

CHALLENGES AND REQUIREMENTS FOR SUSTAINABLE DEVELOPMENT OF ROMANIA'S AGRICULTURE BASED ON THE INPUT-OUTPUT ANALYSIS

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A*bstract:* The paper analyzes economic interconnection generated by Romanian agriculture as supplier and producer in the context of input-output tables compiled for the national economy in 2003, 2004 and 2009 with 34 industries, in producer current prices.

The purpose of study is to outline the number of industries with which agriculture is interrelated as output supplier and input consumer (technical coefficients a_{ij}), the structure of final consumption and gross value added, the importance of exports, imports and gross fixed capital formation. The main conclusions reveal the necessity of recovering and expanding the diversification potential of products and services in agriculture, increasing investments in high tech and more efficient activities processing raw materials offered by agriculture.

Keywords: intermediate output, inputs; final consumption; technical coefficients; export, import, gross fixed capital formation, backward and forward dependencies.

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The input-output model represents one of the most relevant instruments of researching interdependencies of some national economy industries from the viewpoint of up- and downstream production relationships. The quality of

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agriculture, of output supplier for intermediate and final consumption can be compared in value terms with the one of material input consumer and generator of value added, so that we can establish whether agriculture receives inputs or provides more outputs to the other industries with which it enters into production relationships.

Knowing in value (quantitative) terms the role of Romanian agriculture as supplying, output distributing industry and as input (material costs) consumer has a particular importance for determining some strategic backgrounds for Romania's sustainable development. And this, the more so as agriculture underwent during transition a series of changes with respect to the regime of ownership, organisation form, and functioning according to the competitive market and, with and as of Romania's accession to the EU in 2007 it can benefit by a series of facilities (subventions) within the Common Agricultural Policy instruments.

1. Research objectives

The analysis of the Romanian agriculture, based on the statistical data from the input-output tables compiled by the National Institute of Statistics for the years 2003, 2004 and 2009 on the basis of a nomenclature of 34 industries¹, has the following objectives:

- a) **determining the intensity of output links** of the sector "agriculture, fishery and forestry exploitation" as a **consumer** of material inputs from other industries of the national economy and as a distributor of intermediate outputs to the other sectors of the national economy, so as to better analyse the upstream and downstream propagation effects of agriculture, within the whole national economy;
- b) the dynamic analysis of the **number of industries with which agriculture enters into production relationships** and their hierarchy depending on the size of the intermediate output volume distributed to the other industries and material expenditures (inputs) from the other industries that enter into the production costs of agriculture; the flows generated by agriculture to the other industries with which it enters into contact represent an important and revealing element for estimating the size of the technical coefficients "a_{ij}" from quadrant I of the input-output table that are at the basis of the inverse matrix

¹ See National Accounts 2003, 2004 and 2009, Statistical studies and analyses, National Institute of Statistics, 2007, 2011.

coefficients for total direct and indirect expenditures in accordance with the fundamental equation $X = (E-A)^{-1} \cdot Y$, (where E = the identity matrix; A = matrix of technical coefficients; Y = final consumption; X = total output);

- c) **development of the self-consumption share** of agriculture in total output volume of the industry;
- d) **evolution of the final consumption (volume and structure)** in total and by component elements, ensured by agriculture (quadrant II of the input-output model) compared with the level of the intermediate production supplied to other industries;
- e) analysis of the gross value added, of imports and exports, and of subsidies.

2. Agriculture intermediate output

The strategic importance of agriculture for the entire national economy (Otiman I.P. et al. 2012) should not be limited only to food security of the population. It should also contain to an equal extent its contribution to increasing exports of agricultural food products and services, and the supply of raw and semi-fabricated materials for the vital industries of the economy such as food and processing industries. Of no lesser importance is the role of ecological agriculture in combating pollution effects, ensuring environmental balance and population health.

Table 1. Total output and intermediate output volume supplied by agriculture to the industries of the national economy in the years 2003, 2004 and 2009

Years	Total output, of which:		Intermediate output		Final output		The number of industries to which agriculture supplies own products
	Bill. lei	%	Bill. lei	% din total	Bill. lei	%	
2003	47.2	100.0	23.26	49.2	24.03	50.8	29
2004	63.1	100.0	32.60	51.6	30.54	48.3	26
2009	77.8	100.0	41.8	53.8	36.07	46.2	17

Source: Own calculations based on the primary data of the input-output tables, in the years 2003, 2004 and 2009. National Accounts, Statistical Studies and Syntheses.

