources (http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG/countries) and presented in Table 9, a reviewed sectoral final demand in 2013 can be calculated, as in Table 9.

The absolute backward and forward direct and indirect effects were calculated also for the reviewed final demand in 2013, based on the effective sectoral output, in Table 9.

Some conclusions may be formulated by comparing the values of backward and forward linkages for each sector and their theoretical and effective output. This comparison refers to the interrelationships between sectors in 2010 and the sectoral output calculated based on the market orientation in 2010 and the final demand of 2013, sized on the sectoral value added in 2013 and then depending on the effective sectoral output.

The output of the *Trade* sector could be higher than the inter-sectoral linkages which have described it to be higher, but the final demand seems to project it lower. The same situation is valid for *Business services*, in 2013. The relative direct and indirect effects throughout economy in 2010 were the greatest for *Agriculture*, as the coefficient of forward linkage and for *Construction* as backward linkage.

The theoretical sectoral output should be comprised in the intervals delimited by backward and forward limits. If the theoretical sectoral output is outside these intervals, as for: *Agriculture*, and *Other services* – the explanation is that the new value added of sectors in 2013, which determined the theoretic final demand described by vector Z, has imposed these changes. The sectoral output is less than the lowest limit, for *Trade* and *Business services*, where the sectoral linkages could allow higher values of their outputs. The high values of relative forward linkages show that it would have been more efficient to invest in these two sectors, rather than in *Agriculture* and *Other services*.

Based on the effective output, the reviewed final demand was calculated and the new backward and forward linkages can be established. The fact that the effective sectoral output in 2013 is greater than the upper sectoral linkages is related to the changing of the technological matrix. The outputs of sectors: *Agriculture*,

Manufacturing, *Construction* and *Other services* were greater than the projected values of their inter-sectoral linkages, meaning that these have been also changed.

Figure 2 presents the effective structure of the sectoral output in 2013 compared to that of the theoretical structure obtained by applying the input-output model.

