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MULTICRITERIA ASSESSMENTS OF THE EUROPEAN CONVERGENCE IN ROMANIA'S AGRI-FOOD ECONOMY

ABSTRACT

This paper attempts to formulate multicriteria assessments regarding Romania's European economic convergence, which also depends on the agri-food sector performance. Five evaluation criteria have been identified: three refer to the domestic economy (economic growth, real earnings and productivity, agri-food integration) and two refer to the European economy (energy intensity of the economy, real agricultural income). Methodologically, we used qualitative and quantitative statistical analysis of each of the five criteria. Under the background of a slower growth in volume of the agricultural GVA (13.5%) compared to total GVA (35.2%) we identified: a "real earnings-productivity" correlation rationality only in three of the eight time slots taken; a considerable deterioration of domestic agri-food integration; a regressive trend of the energy-intensity of Romanian economy, similar to the EU-28 average and to certain member states; a progressive trend of real agricultural income per capita, yet with the highest relative instability.

Key words: economic growth, real wage, productivity, agri-food integration, energy-intensity, real agricultural income, Romania.

JEL Classification: J31, O47, Q13, Q43.

1. INTRODUCTION

The agriculture and food issue is and remains an issue of global and European interest, both *per se* and considered as a subsystem of other "challenges" at world level (globalization, poverty, sustainable development, competitiveness, etc.), and more recently, as part of the financial – economic crisis, still untempered.

The essential particularity of the European economic space – enlarged to 28 countries – is that agriculture and food "consumes" the core of the community budget, this sector requiring adjustment reforms, both with regard to the internal trade rigours – formulated by WTO – and to the real convergence requirements of the European economies.

Romania's European economic convergence generally depends, to a considerable extent, on the agri-food sector performance, measured, into their synthetic expression, also by the significant diminution of the territorial disparities in the endowment with resources and production factors – not consistent with the discrepancies of results, as it is known that one of the essential particularities of agriculture, i.e. the territorial favourability, rarely makes the spatial distribution of production areas (supply) coincide with that of the consumption centers (demand) of agri-food commodities.

2. STATE OF KNOWLEDGE

The previously formulated premises, as introductive benchmarks for any strategic approach to medium or long term development (Otiman P. I. & Steriu V., 2013, coordinators) that targets the increase of competitiveness and European convergence, cannot overlook the present and future of the agri-food sector, as important subsystem of national economy (Toderoiu F., 2001, 2002).

In more than two recent decades, a significant and increasing number of empirical studies referring to the regional economic growth indicators were based (on an explicit or non-explicit basis) on the convergence theory (Iancu A., 2008). The measurement of the effects of pre- and post-accession transformations on the economic and social development of the East-European Member States, on the convergence process and diminution of disparities between the Member States represents a special field of interest of economic research (Toderoiu F., 2009).

From the statistical point of view, the indicators pertaining to the last two decades reveal significant gaps between Romania and the other EU countries, and rather economic, technical and institutional asymmetries and divergences than convergences, which puts the domestic agri-food operators into a less-favourable position, as maintaining the subsistence character induces the value added transfer to other economic sectors (Ciutacu C. *et al*., 2014).

As the "economic convergence – territorial cohesion" binomial is an important objective of the European Union, being steadily promoted mainly in the context of Europe 2020 Strategy, this requires applied studies with regard to the transformation of the present development regions into administrative regions, as territorial pillars of the national economy development (Ianoş I. *et al*., 2013).

3. METHODS AND DATA

The methodological approach considered as adequate for revealing the presence of the European economic convergence process in Romania has as preliminary hypothesis the general macroeconomic evolution on long term (1989–2017), reflected through two statistical modalities: a) dynamic correlation between the main activities contributing the GDP formation; b) quantification of the absolute annual average increase (recoil) of the newly created value in Romania's economy, throughout the period 1989–2013 and by time periods considered relevant, using two statistical calculation formulae that are relatively simple:

$$\delta Ya_t = \left[Ya_t - Ya_{(t-1)} \right] \qquad [1], \text{ where:}$$

– δYa_t = annual absolute modification of GVA (GDP), values that are recalculated in 2012 prices; and:

$$\delta Yma_t = \left[\sum Ya_t / T \right] \qquad [2], \text{ where:}$$

– δYma_t = annual average absolute modification of GVA (GDP) value;

– T = number of years of difference reference time periods, in 1989–2013.

Other two reference macroeconomic variables, each targeting two levels (EU Community and national) can provide indications on the economic convergence. *The first*, represented by a synthetic indicator, which is strongly relevant for the convergent performing or, on the contrary, on the divergent performing of national economy compared to the EU economy, is the *energy intensity of the economy*, measured by the aggregate energy consumption per 1000 euro GDP (*kg. e.p. / 1000 Euro GDP*), revealed in two modalities: a) through the analysis of the comparative quantitative evolution of the specific energy consumption of a given country (region, etc.) with the European average; b) by taking into consideration the yearly average modification rates of the *energy intensity* (IE), determining the time period necessary to bridge up the level gap (T) existing between Romania and the European Union in the year 2012, through a well-known calculation formula:

$$T = \{[Ln(IE_{EU-28}) - Ln(IE_{RO})]\} / \{[Ln(rIE_{RO}) - Ln(IE_{EU-28})]\} \quad [3],$$

where:

– T = duration of bridging up the level gap;

– $Ln(IE_{EU-28})$, $Ln(IE_{EU-28})$ = natural logarithms of level indicators;

– $Ln(rIE_{RO})$, $Ln(rIE_{EU-28})$ = natural logarithms of the modification rates of level indicators.

The second macroeconomic variable, with a strong impact on reaching the convergence through competitiveness, is considered the *real earnings – productivity "binomial"*, both in overall economy and by activities generating value added; the convergence tendency can be revealed through *two analytical methods*: a) *simultaneous analysis of the dynamics* of the two reference indicators (real net average earnings and labour productivity); b) formalization of the long-term trends (1989–2013), regressionally expressed, of the two terms of one of the most important macroeconomic correlations, using the *statistical adjustment method* of the yearly cumulative modifications, according to the formula below:

$$Trend(X_t) = [m \times (X_t) + b] \quad [4],$$

where:

– $Trend(X_t)$ = variable adjustment trend;

– X_t = considered variable ($\sum_t \delta Csmnra_t$ = yearly cumulative modification of the real monthly net average earnings and $\sum_t \delta WqTa_t$ = yearly cumulative modification of labour productivity) respectively;

– m, b = regression coefficient of the linear trend and the free term respectively.

From sectoral perspective, convergence can intervene when the economy has a balanced development, with no inner structural distortions, disintegration processes and "erosion" of the technical – economic performances that can severely jeopardize the social cohesion of the society (Toderoiu F., 2004).