The data from Table 1 highlight the following more important aspects regarding the structure of total output by intermediate output components and final consumption:

- the intermediate agricultural output registered for the analysed period **an increase both in absolute value volume and as share** in total output, which leads to the conclusion of an increased importance of agricultural outputs for the other industries of the national economy;
- **a decrease in the share of agricultural output for final consumption** is registered in the total output of the industry, which means a relative diminution of Romania's agriculture importance in particular for the gross fixed capital formation and to a lesser extent for the individual and collective consumption, and for exports; it should be mentioned that imports of agricultural products to Romania up to 2009 exceeded the volume of exports, which represents for the future a challenge for Romania, which has an underused potential for agricultural products, especially if we take into account that about one-third of the agricultural land is not used, or is insufficiently used, as well as the fact that outputs per hectare are poorer in Romania as compared to other EU countries;
- it is found that the number of industries to which agriculture distributes products and services has sensibly decreased from 29 to 17, which is explained by the decreasing diversification of agricultural output for **the analysed period** (diminution or elimination of technical plants' cultivation, of flax, hemp, medicinal plants, the decrease in some industries of livestock farms, etc.); this decrease in the nomenclature for agricultural products represents a regress, a negative phenomenon and an unfavourable trend that should be counteracted by economic policy measures, placing restoring and developing technical plants cultures or some traditional livestock farms products that are demanded on the internal and external markets at the forefront of concerns;
- the increase in the value volume of output during the analysed period was due, to a large extent, to the **price increase for agricultural products** in particular for intermediate products but which, anyway, were exceeded as dynamics by the prices of industrial products (" price scissors").

In the year 2009, **the industries that benefited (consumed) most** by the intermediate output delivered by agriculture were:

- **self-consumption** (21.3 bill. Lei, that is a share of 51.7% of the intermediate production and 26% from the total production), signifying a certain relative

autonomy of the agriculture sector, an increased degree of independence for its production, as compared with the other industries of the economy, but also a higher self-improving capacity of the agricultural output supplying renewable energy resources; the input-output multidimensional analysis (Estrada R. 2009, 2012) could be used for catching up the relationships among different agricultural production sub-sectors (self-consumption) by applying partial differentiations on group of functions which are interfacing within the same models.

- **products of the food, beverages and tobacco products industry** (14.8 bill. Lei) agriculture still having a high potential for developing or sort diversification of the agro-food complex output;
- **hotel and food services** (1,24 bill.lei), which represents, as well, a consumer with growth potential for agricultural products;
- **wholesale and retail services** (1.1 bill. Lei) that are still in deficit with respect to timely and good quality collection and acquisition and, thus, need to be developed, on one hand, and, on the other hand, are hampered by a series of parasite intermediaries, that increase directly and indirectly several times the retail prices in some instances thereby causing prejudices to agricultural producers.

3. Agriculture as material input consumer from other industries

In our opinion, the clarification of the issue related to the position of agriculture as industry receiving more from the other industries of the national economy than it delivers (!) might be realised by comparing for the analysed period the volume of the outputs and inputs of the industry from quadrant I, the difference between the two value sizes being edifying to this end.

Table 2. Intermediate output distributed by agriculture within the economy and material inputs to other industries for the years 2003, 2004 and 2009

Years	Number of industries from which agriculture purchases inputs	Total distributed intermediate output	Total material inputs	Difference between intermediate output and inputs
(0)	(1)	(2)	(3)	(4)=(2)-(3)
2003	32	23,26	20,24	+3,01
2004	29	32,60	27,58	+5,10
2009	27	41,82	35,17	+6,63

Source: Own calculations based on the primary data of the input-output tables for the years 2003, 2004 and 2009, National Accounts, NIS, Statistical studies and syntheses.

The main conclusion that can be drawn from the data in Table 2 is that agriculture **provides more value** in products and services to the other industries of the economy than it receives from them. The opinions according to which agriculture would be a losing industry, a sort of “black hole” for the economy are, therefore, completely wrong. On the contrary, agriculture is the one providing more and more intermediate output to other industries, as against the material inputs it receives. Consequently, agriculture is to a large extent a resource provider for processing by other industries, than a resource consumer.

