

Filon TODEROIU

*Institute of Agricultural Economics, Romanian Academy, Bucharest
filitod@yahoo.com; filon@eadr.ro*

MACROECONOMIC VARIABLES INFLUENCING THE EUROPEAN CONVERGENCE OF THE ROMANIAN AGRI-FOOD SECTOR

ABSTRACT

The methodological opening necessary to approach the economic convergence was based on a series of recent empirical studies, both at national level, in a European context and at the level of the agri-food sector, compared to overall Romanian economy.

The competitiveness, which generates convergence, is usually related to tangible results, such as continuous productivity growth, high real wages and living standard, innovating processes with driving effect.

The disarticulation in the Romanian economy dynamics in the last two decades is confirmed by the strong relative instability, measured by the variation coefficients (CoV%), ranging from 6.03% (in total GVA) to 14.83% (in agriculture).

The energy intensity – in principle considered as a measure of the energy efficiency of a nation's economy – experienced a strong regressive trend in Romania, compared to the EU-27 average, and bridging up the gaps requires extremely long periods of time (from 121.2 years to 32.7 years).

Out of the six time periods considered as relevant for comparing economic performances, only in two (1993–1996 and 2001–2004) the “real wages – productivity” correlation was in the limits of economic rationality.

The intensity of intermediary deliveries of agriculture to food industry was down by more than 35% (from 65.1% in 1989 to only 29.9% in 2007), while the intensity of intermediary deliveries from food industry to agriculture was down by more than 14.5% (from 19.1% in 1989 to 4.6% in 2007).

The intensity of intermediary acquisitions of food industry from agriculture decreased by 46.7% (from 76.7% in 1989 to 30.0% in 2007), while that of agriculture from the food industry by 11% (from 18.0% in 1989 to 7.0% in 2007).

The gross agricultural output per hectare in Romania had the highest variation coefficient among the seven investigated countries, *i.e.* 23.5%, compared to only 6.5% in Germany, under the conditions of a large technological performance gap between Romania and the compared countries.

The bi-factorial regression adjustment of the gross agricultural output per hectare, for which a determination coefficient of 80.4% was determined, reflects its pregnant dependence on cereal production.

The real income from the agricultural activity in Romania was, in cumulative relative terms, by only 7.8% higher in 2008 compared to 2000; this increase lay between the decline by 9.2% (Netherlands) and the increase by 31.5% (Bulgaria); in Romania's case, there was a striking amplitude of average yearly modifications, from 27.12% in the period 2001–2004 (2000 = 1), to – 12.85% in the period 2005–2008 (2004 = 1), *i.e.* the highest difference in rates among the compared countries.

Key words: economic convergence, energy intensity, wages–productivity correlation, intermediary deliveries and acquisitions, A Indicator.

JEL Classification: C22; D57; O11; O47; Q43.

1. INTRODUCTION

The agriculture and food issue is and remains of global and European interest, both *per se* and regarded as a subsystem of other “challenges” at world level (globalization, poverty, sustainable development, competitiveness, etc.), and more recently, the current financial-economic crisis.

The European economic area – already enlarged to 27 countries – has the particularity that agriculture and food “consumes” the main portion of the Community budgetary “pie” and calls for adjustment reforms, both to the rigours of the international trade formulated by WTO and to the real convergence requirements of the European economies.

Romania’s European economic convergence largely depends on the agri-food sector performance, also measured in its synthetic form, by the significant diminution of the territorial disparities in the endowment with production resources and factors, non-concordant with the discrepancies from the results, as it is known that one of the main particularities of agriculture – the territorial zonality of agriculture favourability rarely makes the spatial distribution of production zones (supply) coincide with the consumption centers (demand) of agri-food commodities.

The previously formulated premises, as introductory benchmarks for any medium or long-term development strategic approach, which targets the increase of competitiveness and European convergence, cannot overlook the presence and future of the agri-food sector, as important subsystem of national economy.

The present paper intends, starting from the theoretical concepts related to the regional economic convergence, generating social cohesion (chapter 1), to present the general macro-economic background (subchapter 2.1), in which to quantify the influences of explanatory variables, on one hand subsumed to the domestic convergence by the “wages – productivity” correlation (subchapter 2.3), agri-food integration (subchapter 2.4) and on the other hand, pertaining to European convergence, by the energy intensity in the economy (subchapter 2.2), yields and investments in agriculture (subchapter 2.5) and real incomes in agriculture (subchapter 2.6).

2. MATERIAL AND METHOD

2.1. PROBLEM ONTOGENESIS

In the last two decades, a significant increasing number of empirical studies on the regional economic growth indicators were (explicitly or not) based on the so-called convergence theory¹ (Bussoletti *et al.*, 2003; Islam 2003).

¹ See Bussoletti, S., Esposti, R. (2003), “Structural funds, regional convergence and agricultural employment in the enlarged EU. A panel – data Approach”, in 87th EAAE – Seminar, “*Assessing Rural Development of the CAP*”; Islam, N. (2003), “What Have We Learnt from the Convergence Debate?”, in *Journal of Economic Surveys*, No.3, Vol. 17, pp. 309–362.

These studies apply certain models and methods initially designed for the study of long-term growth of the economies of larger countries to the regional context rather than to the regional environment or to the short-term growth² (Barro & Sala-i-Martin, 1995).

The measurement of the effects of European integration upon the economic and social development of the Member States, upon the convergence process and narrowing the gaps between the Member States represents a field of special interest, both for academicians and for practitioners³.

The economic and social cohesion policy of the European Union, for the programming period 2007–2013, targets, in a synthetic vision, three great objectives: *convergence*, addressed to the regions from the EU Member States with GDP/capita under the limit of

75% of the Community average and to the regions falling into the so-called “statistical effect” of changing the EU average, following the accession of new countries; *regional competitiveness and employment*, targeting the regions that are not eligible under the convergence objective; *European territorial co-operation*, targeting transnational, cross-border and inter-regional co-operation.

In Romania, the governmental policy of economic-social convergence seems relatively diffusely formulated, being included in the regional development policy, for which the Convergence Program 2008–2011⁴ has in view two objectives, namely: *diminution of current regional disequilibria*, by stimulating the increase of competitiveness and revitalization of less-favoured areas and *balanced regional development*, by correlating the national public policies of sectoral development with the public policies of local development: infrastructure and transports, labour employment increase, rural development, health and education, environment.

2.2. METHODOLOGY USED

State of knowledge. On the basis of a series of recent empirical studies⁵ (Toderoiu, 2009, 2010, 2010a), the necessary methodological opening was developed

² See Barro, R.J. and Sala-i-Martin, X., (1995), *Economic Growth*, McGraw-Hill.

³ See Zaman, Gh., Georgescu, G. (2009), “Structural fund absorption: a new challenge for Romania”, in: *Romanian Journal of Economic Forecasting (RJEF)*, no. 1, pp. 138–154.

⁴ See: Convergence Program 2008–2011, Romania’s Government, May 2009, 79 p. In accordance with the EC requirements, the third edition of the Convergence Program complies with the methodology on the contents and format of the Convergence and Stability Programs, adopted by Ecofin Council on October 10, 2005.

⁵ See Toderoiu, F., (2009), “Real Economic Convergence – European and National Dimensions”, in: *Agricultural Economics and Rural Development*, Volume 6, No. 2, Romanian Academy Publishers, Bucharest, p. 159–180; ftp://www.ipe.ro/RePEc/iag/iag_pdf/AERD0902_159-180.pdf; Toderoiu, F., (2010), “Convergența economică reală – dimensiuni europene și naționale”, in: *Economie Agrară și Dezvoltare Rurală*, Serie nouă, Anul VII, nr. 1, Ed. Academiei Române, București, pp. 17–40; Toderoiu, F. (2010a), “Regional Disparities in Rural Development and the Implications on the Socio-Economic

for the approach to the economic convergence issue, both at national level, in EU context, and at sectoral agri-food level, in relation with the overall Romanian economy.