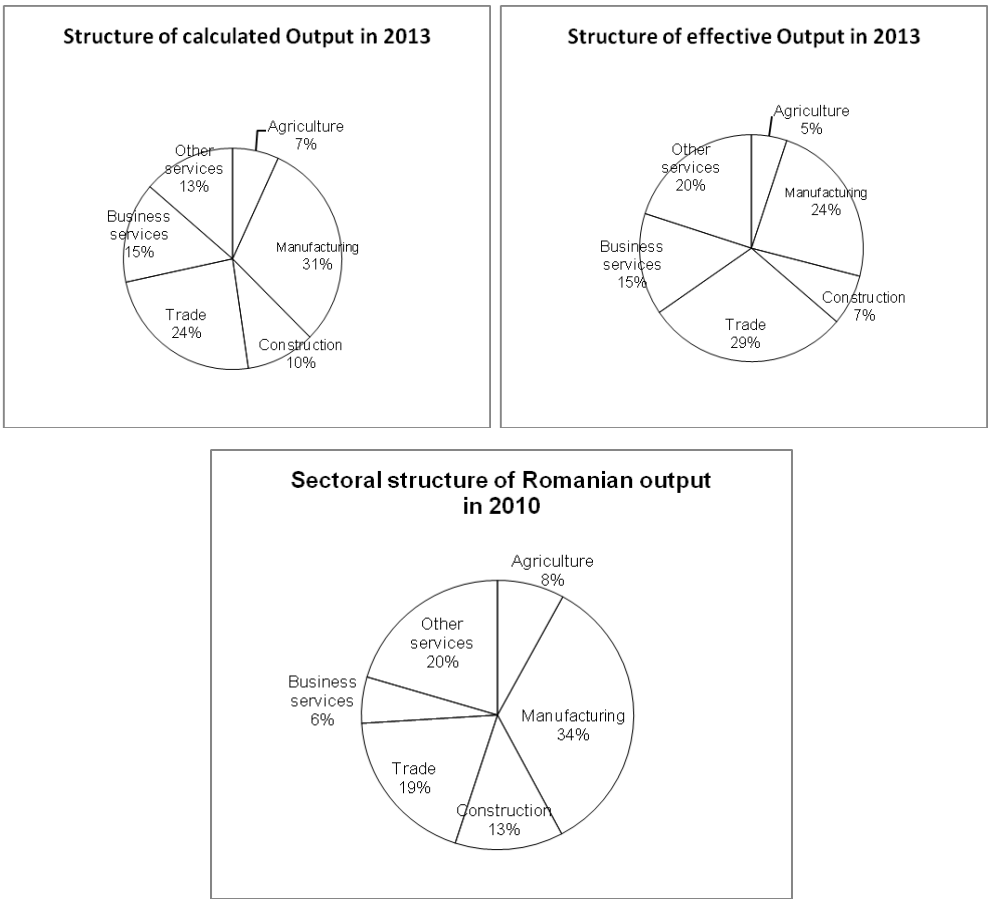

Fig. 2. *Comparative structures of calculated and sectoral economy in Romania, in 2010 and 2013*

The effective sectoral output was higher for all sectors. But the projected structure in 2013 using the input-output model is different face to the effective sectoral structure in 2013. The decreasing of the *Manufacturing* weight in Romanian output in favour of increasing the *Trade* sector is not quite a good aspect. Also the lower proportions of *Agriculture* and *Construction* in favour of a greater proportion of *Other services* cannot be a sign of a sustainable national economy.

The structure of economic sectors changed in 2013 compared to 2010. Comparing the structure of the sectoral output in 2010, presented also in Fig. 2, with that of the output in 2013, the tendency of structural changes becomes obvious, i.e. it is not one of an industrialized economy. The increase in 2013 of the proportions of *Trade* and *Business services* by 10% each, by decreasing the weights of *Agriculture* by 3%, *Manufacturing* by 10%, and *Construction* by 6%, could have been well perceived only if the Romanian society had already been developed and the future way of development had envisaged keeping the natural resources for the environment protection and a healthier life for Romanian people.

The differences can be considered due to the incomplete data and due to the assumptions of the input-output model which suppose fully respecting the relationships between sectors, the theoretical aspects about substitution and competition processes.

3.3. Estimating the Romanian GDP in 2013

In Table 10, there is a simulation for the Input-Output table of the Romanian economy in 2013. The Romanian GDP, valued at market prices, can be determined starting from theoretical data, italic format, in Table 10 and also from the data recorded in Eurostat and the World Bank sources (http://ec.europa.eu/eurostat/web/esa-supply-use-input-tables/methodology/supply-use-tables):

- according to the production approach, as:
  - GDP = Output basic prices - Intermediate consumption at purchasers' prices + Taxes less subsidies on products = 221,547 – 94,275 + 17,010 = 144,282.2 (mill. euro), or
  - GDP = Output basic prices-Intermediate consumption at purchasers' prices + Taxes less subsidies on products = 362,513 – 235,242 + 17,010 = 144,282.2 (mill. euro).
- according to the income approach, the values are the same for theoretical and effective values:
  - GDP = (Compensation of employees + Other net taxes on production + Operating surplus, gross) + Taxes less subsidies on products = Value added at basic prices + Taxes less subsidies on products
    GDP = (45,451 + 3,512 + 78,309) + 17010 = 127,272 + 17,010 = 144,282.2 (mill. euro).
- according to the expenditure approach, the values are the same for theoretical and effective values:
  - GDP = Final Uses – Imports = [(Private consumption + Government consumption) + (Gross fixed capital formation + Changes in inventories and valuables) + Exports] – Imports = Final consumption expenditure + Gross capital formation + (Exports – Imports) = Final consumption expenditure + Gross capital formation - Net Exports.

GDP = 205,602 – 61,320 = [(89,398 + 20,480) + (33,539 + 1,587) + 60,559] – – 61,320 = 144,282.2 (mill. euro).

The theoretical value of *Total uses* is obtained in two ways, as:

- sum of *Domestic products (intermediates) + Imports + Taxes less subsidies on products*
  - Theoretical Total uses = 22,1547 + 61,320 + 17,010 = 299,878 (mill. euro),
- sum of *Total intermediate consumption + Final uses*
  - Theoretical Total uses = 94,275 + 205,602 = 299,878 (mill. euro).