In the year 2009, the main industries supplying important inputs to agriculture were:

- chemical industry products (4.0 bill.lei – 11.4% of total inputs volume);
- rubber, plastics and other non-metallic ore products (1.13 bill.lei – 3.3%);
- products of the steel industry, metallic constructions industry and metal products (excluding machinery, tools and equipments) (1.1 bill.lei – 3.3%);
- financial and insurance services (0.9 bill.lei – 2.5%);
- electric power, gas, steam, air conditioning (0.89 bill.lei – 2.5%);
- administrative and assistance services (0.4 bill.lei- 1.1%).

The fact that agriculture has inputs from 27 industries and provides output to a number of 17 industries does not mean that agriculture consumes more than it can generate. On the contrary, this difference highlights a strong upstream propagation effect.

4. Gross value added

One of the structural issues of the transition economy in Romania was related to changing the structure of the GDP by main economic sectors, so as to reach a share of over 60% in GDP of the tertiary sector, and diminish sensibly the relatively past high shares of agriculture and industry.

Currently, it can be said that Romania took important steps towards convergence with the GDP structures from EU developed countries, if we take into account the increasing share of the services sector.

Yet, there is a great difference between the ways in which structural changes of the GDP occurred in developed countries and in Romania. Percentage structural changes are not always relevant!

In developed countries, the current GDP structure by main economic sectors took place under conditions in which the **gross value added of services increased faster than the value added of the agricultural and industrial sector**, which grew permanently but at differing rates.

In Romania, the increase in the services share in GDP occurred while **in agriculture and industry the absolute volume decreased for a good period of time** for the gross value added. This structural percentage change, in fact, is just a “facade” because it is based on relative figures that didn’t have the economic growth in all sectors of the Romanian economy as support element.

What is of interest at differing rates in the current research is the percentage relationship in which the gross value added is correlated with the total production and other relevant macro-indicators of the input-output model.

Table 3. Gross value added and total output of the agricultural sector for the years 2003, 2004, 2009

Years	Total output		Gross value added		Employees' remuneration	
	bill.lei	%	bill.lei	%	bill.lei	%
2003	49.09	100.0	22.84	53.0	3.61	15.0
2004	58.62	100.0	31.04	52.9	4.9	15.0
2009	97.6	100.0	45.09	46.0	9.6	20.0

Source: Own calculations based on the primary data of the input-output tables in the years 2003, 2004 and 2009, National Accounts, NIS, Statistical studies and syntheses.

As shown by data in Table 3, **a decrease in the share of value added** is found in the total output of 9 pp in the year 2009, against the year 2003, which means an increase in the share of material expenditures of the agricultural industry, the main factors of influence being increasing prices for electric power, fertilizers and other material inputs of the industry, the low agriculture performances as a result of low-level technology, but also due to an increase in the remuneration level of the employees without the adequate support by labour productivity.

As of 2007, agriculture received subsidies within the Common Agricultural Policy of 107 Euro/eligible hectare, several times lower as against the subventions per hectare received by Malta, Greece, France, the Netherlands, etc. Regarding these community subventions we would like to make two comments:

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- the lower value of the subsidy per hectare of agricultural land in Romania as compared with a several times higher value granted to other EU member countries represents a necessary but not sufficient condition for Romanian agriculture of lesser performance to succeed in diminishing the absolute gaps in performance per hectare so as to follow the trajectory of the convergence objective of EU 2020;
 - the reason why Romania benefits of smaller subsidies per hectare against other countries is, as a rule, known and, willing or not, accepted! This situation (whether we like it or not) is preferable to the situation before Romania's accession to the EU when no subventions were received, and, no matter how small, the subvention should still lead to an increase in Romanian agriculture's efficiency so as to be an argument in the future for increasing the amount of the subvention per hectare;
 - even if the subsidies for agriculture of 4,759 billion lei in 2009 would be decreased from the total value of the intermediate output surplus against the total volume of agriculture's material inputs, **still a negative value would not be registered** between the outputs and inputs, which would imply that agriculture spend (receive) more than it provides at the macroeconomic level.

The expected favourable impact on Romanian agro-food sector growth during five years, since Romania entered EU in 2007, seems to be doubtful (Toderoiu F., 2011) as for as economic and financial current crisis is concerned.