*Three different modalities*⁶ for configuring the *regional convergence of the economic activity* were revealed: *the first*, which is the simplest, by measuring the absolute discrepancy between the maximum and minimum limits of GDP per capita, at regional NUTS – 2 level; *the second* approach, by estimating the share of the population living in the regions, with certain GDP per capita levels, as compared to the EU–27 average; *the third* method, by calculating the regional GDP dispersion at NUTS – 2 level.

The convergence process relevance can be confirmed by the levels of certain statistical indicators in time, referring to homogeneity, concentration, polarization, entropy, complementarity⁷.

The complex process of economic-social convergence in any country or community of states can be approached from *two main perspectives*: on one hand, as *stage of convergence fulfilment*, and on the other hand, as *intensity of convergence fulfilment process*.

The *stage of convergence fulfilment* can be measured by a “panel” of five groups of indicators: *spread indicators* (simple – amplitude and deviation) and synthetic indicators (dispersion, mean square deviation – also called σ convergence, variation coefficient and mean linear deviation, the decreasing trend of these indicators revealing the convergence process intensity); referring to the *concentration level* (Gini, Gini-Struck coefficients, Gini-Lorenz coefficient and curve, Herfindahl coefficient, Theil index). The tendency to zero of these concentration coefficients reveals the existence of “equity”, equilibrium, proportionality between the distribution of resources and results; referring to the *polarization level* (the concentration coefficient variant); referring to *multidimensionality* (human development index – HDI); referring to *complementarity*, by which a mutually beneficial economic cooperation potential is signalled out.

The *intensity of convergence fulfilment process* can be assessed on the basis of a “panel” of *five indicators* (β regression and convergence analysis; co-integrated series; matrix of transition probabilities; spatial dependence test; territorial econometrics; unequal indices of economic growth).

By comparison with the neo-classical models, in which, for a given population, there is an optimal savings rate (and hence investment rate), which determines the long-term equilibrium of GDP per capita, the new theory of economic growth represents a significant methodological advance.

Cohesion in Romania”, Paper presented at the Polish – Romanian Symposium, Bucharest, September, 22–23.

⁶ See Krueger A (2009) “Narrowing spread in regional GDP”, *Eurostat Statistic in Focus*, 75, p.8.

⁷ See: Pecican, E. St. (2009), “Indicatori privind convergența reală și aplicațiile acestora”, in Iancu, A. (coord.) “*Convergența economică*”, Ed. Academiei Române, București, pp. 11–43.

The opinion trend⁸, which emerged in recent years, formulates the postulate according to which the economic growth is a transitory process of adjusting the moment from which the cumulative factor (capital) exceeds the decreasing marginal income.

The regional convergence and the determinants of economic growth can be empirically investigated, more thoroughly, on the basis of *two main theoretical approaches*, referring to a common vision on the technological changes for growth: “*the new theory of growth*” (in regional sense); the (neo) Schumpeterian (or evolutionist) vision on economic growth.

The testing of the above-mentioned theories had a good application ground by the European integration process, through two accompanying phenomena: *the very existence of convergence*, which had been debatable for a long time (different studies produced puzzling results with regard to the dynamics of the indicator GDP/capita after 1980); *increased heterogeneity* between the EU countries, by the emergence of increasing dissimilarities inside the countries, which suggests a polarized development in Europe (see concept of “club convergence”, introduced by⁹).

The economic convergence process can be statistically investigated on the basis of *two sets* of relevant indicators: *economic structure indicators* (population and demographic density; share of employment in the primary and secondary sectors); *economic performance indicators* (GDP/capita, in PPS; employment rate; real GDP growth rate (in constant prices); real GDP growth rate / employee.

In recent years, the importance of *regional competitiveness* has been increasingly in the center of public attention and debates, while certain alarming tendencies have been signalled out with regard to the competitive advantage, both in global and local context, this subject being on top of the list in formulating the EU policies.

The regional economic environment can be generally modelled by the simultaneous action of three great groups of factors that influence the entrepreneurial spirit, namely factors specific to the *macro-climate*, *micro-climate* and factors specific to *each individual* in part (GEA 2007).

As a rule, the theoretical constructions generally increasingly combine the macro aspects of the industrial policies with the regional aspects of the economy of industrial agglomerations. In other words, the regional competitiveness policy plays a new role, an increased role, by focusing on the regions featuring the greatest competitiveness growth.

⁸ See: „Policy guidelines for regions falling under the new new competitiveness...”, vol. I, Statistical analysis, Csil Milano, dec. 2005.

⁹ Quah, D.T. (1996), “Regional convergence clusters across Europe”, *European Economic Review*, vol. 40.

Regardless of definition, competitiveness is usually related to tangible results, such as the continuous productivity growth, high living standard and real wages, innovating processes with driving effects. The necessary conditions for the study of competitiveness at national level can be common to those necessary for the analysis at regional level, though in the case of the latter, certain usual constraints, i.e. mobility of production factors, trade barriers, absorption of macro-economic shocks, are incomparably more relaxed.

The analytical analyses used with time series data are constructed on the hypothesis of links, stable over time, between different economic sizes – GVA, economic potential¹⁰ and demographic density of a given region. On this basis, (medium-term) forecasts can be made, also taking into consideration the exogenous influences on the long-term economic and demographic evolution in a region.

Starting from the postulate that there would be no universally accepted definition of regional (competitiveness), this concept tries to measure the economic prosperity level of regions¹¹; this approach is usually based on constructing a set of indicators and then, by comparing the results by regions, in order to measure the success obtained by each region in part.

The utility of this exercise resides in finding out if these basic factors of success can be also used in the less performing regions¹².

Methodological approaches. Before the presentation of the methodological approaches considered adequate for revealing the presence of the European economic convergence process in Romania, we shall briefly present a general framework of the macroeconomic evolution, on the long term (1989–2014), based on two statistical modalities:

¹⁰ See Votteler, M. (2004), *Wachstum und Konvergenz in den europaischen Regionen*, in “Standort (Ost) Deutschland”, ifo Bericht, pp. 19 - 27. It is considered that the economic potential of a region depends on its geographic situation (in principle, the central regions are favoured), hence the question to what extent the production factors are attracted and by this, additional economic growth can be generated.

¹¹ See Voinea, L. (coord.) *et al.* (2007), “*Manual de evaluare a competitivității regionale*” (Manual on regional competitiveness assessment), GEA, București. It is considered that the *gross domestic product (GDP) per capita* measures both the general development level and the regional living standard. In practice, it is also frequently used as partial expression of regional productivity, sufficient arguments existing for such an interpretation (*e.g.* GDP/capita decomposition into a multiplying aggregate of other four component factors, each of these having a specific economic interpretation. (see www.gea.org.ro, 2007). It is worth mentioning that the most important indicators in GDP/capita growth are the first three – GDP/total number of worked hours (labour productivity), total number of worked hours/total employees and total employees/active population (employment rate), the fourth indicator – active population/total population – representing the so-called demographic component (activity rate), generally less relevant on the short and medium term (see *Vincze 2002*).

¹² The reference studies (see *GEA 2007*) on regional competitiveness measurement frequently use the labour *employment rates dispersion method*. This is null when the employment rates inside the region (urban – rural) are identical and increases when there is a positive modification in the employment differences by areas of residence (urban – rural).