The signaling out and quantification of the absence of internal economic convergence of the Romanian agri-food sector can be achieved by measuring the intensity of economic flows between the two main "aggregates" of the agri-food economy ("agriculture" – consisting of six activities and the "food economy" – consisting of ten activities) (Artis M. *et al*., 1994).

In this respect, two statistical modalities were identified for the measurement of the presence or absence of the integrative, convergent and cohesive development process in the Romanian agri-food economy:

a) measuring the intensity of inter – relations between agriculture and the food industry, by two simultaneous flows (intermediary deliveries – LI and intermediary acquisitions – AI), according to the two analytical formulae:

$$\lambda LI_{a\to ia} = \langle LI_a / LIt_{ia} \rangle \quad [5]$$

$$\lambda LI_{ia\to a} = \langle LI_{ia} / LIt_a \rangle \quad [6]$$

$$\lambda AI_{a\leftarrow ia} = \langle AI_{ia} / AIt_a \rangle \quad [7]$$

$$\lambda AI_{ia\leftarrow a} = \langle AI_a / AIt_{ia} \rangle \quad [8]$$

where:

– $\lambda LI_{a\to ia}$, $\lambda LI_{ia\to a}$ = intensities of intermediary deliveries of agriculture to the food industry and of the food industry to agriculture respectively;

– $\lambda AI_{a\leftarrow ia}$, $\lambda AI_{ia\leftarrow a}$ = intensities of intermediary acquisitions of agriculture from the food industry and of the food industry from agriculture respectively;

b) measuring the intensity of intermediary deliveries (LI) and of intermediary acquisitions (AI) respectively of each of the two aggregates of the agri-food economy (agriculture – a and food industry – ia) in the corresponding totals , according to the following formulae:

$$\mu LI_a = \left\langle LI_a / LIt_a \right\rangle \quad [9]$$

$$\mu LI_{ia} = \left\langle LI_{ia} / LIt_{ia} \right\rangle \quad [10]$$

$$\mu AI_a = \left\langle AI_a / AIt_a \right\rangle \quad [11]$$

$$\mu AI_{ia} = \left\langle AI_{ia} / AIt_{ia} \right\rangle \quad [12]$$

where:

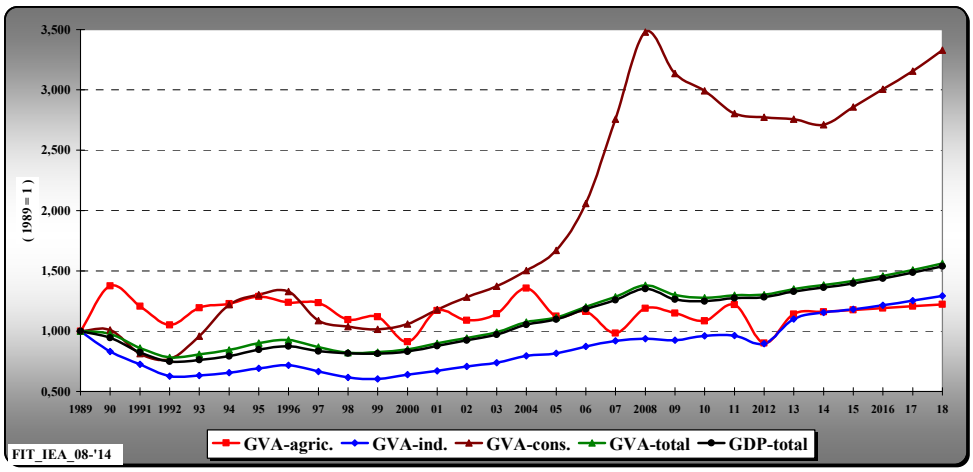
– μLI_a, μLI_{ia} = shares of the intermediary deliveries of agriculture and food industry in total corresponding intermediary deliveries;

– μAI_a, μAI_{ia} = shares of the intermediary acquisitions of agriculture and food industry in total corresponding intermediary acquisitions.

The application of the previously mentioned statistical – mathematical methods was based on the official data coming from several sources: National Institute of Statistics (Statistical Yearbook – different years, for the period 1989–2012; National Accounts, for the years 1989–2011), National Commission of Prognosis (for the period 2012–2017), EUROSTAT (for the period 2001–2012).

4. RESULTS AND DISCUSSIONS

At the end of the year 2013, i.e. after almost one quarter of a century of economic and social transformations, the national production – measured by the gross value added (GVA) of different economic sectors and the total gross domestic product (GDP) – was by 35.2% higher than that in 1989 (in the case of total GDP) and by 32.7% higher (in total GDP), with great dynamic variations between the main three activities (according to CAEN classification): from only 2.7% increase in industry, to an unnatural "boom" in constructions (+186.7%), with agriculture having a moderate increase by 13.5% (Figure 1).



Source: own calculation based on data from Romania's Statistical Yearbook, 1990–2012 series, NIS, for the period 2012–2017, Convergence Prog. Forecast, NCP, 05.05.2014.

Figure 1. GVA and GDP dynamics in Romania's economy, 1990–2017 (1989 = 1).

The obvious disarticulation of the sectoral dynamics of Romania's economy in the last 24 years (1990–2013) is confirmed by the strong relative instability of the evolution of gross value added generation in the activity sectors under analysis (measurable by the variation coefficients (CoV%) (Otiman & Steriu, 2014). The oscillation range is from 5.45% (GVA – total) to 15.42% (GVA – agriculture), in which the other three activities are also placed (13.07% – constructions, 6.87% – industry and 5.48% – GDP – total).

The significant fractures produced in the dynamics of newly created value generation in the Romanian economy in the period 1990–2013 (1989 – reference year) are argumented by the presence of four periods of economic decline (1990–1992; 1997–2000 and 2009–2011), simultaneous with four economic growth periods (1993–1996, 2001–2008 and 2012–2013), oscillations that can seriously put under question the consistence of reaching convergence at macroeconomic level.

The asymmetric evolution of GVA (GDP) in the economy, corresponding to the five economic aggregates, is largely revealed by the modification (increase or decrease) of the yearly absolute average of the newly created value (expressed in

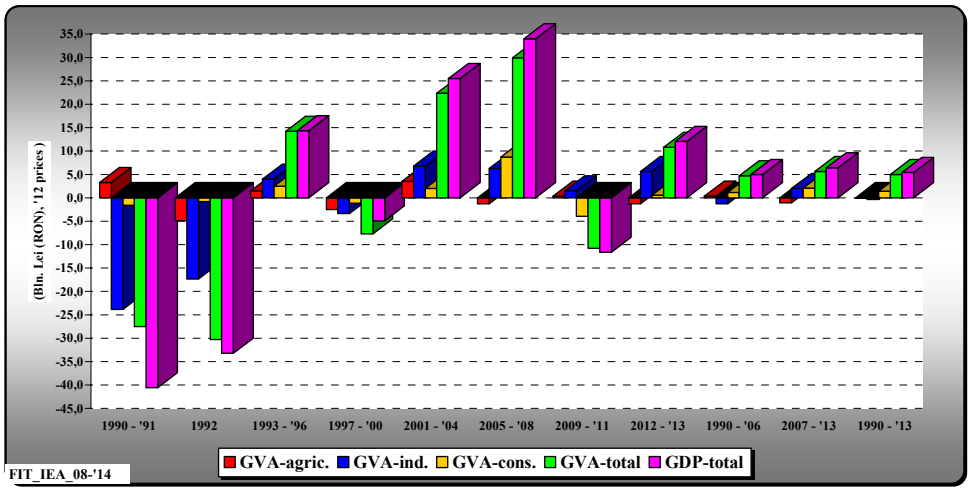
2012 prices), throughout the period 1990–2013 and by different time periods considered as relevant, thus confirming the relative instability, as a persisting phenomenon in the Romanian economy (Table 1).