5. Exports, imports and gross fixed capital formation in agriculture

According to input-output tables, the deficit balance of foreign trade for agriculture underwent a slight improvement in 2009, meaning that the volume of imports was exceeded by exports, a trend which continued.

The economic crisis affected the dynamics of agricultural products imports, to a larger extent than the one of exports. Thus, in 2009, the volume of exports in the input-output tables for agriculture was 5.3 bill. lei, and the one of imports 4.06 bill. lei. In the year 2010, the national statistics registered a modest surplus of the trade balance for agricultural products of the economic agents with foreign capital in agriculture.

In the year 2011, the export of agricultural products of companies with foreign capital from Romania represented 1.2% of the total volume of Romanian exports, and the one of imports 0.4% of the total Romanian imports¹. The trade balance registered in 2011 a surplus of + 329 mill. Euro (export 546 mill. Euro and import 217 mill. Euro). Yet, FDI has a modest share in the Romanian agricultural products export. Still, their impact is favourable as they do not generate trade balance deficit. The calculations based on national accounts for 2009 indicate that **Romania is a net exporter of agricultural products and net importer of food stuff**, an asymmetry completely unfavourable to the requirements of sustainable development because we export relatively cheap raw materials and import more expensive processed products, which leads to the deterioration of the terms of trade.

Table 4. Structure of agricultural food stuff exports and imports of Romania in the year 2011, by categories of products and destination/origin

- % -

Total export, from which:	Total export	Exports from EU-27	Exports extra EU-27
-raw materials	28.0	18.0	54.0
-processed products	40.0	42.0	34.0
-finite products	31.0	38.0	11.0
-other products	1.0	2.0	1.0
Total imports, from which:	Total import	Imports from EU-27	Imports extra EU-27
-raw materials	13.0	11.0	19.0
-processed products	31.0	25.0	51.0
-finite products	54.0	60.0	30.0
-other products	2.0	4.0	0.0

Source: EC, DG Agri, Member States Factsheet, 2012.

The share of FDI in agriculture in total FDI volume was at the end of the year 2011 only 2.4%, which indicates a low attractiveness for the foreign capital in this sector of activity. In fact, the gross fixed capital formation in agriculture for Romania was 0.251 bill. lei in 2009, which highlights a poor endowment of agriculture with modern production technologies insufficient ratio of gross fixed

¹ See "Direct foreign investments in Romania in the year 2011", NBR, ISN 2012, p.14.

capital formation in our agriculture (Luca L. et al.) is one of factors hampering diminution of the efficiency crop gaps between Romania and the other developed EU countries.

In 2009, the share of the agricultural industry in the total gross value added at national level was 7.1% as compared to 3.3% in Hungary, 3.6% in Poland and 3.8% in EU-12. One should note that the decrease in the share by 7.7% should not be obtained by diminishing the absolute level of agricultural output, but by increasing this output at rates higher than in the industries pertaining to the secondary and tertiary sectors. Only this way there would be favourable changes in the macroeconomic structure of Romania.

6. Some final remarks

According to the analysis based on the input-output models we highlight the following conclusions:

- agriculture, a vital industry of the Romanian economy, **does not represent an activity consuming more than it generates**, but, on the contrary, the value of the intermediate output of agriculture distributed to other industries exceeds the one of the material expenditures (inputs) of these industries even if the subventions are added to the inputs;
- **the decrease in the value added share and final consumption** represents an unfavourable trend in agriculture, generated by the prices increase for electric power, fertilizers and other primary inputs and for other products for which the price scissors intervenes;
- the agriculture has production relations as regards the material consumption with a larger number of industries (27), if compared to the links it has as distributing industry (17), which represents a growth factor for the demand within the national economy;
- the export of agricultural products exceeds the import, but the food industry registers a very high trade balance deficit, which asymmetry is reflected in the unfavourable situation of Romania as **exporter of raw material and importer of processed products** (Popescu M., 2011);
- foreign direct investments in agriculture represent **a small share of 2.4%** of the total FDI, and the gross capital formation in this industry is also small, which does not allow, for the time being, for an increase in endowing the industry with technologies, equipment, agricultural machinery and tools, and performance infrastructure;

- last but not least, in evaluating the role of agriculture, we believe that it is necessary to **include** (internalise) **positive externalities** (marginal benefits from thirds parties), which justifies the granting of corrective subventions, just as internalising the negative externalities is regulated, under the market conditions, by Pigouvian corrective taxes.

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