- *The first*, referring to the dynamic correlation between the main activities contributing to GDP creation;
- *The second*, targeting the quantification of the absolute average yearly increase (decline) of the newly created value in Romania's economy, throughout 1990–2010 and by different time periods considered relevant, using two relatively simple statistical calculation formulae:

$$\delta Y_{a_t} = [Y_{a_t} - Y_{a_{t-1}}] \quad [1],$$

where:

- δY_{a_t} = absolute yearly modification of GVA (GDP), recalculated in 2009 prices;
- and:

$$\delta Y_{ma} = [\sum \delta Y_{a_t} / T] \quad [2],$$

where:

- δY_{ma} = absolute valoric yearly modification of GVA (GDP);
- T = number of years from different reference periods, throughout 1990–2010–2014.

The approach to economic convergence can be based, in a first instance, on two reference macroeconomic variables, each of them targeting two levels (the EU level and the national level).

We refer here, *in the first place*, to a highly expressive synthetic indicator, on convergent or divergent performance of national economy versus the European economy: the energy intensity of the economy, measured by the aggregate energy consumption per 1000 euro gross domestic product (*kilogram of oil equivalent/1000 euro GDP*).

The overall Romanian economy convergence with the EU–27 average, through this economic performance indicator, can be revealed in two modalities:

- firstly, by the analysis of the comparative quantitative evolution of the energy consumption specific to the economy of a country (region, etc.) with the EU average;
- secondly, by taking into consideration the yearly average rates of *energy intensity (IE)* modification, determining the necessary time period for the recovery of the existing level gap (T) in the year 2008 between Romania and the European Union, by a well-known formula:

$$T = \{[\text{Ln}(\text{IE}_{\text{EU-27}}) - \text{Ln}(\text{IE}_{\text{RO}})] / [\text{Ln}(\text{rIE}_{\text{RO}}) - \text{Ln}(\text{rIE}_{\text{EU-27}})]\} \quad [3],$$

where:

- T = time period for the recovery of the level gap;
- $\text{Ln}(\text{IE}_{\text{EU-27}})$, $\text{Ln}(\text{IE}_{\text{RO}})$ = natural logarithms of the level indicators;
- $\text{Ln}(\text{rIE}_{\text{RO}})$, $\text{Ln}(\text{rIE}_{\text{EU-27}})$ = natural logarithms of the level indicators modification rates.

In the second place, at national level, a macro-economic variable with a strong impact on convergence fulfillment through competitiveness can be considered the *wage – productivity “tandem”*, both in overall economy and by activities generating value added.

The presence or absence of economic convergence, as revealed by the “wage – productivity” correlation, very frequently brought to the public debate, mainly after the beginning of the economic-financial crisis, can be revealed by *two analytical methods*:

- by the *simultaneous analysis of the dynamics* of the two reference indicators (average real net wage and labour productivity) of any economy;
- by the analysis of the long-term trends (1989–2009), regressionally expressed, of the two terms of one of the most important macro-economic correlation, by using the *statistical adjustment method* of the cumulated yearly modifications, according to the following formula:

$$\text{Trend (X}_t\text{)} = \mathbf{m} \cdot \mathbf{X}_t + \mathbf{b}, \quad [4],$$

where:

- Trend (X_t) = variables adjustment equation;
- X_t = considered variables ($\Sigma \delta C_{smnra}$ = cumulated yearly modification of the monthly average real net wages and respectively, $\Sigma \delta W_{qTa}$ = cumulated yearly modification of labour productivity);

m; b = regression coefficient of linear trend and the constant term, respectively.

Getting the economic convergence down to the sectoral level, it is considered that a given economy has a balanced development when there are no structural distortions, no disintegration or “erosion” of its technical-economic performance, which might severely impact the social cohesion of the society.

From this perspective, the absence of domestic economic convergence in the Romanian agri-food sector can be revealed and quantified by measuring the intensity of economic flows between the two main “aggregates” of agri-food economy (“agriculture” – consisting of six activities and “food industry” – consisting of ten activities)¹³.

¹³ See Artis M. et al. (1994) “*El sistema agroalimentario catalan en la tabla Input - Output de 1987*”, în Investigation Agraria – Economia (IAE), INITAA, vol. 9, no. 1; Enciso J.P. et al. (1995) “*Una vision del complejo de produccion agroalimentario espanol en la decada de los ochenta*”, în Investigation Agraria – Economia (IAE), INITAA, vol. 10, no. 3; Toderoiu F. (2001) “*Sectorul agroalimentar în România – mutații structurale multicriteriale comparative*”, IEA – INCE, București; Toderoiu F. (2002) “*Agricultura – resurse și eficiență – o retrospectivă semiseculară*”, Ed. Expert, București; Toderoiu F. (2003), “*Sectorul agroalimentar în România – corelații macroeconomice ale competitivității*”, IEA – INCE, București.

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

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

$$\lambda LI_{a \rightarrow ia} = (LI_a / LI_{ia}) \quad [5],$$

$$\lambda LI_{ia \rightarrow a} = (LI_{ia} / LI_a) \quad [6],$$

$$\lambda AI_{a \leftarrow ia} = (AI_{ia} / AI_a) \quad [7],$$

$$\lambda AI_{ia \leftarrow a} = (AI_a / AI_{ia}) \quad [8],$$

where:

– $\lambda LI_{a \rightarrow ia}$, $\lambda LI_{ia \rightarrow a}$, = intermediary deliveries intensity from agriculture to food industry and from food industry to agriculture respectively;

– $\lambda AI_{a \leftarrow ia}$, $\lambda AI_{ia \leftarrow a}$ = intermediary acquisitions intensity of agriculture from food industry and of 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 from the agri-food economy (agriculture – **a** and food industry – **ia**) in corresponding totals, according to the following formulae:

$$\mu LI_a = (LI_a / LI_{ia}) \quad [9],$$

$$\mu LI_{ia} = (LI_{ia} / LI_a) \quad [10],$$

$$\mu AI_a = (AI_a / AI_{ia}) \quad [11],$$

$$\mu AI_{ia} = (AI_{ia} / AI_a) \quad [12],$$

where:

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

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

Together with the agri-food disintegration, the “erosion” of the technical-economic performance in the Romanian agri-food sector also contributed to the lack of economic convergence.

This erosion of the technological performance of Romania’s agriculture, which unfortunately has been perpetuated, is “supported” by at least two “pillars” – the gaps in the average yields per hectare in cereals (“representative product” of the

main “players” on the European agricultural markets) and the gaps in the gross investments per agricultural hectare – which contributed to the low level of the gross agricultural output per hectare.

The econometric materialization of this inter-dependency is analytically expressed in the multiple linear regression¹⁴, according to formula:

$$Y = m_1 * X_1 + m_2 * X_2 + m_n * X_n \dots + b \quad [13],$$

where:

- Y = dependent variable, function of independent variables $X_1 \dots X_n$;
- $m_1 \dots m_n$ = linear regression coefficients;
- b = valoric constant.