Table 1
Yearly average modifications of GVA and total GDP in Romania's economy, 1989–2013 (billion RON, 2012 prices)

	GVA-agric.	GVA-ind.	GVA-cons.	GVA-total	GDP-total
1990–'91	3.2	-23.9	-1.6	-27.6	-40.6
1992	-4.9	-17.4	-0.8	-30.3	-33.3
1993–'96	1.5	4.0	2.5	14.2	14.3
1997–'00	-2.5	-3.4	-1.2	-7.7	-5.0
2001–'04	3.5	6.7	2.0	22.3	25.5
2005–'08	-1.3	6.3	8.7	29.9	34.0
2009–'11	0.3	1.5	-4.0	-10.8	-11.7
2012–'13	-1.3	5.6	0.6	10.8	12.0
1990–'06	0.3	-1.3	1.1	4.6	5.0
2007–'13	-1.1	1.9	2.0	5.6	6.4
1990–'13	-0.1	-0.4	1.4	4.9	5.4

Source: own calculations, based on Romania's Statistical Yearbooks, 1990–2012 series, NIS; for the period 2012–2017, Convergence Prog. Forecast, National Commission of Prognosis, 05.05.2014.

Practically, throughout the period 1990–2013, the yearly absolute modification average of total GDP reached about 5.4 billion RON, which can be explained by the 149.8 billion RON differential between the cumulative increase of GDP total (of 319.2 billion RON), accomplished in 14 years of economic growth and the cumulated decline of the same indicator (of 169.4 billion RON), in 10 years of economic decline, out of the 24 years under investigation (Figure 2).



Source: own calculation based on data from Romania's Statistical Yearbook, 1990–2012 series, NIS, for the period 2012–2017, Convergence Prog. Forecast, NCP, 05.05.2014.

Figure 2. Yearly average modifications of GVA (GDP) in Romania's economy, (1989–2014, billion RON, 2012 prices).

Among the other four sectoral aggregate indicators taken into consideration, only GVA – constructions and GVA – total had annual average increases throughout the period 1990–2013, which reached about 1.4 billion RON and 4.9 billion RON respectively, while agriculture and industry had an annual average decrease of 0.1 billion RON and 0.4 billion RON respectively.

4.1. The criterion energy-intensity of the economy

The energy intensity is a measure of the energy efficiency of a nation's economy, and this can be calculated as "units of energy per unit of GDP".

As a reference macroeconomic variable in revealing convergence through competitiveness, the energy intensity has a strong regressive tendency in Romania compared to the EU-28 average (Table 2).

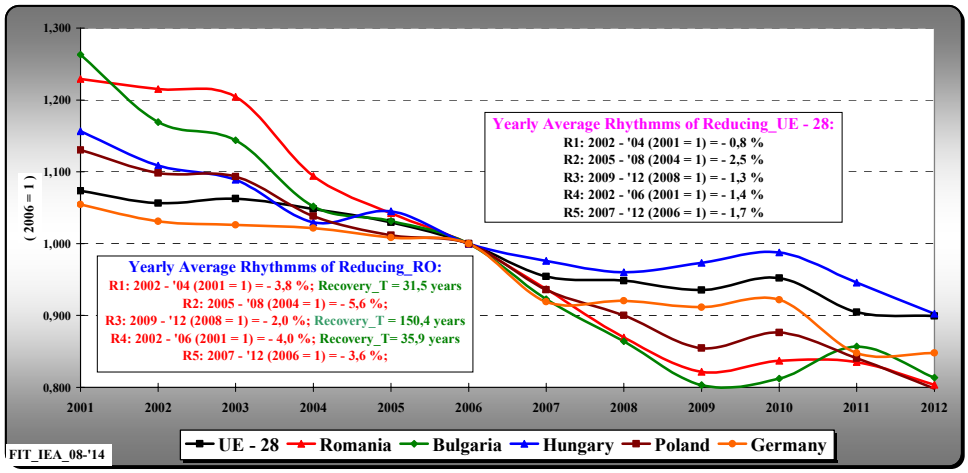
Table 2

Energy intensity of the economy (kg. oil equivalent/1000 euro GDP), yearly modification rate (%) and the time needed for gap recovery (years), in Romania and EU-28, 2001–2012

	EU-28	**Romania**
2001	170.9	579.5
2004	166.9	515.9
2006	159.2	471.4
2008	151.0	409.9
2012	143.2	378.8
R1: 2002–2004 (2001 = 1)	**-0.8 %**	**-3.8 %**
R2: 2005–2008 (2004 = 1)	-2.5 %	-5.6 %
R3: 2009–2012 (2008 = 1)	**-1.3 %**	**-2.0 %**
R4: 2002–2006 (2001 = 1)	**-1.4 %**	**-4.0 %**
R5: 2007–2012 (2006 = 1)	-1.7 %	-3.6 %
Topt.: R(RO / EU)=max (years)	**-**	**31.5**
Tmod.: R(RO / EU)=medim (years)	**-**	**35.9**
Tpes.: R(RO / EU)=min (years)	**-**	**150.4**

Source: own calculations based on Eurostat data; extraction date: 29 Aug 2014 23:05:12 MEST http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tsdec360.

Thus, while on the average in EU-28 the decline of the energy intensity of EU economy was 16.2%, in the year 2012, compared to 2001, in Romania the energy-intensity regression (measured in kg. oil equivalent/1000 euro GDP) was more than double (34.6%). However, dissimilitude subsists with regard to the yearly average diminution rates of energy intensity in the EU and Romanian economies. While the "cruising speeds" of the energy "cost" diminution of the Romanian economy ranged from 2.0% (2009–2012) to 5.6% (2005–2008), on the average in EU-28, the "energy cheapening" of the economy ranged from 0.8% (2002–2004) to 2.5% (2005–2008) (Figure 3).



Source: own calculations based on Eurostat data; Date of extraction: 29 Aug 2014 23:05:12 MEST http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tsdec360.

Figure 3. Energy intensity of the economy, in Romania and in certain EU member states, 2001–2012 (2006 = 1).