The effective value of *Total uses* is obtained, as:

- sum of *Domestic products (intermediates) + Imports + Taxes less subsidies on products*
  - Effective Total uses = 362,513 + 61,320 + 17,010 = 440,844 (mill. euro),
- sum of Total intermediate consumption + Final uses
  - Effective Total uses = 235,242 + 205,602 = 440,844 (mill. euro).

In Table 10, the presented data also have effective and theoretical values, which were calculated with the Input-Output model.

4. Conclusions

The paper presented the approach of European Input-Output analyses.

The ascending evolution of the Romanian GDP during 2010-2014 has allowed in this paper to consider at least the sectoral structure of the Romanian economy from 2010.

The technological matrices calculated based on the structural coefficients of the Romanian Input-Output table for 2010, for six sectors, were the basis of the estimation of the sectoral output for 2013. The multipliers describing the backward and the forward linkages and the direct and indirect effects of the economic activity of sectors throughout the entire economy were considered to be the same as those of 2010.

Knowing the sectoral value added and some effective indicators recorded from different data sources for 2013, after applying input-output models, the estimated sectoral final demand and sectoral output could be provided.
(http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG/countries)

A part of the Input-Output table of the Romanian economy in 2013, was projected, with estimated indicators in millions euro, current prices.

For 2013, the Romanian GDP was calculated using the three methods: production, income and expenditure approaches, based on the projected Input-Output table.

	Production sectors *i*	Intermediate Consumption, *j*							FINAL USES								
		Agri-culture	Manufac-turing	Con-struc-tion	Trade	Business services	Other services	Total	Private cons.	Govern cons.	GFCF	Changes in inven-tories	GCF	Exports FOB	Final uses, *y* theoretic 1	Final uses, *y* theoretic 2	Total uses, output *x*
1	Agriculture														*4486*	*5178*	18527
2	Manufacturing														*39343*	*42292*	86488
3	Construction														*13837*	*11941*	26239
4	Trade														*31705*	*71254*	105903
5	Business serv.														*25120*	*39453*	52638
6	Other services														*16404*	*47704*	72718
7	Domestic prod.														***130894***	***217821***	**362513**
8	Agriculture																
9	Manufacturing																
10	Construction																
11	Trade																
12	Business serv.																
13	Other services																
14	Imported prod.															61320	61320
15	Taxes less sub-sidies prod.							16528							482	17010	17010
	Theoretic Total intermediates	*7233*	*33729*	*13063*	*22645*	*5367*	*12239*	*94275*	*89398*	*20480*	*33539*	*1587*	*35126*	*60599*	*205602*	***299878***	
16	Total intermedi-ates	10657	52158	16787	75591	25346	54702	235242	89398	20480	33539	1587	35126	60599	205602		**440844**
17	Compensation of employees							45451									
18	Other net taxes on production							3512									
19	Operating sur-plus, gross							78309									
20	Value added at basic prices	7870	34330	9451	30312	27293	18016	127272									
21	Output b. p.	18527	86488	26239	105903	52638	72718	**362513**									
22	*Theoretic Output*	*15103*	*68058*	*22514*	*52957*	*32659*	*30255*	***221547***									

Table 10. *Estimated Input-Output table for Romania in 2013 (Mill. euro, current prices)*

The limits of this scientific research and its benefits must also be considered.

The forecasting for the next year, 2011, could consider the input-output case of the previous year, 2010, but until 2013, a lot of institutional, legal, political, economic and social changes could affect the inter-sectoral relations and also the forward and backward linkages.

These changes are reflected in the changing of the technological matrix. The forecasting of the economic sectoral structure of the output in 2013 used the same technological matrix as in 2010.

The sectoral analysis could be the basis for some sectoral economic policies to be developed and undertaken by the Romanian government. The sectoral efficiency could be analysed by comparing the backward and the forward linkages. In 2010, the sectors *Manufacturing* and *Construction* had lower multipliers of forward direct and indirect effects than the backward ones, showing a lack of efficiency, especially for *Construction*.

This paper is an approach of forecasting the sectoral structure of the Romanian economy, based on the diffusion of the direct and indirect effects, described by the inter-sectoral linkages, which are quite stable in certain time periods, when the national economy has a constant tendency of evolution, as that during 2010-2014.

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