3. RESULTS AND DISCUSSIONS

3.1. MACRO-ECONOMIC FRAMEWORK OF EUROPEAN CONVERGENCE

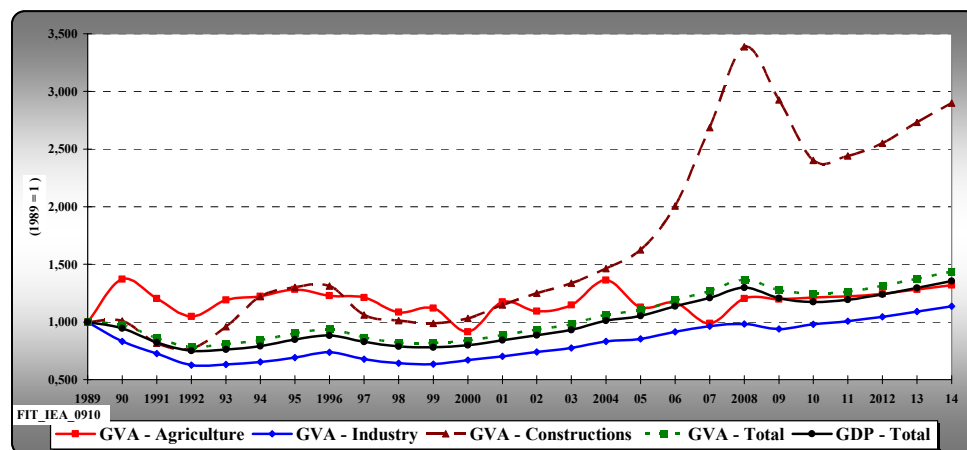
At the end of 2009, after 20 years of economic and social transformations, the national production (measured by GVA of the main economic activities and total GDP) was by 20.6% higher than in 1989, in total GDP, and by 27.8% in total GVA, with great dynamic discrepancies between the three activities (according to NACE classification), namely from decline, by 5.9% in GVA – industry, to growth by 192.6% in GVA – constructions, while GVA – agriculture was up by about 20% (Graph 1).

The obvious disarticulation of Romania’s economy dynamics in the last two decades is confirmed by the strong relative instability of the value added creation in the investigated activities, measurable by the variation coefficients (CoV%), which range from 6.03% (in total GVA), to 14.83% (in agriculture); the other three activities also lie within this variation range (14.01% – constructions, 7.39% – industry and 6.20% – total GDP).

The significant fragmentation produced in the evolution of the newly-created value in Romania’s economy, in the period 1990–2010 (1989 – reference year), from decline periods (1990–1992; 1997–1999; 2009–2010) to growth periods (1993–1996; and 2000–2008), seriously put under debate the real consistency of reaching convergence at macro-economic level.

¹⁴ The linear regression parameters are determined through the LINEST statistical application of the Excel software package, based on the least square method (LSM), according to the following

formulae:
$$m = \frac{[n(\sum xy) - \sum x \sum y]}{[n \sum x^2 - (\sum x)^2]} ; b = \frac{[\sum y \sum (x^2) - \sum x \sum xy]}{n(\sum x^2) - (\sum x)^2} .$$



Source: own calculations on Stat. Yearbook, Series 1990 - 2008; MSB, Nr. 2 / 2010; NCP - Prognosis 05.11.2010;

Graph 1. GVA (GDP) dynamics in Romania's economy, 1989–2014 (1989 = 1).

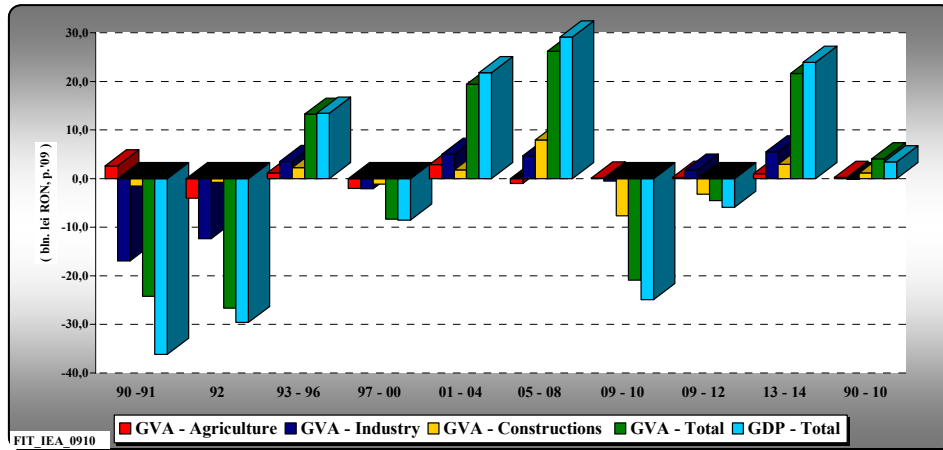
In comparable terms (2009 prices), the asymmetric evolution of GVA (GDP) corresponding to the five economic aggregates, more obviously revealed by the modification (increase or decrease) of the yearly absolute average of newly-created value, throughout 1990–2010 and by different periods considered relevant, comes to reconfirm the relative instability as persistent phenomenon (Table 1).

Table 1
Yearly average modifications of total GVA and GDP in Romania's economy,
1989–2014 (billion RON, 2009 prices)

	1990–1991	1992	1993–1996	1997–2000	2001–2004	2005–2008	2009–2010	2009–2012	2013–2014	1990–2010
GVA – agriculture	2.6	–4.0	1.2	–2.0	2.9	–1.0	0.1	0.3	1.0	0.3
GVA – industry	–17.0	–12.4	3.5	–2.1	5.0	4.7	–0.5	1.7	5.5	–0.1
GVA – constructions	–1.5	–0.8	2.2	–1.2	1.8	8.0	–7.7	–3.2	2.9	1.2
GVA – total	–24.2	–26.6	13.2	–8.3	19.4	26.2	–20.9	–4.6	21.6	4.1
GDP – total	–36.2	–29.6	13.5	–8.5	21.8	29.1	–23.4	–5.1	23.9	3.5

Source: Own calculations, based on Romania's Statistical Yearbook, 2010; for 2008–2014, National Forecast Commission, Autumn forecast 05.11.2010.

Practically, throughout 1990–2010, the yearly average of total GDP absolute modification reached about 3.5 billion RON, which can be explained by the (74.5 billion RON) differential between the cumulated GDP increase (of 257.4 billion RON), achieved in the 12 years of economic growth and the cumulated decline of the same indicator (of 182.9 billion RON), achieved in the 9 years of economic decline, related to the 21 years under investigation (Graph 2).



Source: own calculations on Stat. Yearbook, Series 1990 - 2008; MSB, Nr. 2 / 2010; NCP - Prognosis 05.11.2010;

Graph 2. Yearly average modifications of total GVA (GDP) in Romania's economy, 1989–2014 (billion RON, 2009 prices).

Among the other 4 aggregate indicators under consideration, only GVA – industry experienced an average yearly decline of about 0.1 billion RON in the investigated period, while agriculture, constructions and overall economy had yearly average growth ranging from 0.3 billion RON to 4.1 billion RON.

3.2. EUROPEAN CONVERGENCE THROUGH THE ENERGY INTENSITY OF THE ECONOMY

Energy intensity mainly represents a measure of the energy efficiency of a nation¹⁵; this can be calculated as energy units per GDP unit¹⁶.

As a reference macro-economic variable in revealing convergence through competitiveness, the energy intensity has a strong regressive trend in Romania, compared to the EU–27 average (Table 2).

¹⁵ See www.wikipedia.org: It is considered that a high *energy intensity* (EI) reveals a high cost of energy conversion into GDP and similarly, a low energy intensity indicates a low conversion cost. The energy intensity of a given economy, in general, can be influenced by many factors, among which the requirements derived from the general living standard in relation to the weather conditions in the economy have a particular significance.