In Romania's post-accession period taken into consideration (2007–2012), Poland had an energy intensity decline of the economy of –20.2%, slightly higher than that of Romania (–19.6%).

One of the main consequences of the great differences of energy intensity, both at the beginning of the period under analysis (2001) and at the end of it (2012), and of the different decreasing rates of energy intensity resides in the unusually long time periods considered necessary to bridge up the level gap existing in the year 2012. Thus, theoretically, with the diminution rates from the period 2009–2012 (EU-28 = –1.3% and RO = –2.0%), Romania would reach the average EU level of the year 2012 after 150.4 years (pessimist scenario), while with the "pair" of rates from the period 2002–2006 (–1.4% and –4.0%) the full convergence could be reached in 35.9 years (moderate scenario); with the "rates" of the period 2002–2004 (–0.8% and –3.8%), 31.5 years would be necessary (optimist scenario) in order to bridge up the energy performance gap between Romania and the EU-28 average.

If we take into consideration the fact that up to now, in the energy intensity of the national economic aggregate, the weather-dependence issue of agriculture was less important, it is expected that by reconsidering the irrigation role an additional energy consumption in agriculture is necessary; this will raise the energy intensity level of the Romanian economy, and therefore will prolong the gap recovery duration and will consequently delay reaching convergence through performance.

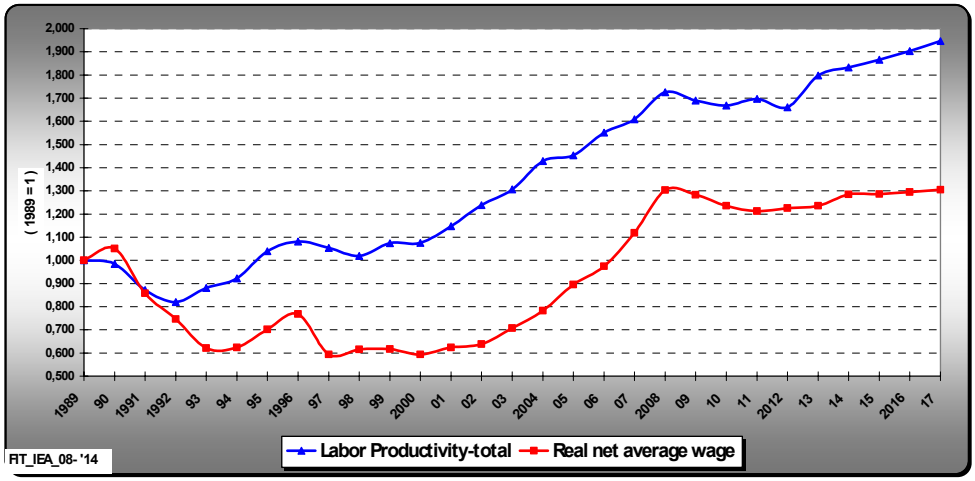
4.2. The criterion of "real earnings – productivity" correlation rationality

Being considered in all the functional market economies as one of the macroeconomic competitiveness pillars, the real earnings – labour productivity

correlation can reveal, to the extent in which it evolves within the economic rationality limits, the presence of propensity for economic convergence and social cohesion in the respective country (zone, region) (Toderoiu, 2002).

Determined as ratio of GVA total to the active population employed in the economy (values deflated by the implicit GDP price deflator), labour productivity is correlated with the real wages (net nominal average wages deflated by the general consumer price index); in this correlation, labour productivity should normally outstrip the real wages in terms of growth rate.

In the period 1990–2013 (1989 = 1), the dynamic correlation between real earnings and labour productivity in Romania's economy evolved within the economic rationality limits, in the sense that in the 24-year period only in one year (1990) the real wages index was higher than the labour productivity index; since 1992, the ratio between the two terms of the correlation has been reversed (Figure 4).



Source: own calculation based on data from Romania's Statistical Yearbook, 1990–2012 series, NIS, for the period 2012–2017, Convergence Prog. Forecast, NCP, 05.05.2014.

Figure 4. Dynamic correlation between the real net average wages (CSMNr-f89) and labour productivity (WqTa-f89), in Romania's economy, 1989–2009 (1989 = 1).

Two main conclusions can be drawn from the analysis of the dynamic correlation between the real earnings and labour productivity (by the identification of *eight relevant time periods* for which average yearly modification rates have been determined, as a modality to reveal the propensity for internal convergence of the Romanian economy):

➢ In all four periods (situations) when both correlation terms have *negative rates* (1990–1991; 1992; 1997–2000 and 2009–2011) the average decrease rates of real wages (–7.39%, –13.02%, –6.22% and –2.36%) are higher that those of labour productivity (–6.58%, –6.10%, –0.13% and –0.57%);

➢ The periods (situations) when both correlation terms have *positive rates* are distributed as follows: in three of them (1993–1996 and 2001–2004 and 2012–

2013) productivity (7.19%, 7.34 % and 2.92%) outstrips the real wages (0.75%, 7.12% and 0.92%), while in the fourth (2005–2008), on the contrary, productivity (4.84%) is in our opinion unnaturally outstripped by real wages (13.59%).

To sum up, the fact that out of the eight time periods convened upon as relevant for comparative judgments of economic performance, only in three of them (1993–1996, 2001–2004 and 2012–2013) the "real wage earnings – productivity" correlation was within the economic rationality limits, reveals the relatively fragile propensity of the Romanian economy for the sustainable setting up of one of its "driving engines" generating convergence and social cohesion through internal competitiveness.

The tendencies of the two terms of "real earnings – productivity" correlation on the long term (1989–2013), regressionally revealed by the statistical adjustment method, have as informational support the yearly cumulated modifications of these (Table 3).

Table 3

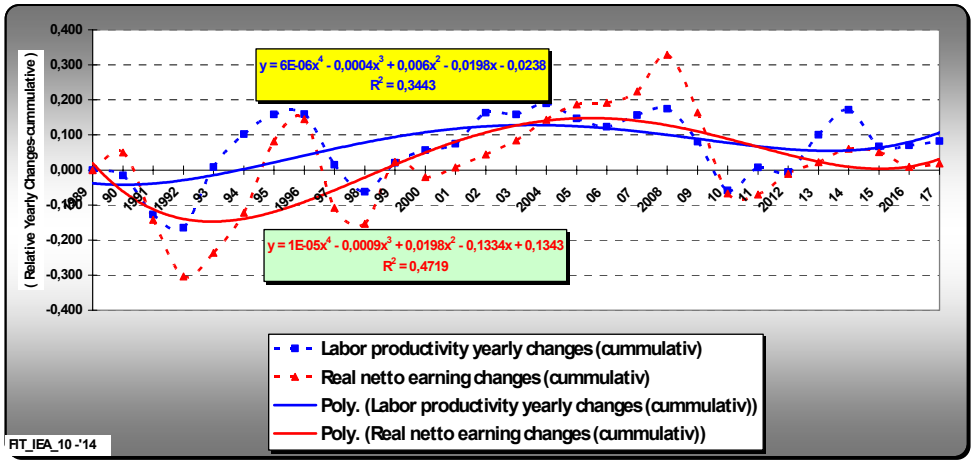
Relative yearly modifications (δWqTa and δCsmnra) and cumulative modifications (ΣδWqTa and ΣδCsmnra) of labour productivity and of real net average wage earnings, in Romania's economy, 1989–2013 (previous year = 1)