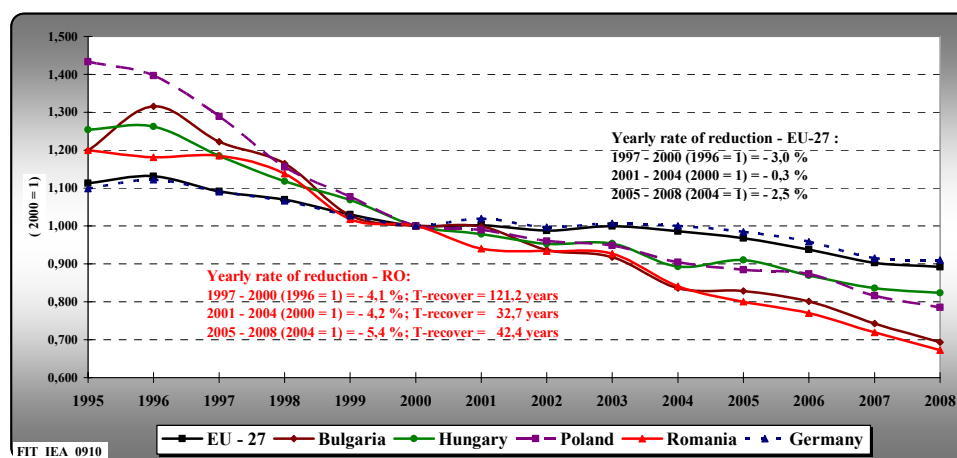
¹⁶ The relevance of this indicator trend consists in the general reflection of the general relation of the energy consumption with the economic development, which can represent a support for the projection of the energy consumption and of its environmental impact. A reverse calculation modality is also possible, *i.e.* the number of GDP units produced by the consumption of one energy unit; this indicator reveals the energy efficiency of an economy (also known as *rate of return on energy consumption*). The energy intensity can be used in comparative studies by countries, while in its differential expression, the percentage change in energy consumption to achieve one percent change in national GDP is named *energy elasticity*.

Thus, while in EU-27 the energy intensity decline of the economy averaged 21.2% in the year 2008 versus 1996, in Romania the energy intensity of the economy decline (measured as oil equivalent kg/1000 euro GDP) was double (43.0%). Yet, dissimilitude subsists from the perspective of the average yearly diminution of the energy intensity of the EU and Romanian economies, in the sense that the “cruise speeds” in Romania are increasingly reductive (from - 4.1% in the period 1997–2000, to - 5.4% in the period 2005–2008), comparatively to the decreasingly reductive speeds in EU-27 (from - 3.0% in the period 1997–2000, to - 2.5% in the period 2005–2008) (Annex 1 and Graph 3).

Table 2
Energy intensity of the economy, yearly modification rate and gap recovery time, in Romania and EU, 1996–2008

	Oil equivalent kg/1000 euro GDP				Yearly modification rates (%)			RO–EU-27 gap recovery time (years)		
	1996	2000	2004	2008	1997–2000	2001–2004	2005–2008			
EU-27	211.97	187.34	184.78	167.11	-3.0	-0.3	-2.5			
Romania	1078.84	913.36	768.3	614.57	-4.1	-4.2	-5.4	121.2	32.7	42.4

Source: Own calculations on the basis of Eurostat data, <http://epp.eurostat.ec.europa.eu/tgm/table>.



Source: own calculations, on the Eurostat data, <http://epp.eurostat.ec.europa.eu/tgm/table>.

Graph 3. Energy intensity of the economy, in Romania and some EU Member States, 1995–2008, (2000 = 1).

One of the main consequences of the significant differences in the energy intensity levels, both at the beginning of the investigated period (1996), and at the end of this period (2008), and of the different rates of energy intensity diminution consists in unusual large periods of time needed for the 2008 level gap recovery. Thus, with the diminution rates from the period 1997–2000, Romania could reach

the average EU level of 2008 after 121.2 years, with the “pair” of rates from the period 2001–2004 full convergence could be reached in 32.7 years; with the “rates” of the period 2005–2008, 42.4 years would be needed for the recovery of energy performance gap between Romania and EU–27. If we have in view that up to the present moment, in the intensity of the national economic aggregate, the problem of the strong weather dependency of agriculture did not count very much, it is expected that the reconsideration of the irrigation role will imply additional energy consumption in agriculture; as this means an increase of the energy intensity of the Romanian economy, it will prolong the gap recovery period and consequently, will delay the convergence through performance.

3.3. INTERNAL CONVERGENCE THROUGH THE “WAGES – PRODUCTIVITY” CORRELATION

As it is considered in all the functional market economies as one of the “pillars” of macro-economic competitiveness, the correlation between the real wages and labour productivity can reveal – to the extent it evolves in the economic rationality limits – the tendency towards economic convergence and social cohesion in the respective country (zone, region).

Determined as ratio of total GVA 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 deflator of consumer prices); normally, in this correlation, labour productivity should outstrip, as growth rate, the real wages (Annex 2).

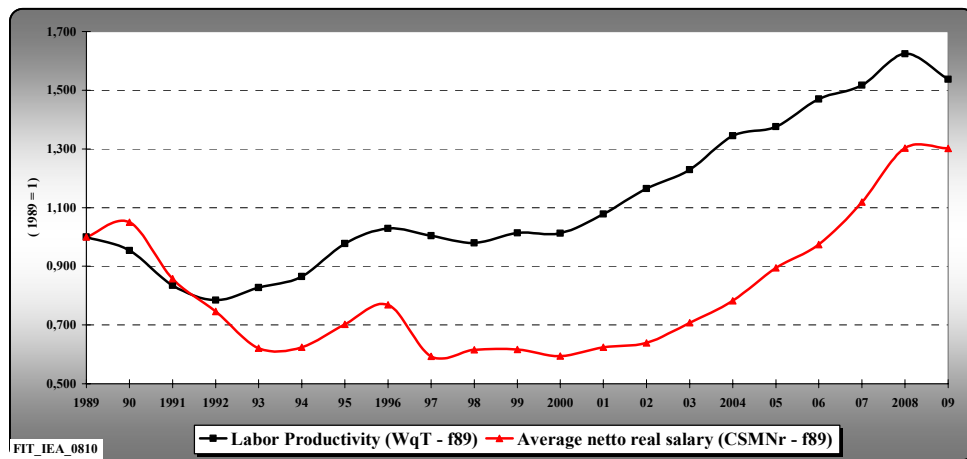
In the period 1990–2009 (1989 = 1), the dynamic correlation between the real wages and labour productivity in Romania’ economy evolved within the economic rationality limits, in the sense that in the 20-year period, only in two years (1990 and 1991) the real wages index was greater than the productivity index, while after 1992, the ratio of the two terms of the correlation was reversed (Graph 4).

Two main conclusions can be drawn from the analysis of the dynamic correlation between real wages and labour productivity (through the identification of six relevant intervals for which yearly average modification rates were determined), as a modality to reflect the tendency towards internal convergence of the Romanian economy:

- From the *three intervals (situations) in which both terms of the correlation present negative rates*, in two (1992 and 1997–2000) the average decrease rates of real wages (–13.02% and 6.22%) were higher than those of labour productivity (–5.98% and –0.0%), while in the third interval (1990–1991), the decline of real wages (–7.39%) was outstripped by that of labour productivity (–8.64%);

- *The intervals (situations) in which both terms of correlation have positive rates* are distributed as follows: in two of them (1993–1996 and 2001–2004) productivity (7.02% and 7.35%) outstripped real wages (0.75% and 7.12%), while in the third period (2005–2008), on the contrary, real wages (13.59%) outstripped productivity (4.83%);

- Briefly, the fact that out of the six time periods considered as relevant for comparing the economic performance only in two of them (1993–1996 and 2001–2004) the “real wages – productivity” correlation was within the economic rationality limits reveals the relatively fragile tendency of the Romanian economy to set up, in a sustainable manner, one of the “engines” generating convergence and social cohesion through internal competitiveness.