	Relative yearly modifications:			**Relative yearly modifications (cumulative):**	
	Labor productive. (δWqTa)	**Real net average wages (δCsmnra)**		**ΣδWqTa**	**ΣδCsmnra**
1989	**0.000**	**0.000**	**1989**	**0.000**	**0.000**
90	-0.015	0.050	90	-0.015	0.050
1991	**-0.112**	**-0.193**	**1991**	**-0.127**	**-0.142**
1992	**-0.053**	**-0.112**	**1992**	**-0.165**	**-0.304**
93	0.061	-0.125	93	0.008	-0.237
94	0.042	0.003	94	0.103	-0.122
95	0.117	0.078	95	0.158	0.081
1996	**0.043**	**0.066**	**1996**	**0.159**	**0.145**
97	-0.028	-0.175	97	0.015	-0.108
98	-0.034	0.022	98	-0.062	-0.153
99	0.054	0.001	99	0.020	0.023
2000	**0.003**	**-0.022**	**2000**	**0.057**	**-0.021**
01	0.072	0.029	01	0.075	0.007
02	0.091	0.015	02	0.163	0.045
03	0.067	0.069	03	0.158	0.084
2004	**0.123**	**0.075**	**2004**	**0.190**	**0.143**
05	0.024	0.112	05	0.147	0.187
06	0.099	0.080	06	0.123	0.192
07	0.058	0.144	07	0.157	0.224
2008	**0.117**	**0.184**	**2008**	**0.174**	**0.328**
09	-0.036	-0.020	09	0.081	0.164
10	-0.022	-0.047	10	-0.058	-0.067
11	0.029	-0.023	11	0.007	-0.070
2012	**-0.035**	**0.012**	**2012**	**-0.006**	**-0.011**
13	0.136	0.010	13	0.101	0.022

Source: own calculations, based on data from Romania's Statistical Yearbooks, 1990–2012 data series, NIS; for the period 2012–2017, Convergence Programs Forecast, NCP, 05.05.2014.

The first aspect to be noticed is that at the end of the four comparative intervals convened upon in our approach (year 2013), the relative cumulative growth of real wages was only 2.2%, while that of social labour productivity reached 10.1%; the difference between these two (7.9%) synthetically confirms the beginning of rationality re-establishment in the Romanian economy, in the sense of a faster increase of labour productivity compared to real earnings.

The second aspect is that in the three years of pregnant economic crisis (2009–2011), three situations of the investigated correlation were noticed, namely: higher decrease of productivity compared to real wages (2009); lower productivity diminution compared to real wages (2010); productivity increase accompanied by the diminution of real wages (2011) (Figure 5).



Source: own calculation based on data from Romania's Statistical Yearbook, 1990–2012 series, NIS, for the period 2012–2017, Convergence Prog. Forecast, NCP, 05.05.2014.

Figure 5. Trends of yearly cumulative relative modifications of labor productivity (ΣδWqTa) and of real net average wages (ΣδCsmnra), in Romania's economy, 1989–2009 (previous year = 1).

Econometrically, we can notice an alternance of economic rationality "situations" of the real earnings – labour productivity correlation in Romania's economy, throughout the period 1990–2013. With a higher determination, the real net wages trend (49.6%) noticeably outstrip the labour productivity trend (36.4%) starting with the year 2003, while the reversal of this type of non-rational correlation timidly emerged in the year 2013.

4.3. Agri-food integration criterion

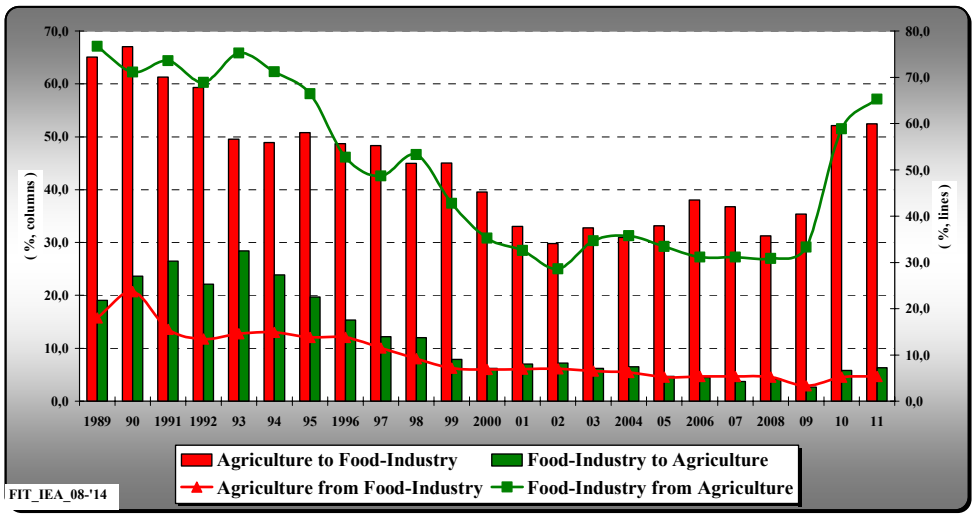
The presence of an agri-food disintegration process in Romania's economy, in the period 1989–2011, can be synthetically expressed by the analysis of the intensity of economic flows between the general aggregate *agriculture* and the *food industry* aggregate, both from the perspective of intermediary deliveries (destinations) and from the perspective of intermediary acquisitions (origins) (Toderoiu F., 2014).

Thus, in the 22 years covered by our analysis, one can notice a diminution by almost 13% of the intensity of intermediary deliveries (*LI*) of agriculture to the food industry (from 65.1% in the year 1989 to 52.4% in 2011, with maximum 67.0% in 1990, minimum 29.8% in 2002 and a variation coefficient of 25.4%) (Figure 6).

At the same time, the intensity of intermediary deliveries flows from the food industry to agriculture was down by about 12.8% (from 19.1% in the year 1989 to 6.3% in the year 2011, with maximum 28.4% in 1993, minimum 2.7% in 2009 and a variation coefficient of 68.8%).

The "agri-food disintegration" phenomenon, which persisted in the Romanian economy throughout the period 1990–2011, was generated by multiple causes, which can be noticed both in the development pattern of the agri-food sector in the command economy period and in the failures of transition, among which the following stand out:

- Asymmetry of the strong destructuring process from the agri-food economy (much faster and more radical in agriculture and slower and more superficial in the food industry);
- Significant narrowing of the population's final agri-food consumption demand, as a result of the simultaneous action of the general economic decline and of persisting inflation and hyperinflation.



Source: own calculation, on the data from Nat. Accounts, 1990–2011, NIS.

Figure 6. Evolution of intermediary deliveries (LI) and of intermediary acquisitions (AI), in the Romanian agri-food economy, 1989–2011.

Throughout the same 22 year-period (1990–2011), it is worth mentioning a diminution by only 11.4% of the intensity of intermediary acquisition flows (*AI*) of the food industry from agriculture (from 76.7% in the year 1989 to 65.3% in 2011,

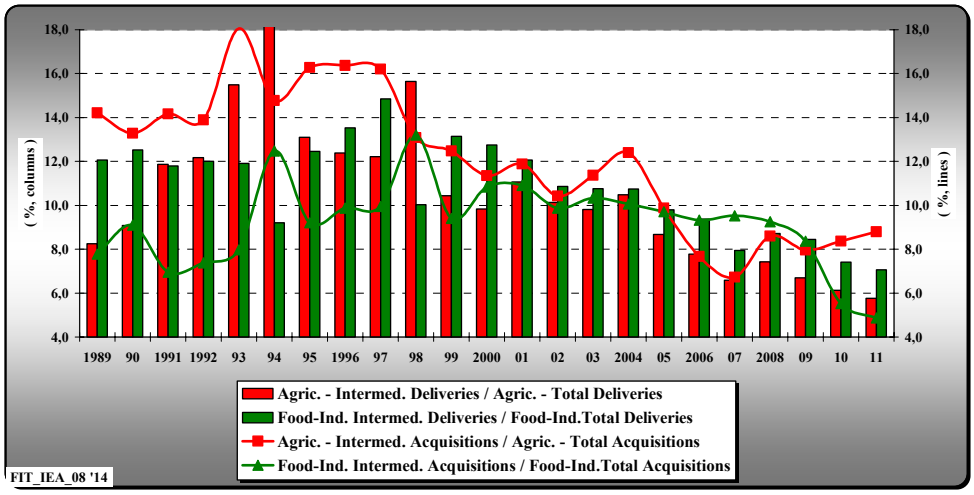
ranging from maximum 76.7% (1989) to 28.6% (2002) and a variation coefficient of 35.2%). At the same time, the intensity of the intermediary acquisitions of agriculture from the food industry decreased by 12.7% (from 18.0% in 1989 to 5.3% in 2011, with maximum 23.7% in 1990 and a variation coefficient of 53.7%).

The other modality to reveal the relative jeopardizing of the internal convergence of the agri-food economy consists in measuring the intensity (share) of total intermediary deliveries (*LI*) and of intermediary acquisitions (*AI*) of each of the two component aggregates (agriculture and food industry) in total aggregate intermediary demand (Figure 7).

A few remarks on the persistence of the agri-food disintegration phenomenon in the Romanian economy are listed below:

➢ The shares of the aggregate "*agriculture*" in total intermediary demand follow an ascending trend, with values ranging from maximum 18.2% (1994) to 5.8% (2011) and an instability coefficient of 30.9% (of intermediary deliveries) and from 18.1% (in the year 1993) to 7.5% (in 2007) respectively, with a variation coefficient of 26.3% (in intermediary acquisitions);

➢ The aggregate "*food industry*" has lower decreasing shares, ranging from 14.9% (1997) to 7.1 % (2011), with an average variation of 19.0%, in intermediary deliveries, and from 13.2% (in 1998) to 4.9% (in 2011) respectively, with a variation coefficient of 21.5% in the intermediary acquisitions.



Source: own calculation, on the data from Nat. Accounts, 1990–2011, NIS.

Figure 7. Evolution of the shares of agriculture and food industry in total aggregate intermediary demand, in the period 1989–2011.

It obviously results that the accomplishment of economic convergence through agri-food integration is jeopardized by the strong relative instability of the intermediary deliveries of agriculture, as a cumulated reflection of the weather-dependency influences and economic-organizational risks in this sector.

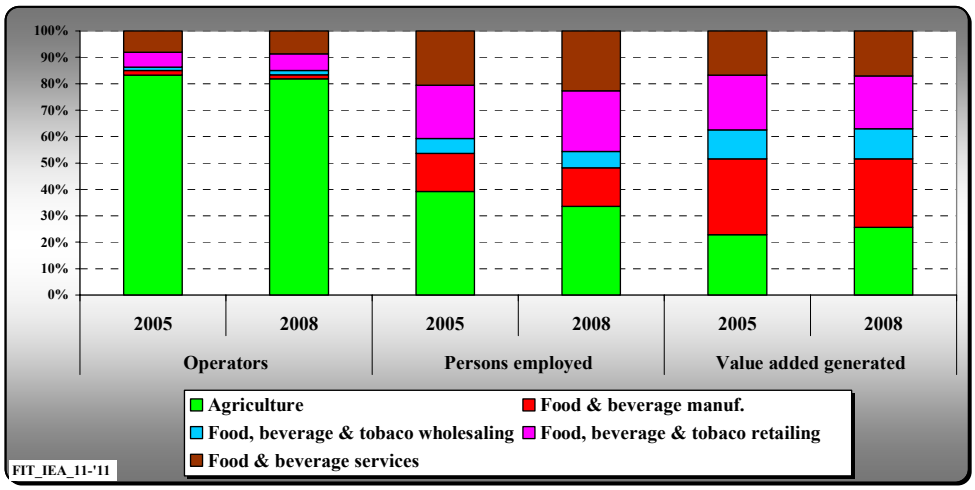
In principle, a performant agri-food economy presupposes the existence of functional agri-food chains, in which each link (segment) should retain, from the total productivity gain (measured by the value differential between the producer of raw agricultural products and the final consumer), what it deserves on the basis of the effort made to generate value added.

In order to reveal the extent to which the agri-food economy organization has the potential to generate internal or external competitiveness, we consider it useful to present a brief comparative diagnosis between Romania and the EU-27 average, from the perspective of multicriterial structure of the agri-food chain, in two reference years (2005 and 2008), for which the latest relevant statistical data are available.

From the perspective of the criterion '*number of enterprises*' (economic operators), in EU-27 (Figure 8), structural changes of the agri-food chain in the year 2008 compared to 2005 can be noticed, in the sense of the absolute diminution (from 14.4 mil. to 13.7 mil.) and of the relative diminution (from 83.2% to 81.8%) of the economic operators in agriculture, while the shares of the other three links in the chain (wholesale trade, retail trade and public food consumption) increased, on a cumulative basis, by 1.6 percent.

The first post-harvest segment (agri-food processing) also lost 0.2%, and thus we can practically say that the relative decline of the cumulative share (by 1.6%) of the economic operators in agriculture and processing was transferred to the other three segments of the chain.