Source: own calculations, on the NIS data, 2010; for 2010: Romania in cifre 2010;

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

The tendencies of the two terms of the “wages – productivity” correlation on the long run (1989–2009), regression ally revealed by the statistical adjustment method, have the yearly and cumulative modifications of these as informational support (Table 3).

The first aspect that can be noticed is that at the end of the six comparative periods considered in our approach (year 2008), the relative cumulative increase of real wages was 32.8%, while labour productivity increase only 15.4%, the difference between the two relative gains (17.4%) synthetically revealing the divergent evolutions, beyond the limits of economic rationality of the two terms of investigated correlation.

The second aspect resides in the fact that in the first year of declared economic crisis (2009), at a labour productivity contraction by 13.3%, the real wages decreased by 14.5%; this situation might be considered as a slight correction of an unusual trend manifested in our economy in the last two decades (Graph 5).

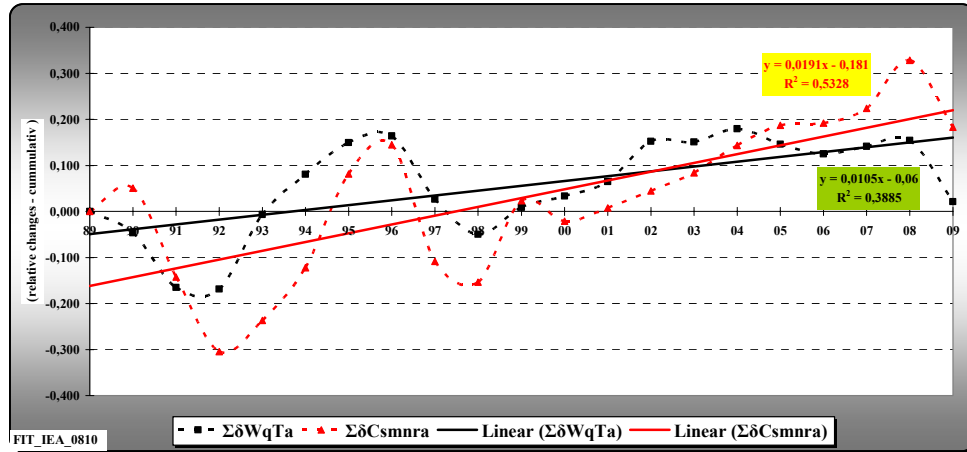
Table 3

Yearly modifications of labour productivity ($\delta WqTa$) and of the real net average wages ($\delta Csmnra$) and cumulative modifications ($\Sigma \delta WqTa$ and $\Sigma \delta Csmnra$) in Romania's economy, 1989–2009 (previous year = 1)

	Labour productivity ($\delta WqTa$)	Real net average wages ($\delta Csmnra$)		$\Sigma \delta WqTa$	$\Sigma \delta Csmnra$
1989	0.000	0.000	1989	0.000	0.000
90	-0.047	0.050	90	-0.047	0.050
1991	-0.119	-0.193	1991	-0.165	-0.142
1992	-0.050	-0.112	1992	-0.169	-0.304
93	0.043	-0.125	93	-0.007	-0.237
94	0.037	0.003	94	0.080	-0.122
95	0.113	0.078	95	0.150	0.081
1996	0.052	0.066	1996	0.164	0.145
97	-0.025	-0.175	97	0.027	-0.108
98	-0.025	0.022	98	-0.050	-0.153
99	0.034	0.001	99	0.009	0.023
2000	-0.001	-0.022	2000	0.033	-0.021
01	0.066	0.029	01	0.065	0.007
02	0.087	0.015	02	0.152	0.045
03	0.064	0.069	03	0.151	0.084
2004	0.115	0.075	2004	0.180	0.143
05	0.030	0.112	05	0.146	0.187
06	0.094	0.080	06	0.125	0.192
07	0.047	0.144	07	0.141	0.224
2008	0.108	0.184	2008	0.154	0.328
09	-0.086	-0.001	09	0.021	0.183

Source: Own calculations, on the basis of NIS 2010 data; for 2009, Romania in figures 2010.

Econometrically, one can notice the relevance of unfavourable correlation between real wages and labour productivity in Romania's economy, throughout the period 1990–2009. As a higher determination, the real net wages trend (53.3%) noticeably outstrips the labour productivity trend (38.9%), beginning with the year 2003, the reversal of this type of non rational correlation type requiring many years from now, mainly in the conditions of the financial-economic crisis under way.



Source: own calculations, on the NIS data, 2010; for 2010: Romania in cifre 2010;

Graph 5. Linear trends of the cumulative relative yearly modifications of labour productivity ($\Sigma\delta WqTa$) and of real net average wages ($\Sigma\delta Csmnra$), in Romania's economy, 1989–2009 (previous year = 1).

3.4. INTERNAL CONVERGENCE THROUGH AGRI-FOOD INTEGRATION

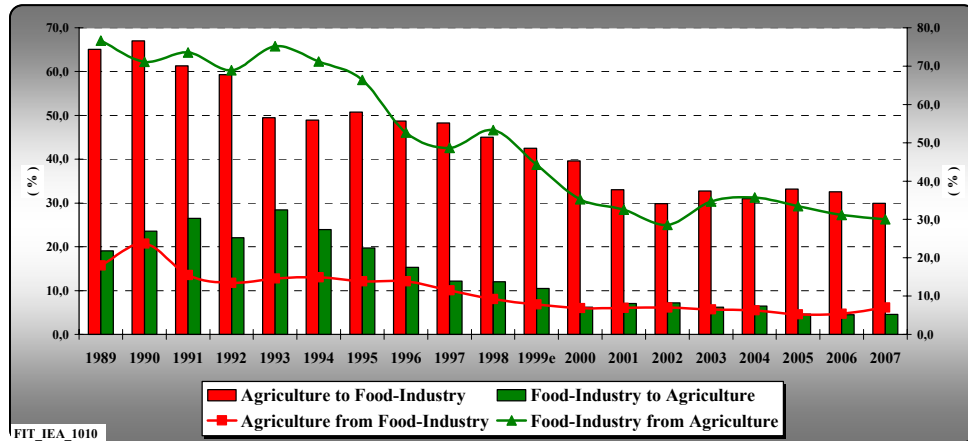
The synthetic expression of the presence of an agri-food disintegration process in Romania's economy, throughout 1989–2007 results from the analysis of the intensity of economic flows between the general aggregate "agriculture" and the "food industry" aggregate, both from the perspective of intermediary deliveries (destinations) and from the perspective of intermediary acquisitions (origins).

Thus, from the perspective of intermediary deliveries a diminution by over 35% of the intensity of intermediary deliveries of agriculture to the food industry can be noticed (from 65.1% in 1989 to only 29.9% in 2007, with maximum 67.0% in 1990 and a variation coefficient of 27.6%) (Graph 6).

At the same time, the intensity of intermediary deliveries flows from the food industry to agriculture was down by over 14.5 percent (from 19.1% in 1989 to 4.6% in 2007, with maximum 28.4% in 1993 and a variation coefficient of 60.7%).

The manifested regressions have multiple causes, which can be found both in the development pattern of the agri-food sector in the command economy period and in the failures during the transition period, among which the following stand out:

- Asymmetry in the destructuring process from agriculture (much faster and more radical) compared to that in food industry (slower and more superficial);
- Narrowing the population's final agri-food consumption demand, following the general economic decline action, under the background of persistent hyperinflation.