From the perspective of the criterion '*number of employed persons*' (employees), in 3 years' time (2006–2008), the share of the segment 'agriculture' diminished by 5.7%, these percentage points being distributed to the other four segments of the agri-food chain.



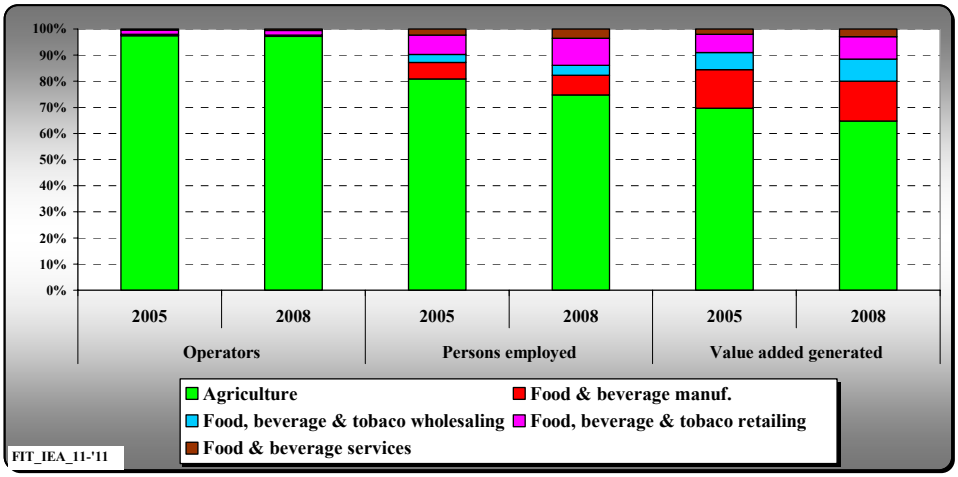
Source: own calculation, on the data from "Food – from farm to fork statistics", Eurostat Poketbooks, 2011 edition.

Figure 8. Multicriterial structure of the agri-food chain in EU-27, in the period 2005–2008.

The diminution of the number of economic operators from the first link of the chain (agriculture), under the background of a likely relative release of labour force, through productivity increase, has induced a favourable effect in the Community agri-food system, in the sense in which the primary production of agricultural raw products began to generate value added gain, leading to the increase of this segment share (by 2.8% in 2008 compared to 2005) in the third criterion of the analysis ('generated value added').

Romania went through the transition and pre-accession period with a relatively rudimentary "structural – agrarian endowment", the excessively strong fragmentation of the landed property and the still unclear agricultural land tenure or land ownership status inhibiting the plenary manifestation of the technical, organizational and managerial progress factors that would make it possible for Romania to experience 'situations' characteristic to the countries with modern economies and agricultural sectors, in which a decreasing number of farms and labour input are able to provide the necessary agri-food products, under increasingly restrictive competitiveness conditions.

Unfortunately, the multicriterial structure of the agri-food chain in Romania (Figure 9) looks entirely different from the overall structure of EU-27.



Source: own calculation, on the data from "Food – from farm to fork statistics", Eurostat Poketbooks, 2011 edition.

Figure 9. Multicriterial structure of the agri-food chain in Romania, in the period 2005–2008.

Briefly, between the two reference years (2005 and 2008), the structural changes in the configuration of certain performant agri-food chains through competitiveness have not been produced yet; we can rather notice the persistence of certain trends that reduce the multiplying effects of value added generated by the sector in overall national economy. Otherwise, no full explanations can be found for the fact that in three-year time, the share of agriculture in total economic operators of the agri-food chain was down from 97.5% to 97.2%, which is a non-significant relative decline.

Furthermore, the 0.3% diminution of the share of the segment agriculture in total operators from the agri-food chain was "outflanked" by a simultaneous diminution by 6.2% of this segment share in total labour input, which consequently did not result in a plus of value added generation, but rather to a minus (of 5.0%).

The other four segments of the agri-food chain, whose cumulated shares with regard to the economic operators ranged from 2.5% (2005) to 2.8% (2008), i.e. a very small number of non-agricultural economic operators put to work 19.1% of the employees from the entire chain, in the year 2005, and 25.3% in the year 2008, these generating 30.3% (2005) and 35.3% respectively (2008) of the value added from Romania's agri-food chain.

Therefore, the brief diagnosis of the structural changes produced in the agri-food chains confirms certain partial conclusions formulated in other previous segments of our scientific approach.

4.4. The real agricultural income criterion

One of the core synthetic variables of the agri-food economy, whose level and dynamics contribute to Romania's positioning in the European convergence competition, is the *real agricultural income*, measured by the so-called "*A* Indicator" (net value added at factor cost per annual work).

Compared to the EU-27 average and to certain countries taken into consideration, the annual index of "*A* Indicator" in Romania features the highest relative instability, revealed by the variation coefficient of 27.8%, which is 1.5 times and more than 4.7 times higher than in Germany and than the EU-27 average respectively (Table 4).

In cumulative real terms, the real income from the agricultural activity in Romania was by 93.0% higher in 2013 than in the year 2000, lying between the minimum level of 15.3% (Netherlands) and the maximum level of 121.6% (Hungary); in overall EU-27, the cumulative growth was 27.3%. In Romania's case, what strikes us is the alternance of periods with real agricultural income growth (11.1% in 2001–2004 and 11.2% in 2009–2011), with other two periods when the real agricultural income decreased (–10.1% in 2005–2008 and –7.8% in 2012–2013) (Figure 10).

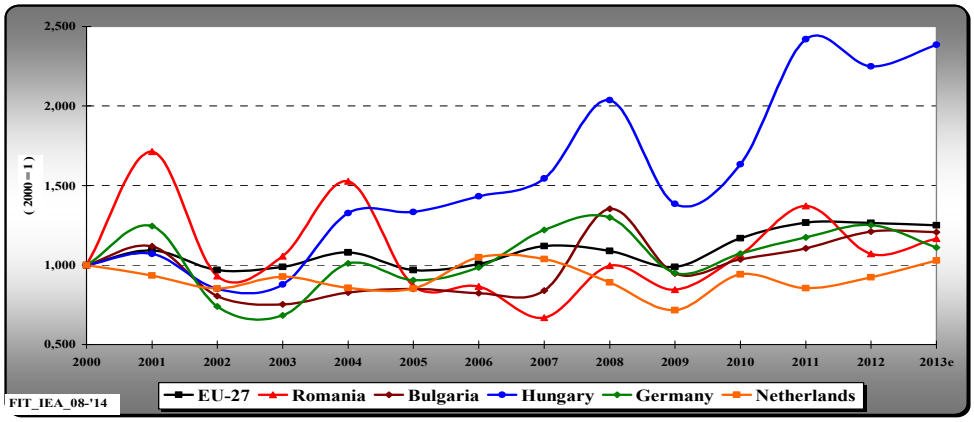
The extent to which one can confirm the presence of European convergence process through the real agricultural income is revealed by the adjustment of yearly cumulative relative modifications of this indicator in Romania and in EU-27 (Figure 11).

Although with weak determinations, the linear trends of the yearly cumulative variations of "*A* Indicator" in Romania's agriculture and in EU agriculture reveal a relatively divergent behaviour; this confirms the real difficulties that the Romanian agri-food sector is facing in reaching European economic convergence.

Table 4
Annual indices, variation coefficients and average yearly rates for "*A* Indicator", in Romania and the European Union, 2000–2013

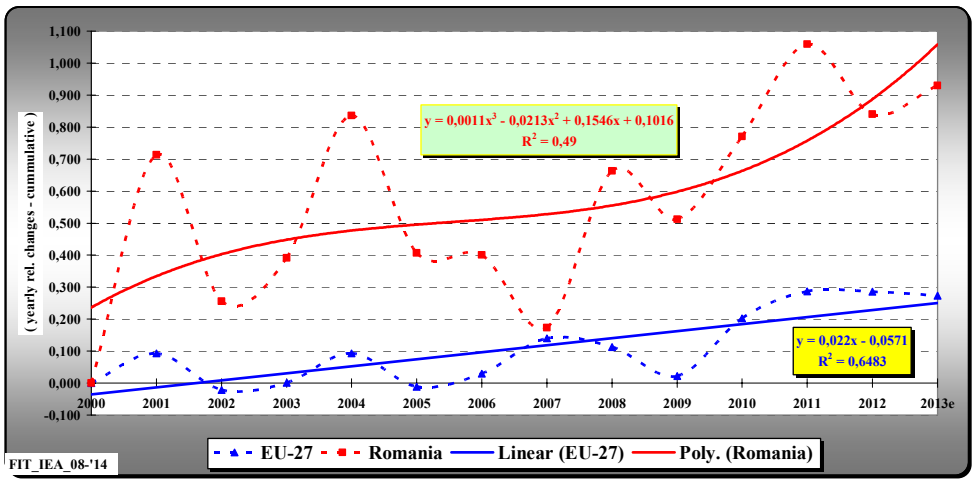
	EU-27	Romania	Bulgaria	Hungary	Germany	Netherlands
2000	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
2001	1.093	1.713	1.118	1.071	1.245	0.934
2002	0.886	0.543	0.720	0.794	0.594	0.912
2003	1.022	1.135	0.936	1.033	0.924	1.087
2004	1.092	**1.446**	**1.097**	**1.511**	**1.481**	**0.925**
2005	0.896	0.571	1.029	1.006	0.894	0.995
2006	1.041	0.993	0.969	1.073	1.088	1.230
2007	1.110	0.773	1.020	1.079	1.242	0.989
2008	0.972	**1.490**	**1.611**	**1.318**	**1.063**	**0.859**
2009	0.909	0.849	0.700	0.680	0.731	0.804
2010	1.181	1.258	1.094	1.180	1.130	1.314
2011	1.085	1.289	1.066	1.482	1.094	0.908
2012	0.998	**0.781**	**1.095**	**0.929**	**1.066**	**1.082**
2013e	0.988	1.089	0.998	1.061	0.887	1.114
Average	*1.020*	*1.066*	*1.032*	*1.087*	*1.031*	*1.011*
StDev	*0.087*	*0.348*	*0.211*	*0.231*	*0.223*	*0.142*
CoV%	***8.56***	***32.66***	***20.45***	***21.24***	***21.59***	***14.05***
Σvar. rel.	**0.273**	**0.930**	**0.452**	**1.216**	**0.439**	**0.153**
01 - "04 ('00 = 1)	**1.95**	**11.14**	**-4.66**	**7.32**	**0.28**	**-3.81**
05 - "08 ('04 = 1)	**0.18**	**-10.11**	**13.13**	**11.31**	**6.46**	**0.98**
09 - "11 ('08 = 1)	**5.21**	**11.25**	**-6.53**	**5.93**	**-3.31**	**-1.39**
12 - "13 ('11 = 1)	**-0.69**	**-7.76**	**4.51**	**-0.72**	**-2.73**	**9.80**

Source: own calculations based on Eurostat data; extraction date: 29 Aug 2014 23:05:12 MEST http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tag00057



Source: own calculations based on Eurostat data; extraction date: 29 Aug 2014 23:05:12 MEST http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tag00057

Figure 10. Dynamics of "*A* Indicator" in Romania's agriculture compared to certain EU countries, 2000–2013 (2000 = 1).



Source: own calculations based on Eurostat data; extraction date: 29 Aug 2014 23:05:12 MEST http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tag00057

Figure 11. Trends of yearly cumulative relative modifications of "*A* Indicator" in Romania's agriculture and in EU-27 agriculture, 2000–2013.

5. CONCLUSIONS

The competitiveness generating convergence is usually linked to tangible results, such as the continuous increase of productivity, real wages and living standard, the development of innovative processes with driving effects. Eight dynamic economic "stages" are identified that reflect the propensity for convergence:

- The disarticulation present in Romania's economy dynamics in the period 1990–2013 is confirmed by the strong relative instability, measured by the variation (CoV %), which have an oscillation range from 5.45% (in total GVA in the economy) to 15.42% (in agriculture).
- The energy intensity, mainly considered a partial expression of the energy efficiency of the economy from a given country, has a strong regressive trend in Romania, compared to EU-28 average, and bridging up the gaps requires excessively long time periods (from 150.4 years to 31.5 years).
- Out of the eight time periods considered as relevant for comparative assessments of economic performance, only in three intervals (1993–1996, 2001–2004 and 2012–2013) the "real earnings – productivity" correlation was within the economic rationality limits (the productivity growth rate outstrips the real wages growth rate).
- The intensity of intermediary deliveries of agriculture to food industry had a maximum percentage decrease by over 37% (from 67.0% in 1990 to only 29.8% in 2002), while the intensity of intermediary deliveries of food industry to agriculture decreased by almost 25% (from 28.4% in 1993 to 2.7% in 2009).

- The intensity of intermediary acquisitions of food industry from agriculture was down by 48.1% (from 76.7% in 1989 to 28.6% in 2002), while the intensity of intermediary acquisitions of agriculture from the food industry by more than 20% (from 23.7% in 1990 to 3.3% in 2009).
- The structural changes produced in the agri-food chains have not been opportune and systematic enough so that these can become fully functional, in the sense of making it possible to transmit the price signals throughout the entire agri-food chain, from farmer to final consumer.
- The real income from agriculture (named "*A* Indicator" in the EU statistics reached a yearly relative increase (in cumulative terms in the period 2000–2013) of 93.0%, which lies between a minimum level of 15.3% (Netherlands) and a maximum level of 121.6% (Hungary); in Romania's case, the relative instability of about 32.7% is also striking, which is 3.8 times as high compared to the EU-27 average.

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