Source: own calculations, on the data from Nat. Accounts, 1990 - 2007, NIS;

Graph 6. Evolution of inter-relations between agriculture and food industry, as intermediary deliveries and intermediary acquisitions respectively, in Romania's economy, 1989–2007.

On the other hand, from the perspective of intermediary acquisitions, it is worth mentioning a stronger diminution (by 46.7%) of the intensity of the intermediary purchases flows of the food industry from agriculture (from 76.7% in 1989, to 30.0% in 2007, with a variation coefficient of 35.8%).

At the same time, the intermediary acquisitions of agriculture from the food industry diminished their intensity by 11% (from 18.0% in 1989 to 7.0% in 2007, with a maximum of 23.7% in 1990, with a variation coefficient of 46.7%).

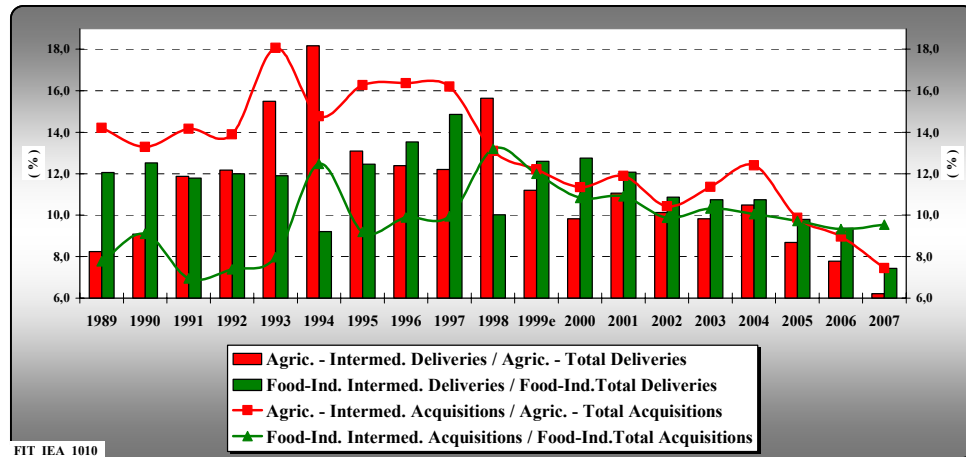
One of the explanations for the emergence and persistence of the agri-food disintegration phenomenon in the Romanian economy resides in the situation created by the excessive increase of the number of suppliers of agricultural raw materials, compared to the relatively low number of agri-food processors, an asymmetric “atomization” generating very high variation coefficients.

The other modality to reflect the internal agri-food economy convergence consists in measuring the intensity of intermediary deliveries (**LI**) and of intermediary acquisitions (**AI**) respectively, of each of the two component aggregates (agriculture – **a** and food industry – **ia**) in the corresponding total (Graph 7).

A few remarks can be formulated with regard to the persistence of the agri-food disintegration phenomenon in the Romanian economy:

- The highest relative instability (measured by the variation coefficient) is found in the aggregate “agriculture”, its shares ranging from 18.2% (1994) to 6.2% (2007), with a variation coefficient of 26.2%, in the intermediary deliveries and from 18.1% (1993) to 7.5% (2007) respectively, with the variation coefficient 21.2%, in intermediary acquisitions;

- The aggregate “food industry” presents lower decreasing shares, from 14.9% (1997) to 7.4% (2007), with an average variation of 15.2%, in the intermediary deliveries and from 13.2% (1998) to 7.0% (1991) respectively, with a variation coefficient of 16.8%, in the intermediary acquisitions.



Source: own calculations, on the data from Nat. Accounts, 1990 - 2007, NIS;

Graph 7. Evolution of the share of agriculture and food industry in total intermediary deliveries (LI) and total intermediary acquisitions (AI) related to the respective activities from the Romanian agri-food economy, 1989–2007.

It obviously results that reaching economic convergence through agri-food integration is endangered by the relatively high instability of the intermediary deliveries of agriculture, as a cumulative reflex of the meteo-dependence influences and economic-organizational risks in this field.

3.5. EUROPEAN CONVERGENCE THROUGH YIELDS AND INVESTMENTS IN AGRICULTURE

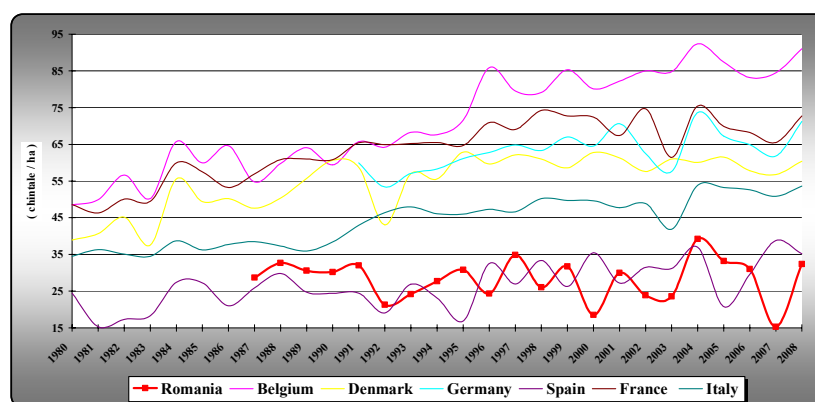
The previous conclusions can be explained, be it partially, by the persisting discordance between the levels of certain partial but relatively relevant indicators for the valoric measurement of the agricultural output (gross agricultural output), of physical productivity of land (average cereal yield) and of investment effort (gross fixed capital formation), between Romania and other six EU Member States.

There are also large technological performance gaps, from the perspective of average grain yields per hectare, not only because these yields are low, but also because they feature high instability, as measured by the variation coefficient (Table 4 and Graph 8), which is 25.2%, almost double compared to the other investigated countries.

The second performance indicator (gross investments per hectare) seems to cumulate the instabilities of the other variables, presenting extremely high variation coefficients (54.4%), with the only amendment that in the compared countries this parameter is also high (Table 5 and Graph 9).

Table 4
Average yields in cereals, in Romania and other EU countries, 1980–2008 (quintals/ha)

	Romania	Belgium	Denmark	Germany	Spain	France	Italy
1980		48.5	38.9		24.5	48.6	34.5
1981		49.9	40.7		15.3	46.3	36.3
1982		56.6	45.2		17.3	50.1	35.1
1983		50.2	37.6		18.3	49.5	34.5
1984		65.7	55.6		27.4	59.9	38.7
1985		59.9	49.4		27.3	57.5	36.2
1986		64.6	50.2		21	53.2	37.7
1987	28.7	54.7	47.6		25.9	56.9	38.5
1988	32.7	59.8	50.4		29.8	60.8	37.3
1989	30.6	64.1	55.7		24.7	61	35.9
1990	30.2	59.4	60.7		24.4	60.8	38.4
1991	32	65.7	58.7	59.9	24.5	65.4	42.9
1992	21.3	64.2	43.1	53.4	19.1	64.9	46.4
1993	24.2	68.3	57	57.1	26.9	65.2	48
1994	27.7	67.6	55.6	58.3	23.1	65.5	46.1
1995	30.8	71.6	62.9	61.1	16.9	64.7	46
1996	24.3	85.9	59.6	62.8	32.5	70.9	47.3
1997	34.9	79.5	62.1	64.8	27	69	46.6
1998	26.1	79.1	61	63.3	33.4	74.2	50.2
1999	31.7	85.3	58.6	67	26.3	72.7	49.7
2000	18.5	80.1	62.8	64.5	35.5	72.4	49.6
2001	30	82.2	61.3	70.6	27.2	67.4	47.7
2002	23.9	85	57.6	62.5	31.5	74.7	48.9
2003	23.6	84.8	61	57.6	31.2	61.4	41.9
2004	39.2	92.4	60.1	73.6	37	75.4	53.8
2005	33.2	87.4	61.5	67.2	20.8	69.9	53.2
2006	31	83.2	57.8	64.9	29.6	68.2	52.6
2007	15.3	84.5	56.8	61.8	38.8	65.5	50.8
2008	32.4	91	60.4	71.2	35.2	72.7	53.6
Average	27.7	71	55	63	28	64	44.1
Stand. deviation	7.0	13.4	7.6	5.3	6.2	8.298	6.56
Variation coef. %	25.2	18.8	13.9	8.3	21.7	13.0	14.9

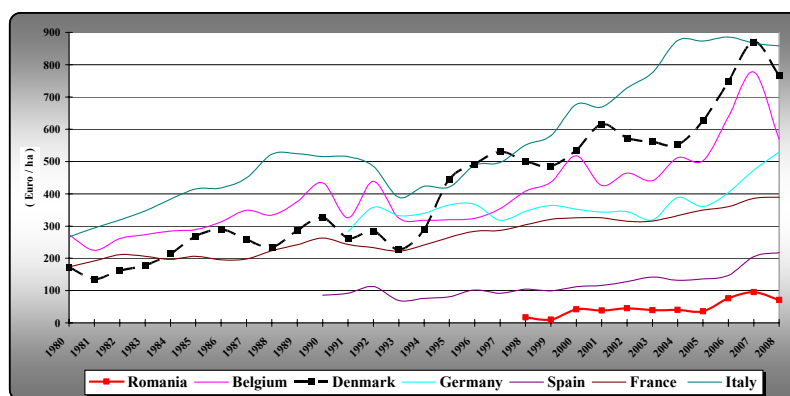


Source: own calculations on the Eurostat data, 2010;

Graph 8. Average cereal yields, in Romania and certain European countries, 1980–2008 (quintals/ha).

Table 5
Gross fixed capital formation in agriculture and certain European countries, (1980–2008) (euro/ha)

	Romania	Belgium	Denmark	Germany	Spain	France	Italy
1980		273	173			174	266
1981		225	136			192	294
1982		261	162			211	319
1983		273	179			206	347
1984		285	214			197	383
1985		289	268			206	415
1986		313	290			195	418
1987		349	258			198	449
1988		334	234			224	523
1989		376	286			242	524
1990		434	326		86	263	515
1991		326	263	283	92	243	515
1992		438	284	358	113	233	485
1993		325	227	332	69	222	389
1994		318	290	340	76	241	423
1995		320	445	366	81	265	421
1996		324	492	367	102	284	488
1997		354	530	318	92	286	497
1998	17	408	501	346	104	304	551
1999	10	436	486	364	99	321	580
2000	42	518	535	352	112	326	677
2001	38	426	615	343	116	326	669
2002	45	464	573	345	128	315	728
2003	39	441	561	319	142	316	776
2004	40	512	552	388	132	332	875
2005	36	503	626	361	136	350	873
2006	76	639	747	404	147	360	886
2007	95	777	871	473	205	386	867
2008	71	569	766	529	218	389	858
<i>Average</i>	<i>46</i>	<i>397</i>	<i>410</i>	<i>366</i>	<i>118</i>	<i>269</i>	<i>552</i>
<i>Stand. deviation</i>	<i>25.2</i>	<i>123.9</i>	<i>202.1</i>	<i>56.8</i>	<i>39.7</i>	<i>63.22</i>	<i>191</i>
<i>Variation coef.%</i>	<i>54.4</i>	<i>31.2</i>	<i>49.3</i>	<i>15.5</i>	<i>33.5</i>	<i>23.5</i>	<i>34.6</i>



Source: own calculations on the Eurostat data, 2010;

Graph 9. Gross fixed capital formation in agriculture, in Romania and certain European countries, (1980–2008) (euro/ha).

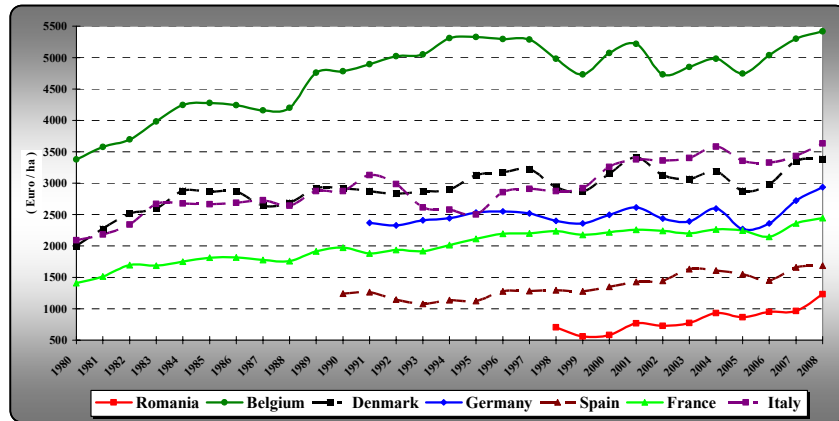
As regards the valoric performance of the agricultural hectare, Romania has the highest variation coefficient in the seven investigated countries, *i.e.* 23.5% compared to only 6.5% in Germany (Table 6), in the conditions of a large performance gap between Romania and the compared countries (Graph 10).

Only the evolution in time of the different indicators – performance factors is not enough for the identification of certain potentials for the improvement of the economic results, derivable from the simultaneously effects of the variables under discussion.

Table 6

Gross agricultural output, in Romania and certain European countries, 1980–2008 (euro/ha)

	Romania	Belgium	Denmark	Germany	Spain	France	Italy
1980		3378	1998			1408	2090
1981		3579	2274			1515	2184
1982		3695	2515			1695	2340
1983		3983	2597			1688	2668
1984		4247	2879			1752	2678
1985		4277	2863			1812	2664
1986		4242	2864			1819	2686
1987		4161	2643			1778	2726
1988		4201	2685			1758	2640
1989		4760	2916			1912	2875
1990		4783	2916		1243	1973	2875
1991		4894	2874	2367	1262	1883	3127
1992		5024	2832	2329	1147	1938	2986
1993		5051	2870	2409	1076	1916	2612
1994		5307	2897	2441	1135	2014	2578
1995		5328	3126	2533	1124	2114	2501
1996		5297	3175	2552	1277	2196	2856
1997		5287	3224	2520	1284	2198	2907
1998	703	4980	2935	2399	1295	2237	2875
1999	559	4730	2863	2361	1277	2179	2916
2000	580	5074	3152	2497	1348	2219	3260
2001	770	5216	3409	2614	1429	2258	3379
2002	726	4731	3128	2435	1447	2242	3360
2003	774	4852	3066	2390	1633	2199	3398
2004	932	4981	3185	2596	1610	2263	3581
2005	865	4747	2876	2268	1548	2245	3353
2006	951	5038	2981	2357	1449	2147	3328
2007	962	5302	3353	2725	1659	2360	3432
2008	1231	5420	3387	2936	1687	2447	3632
<i>Average</i>	823	4709	2913	2485	1365	2006	2914
<i>Stand. deviation</i>	193.3	566.5	312.2	161.2	192.7	261.7	409
<i>Variation coef.%</i>	23.5	12.0	10.7	6.5	14.1	13.0	14.0

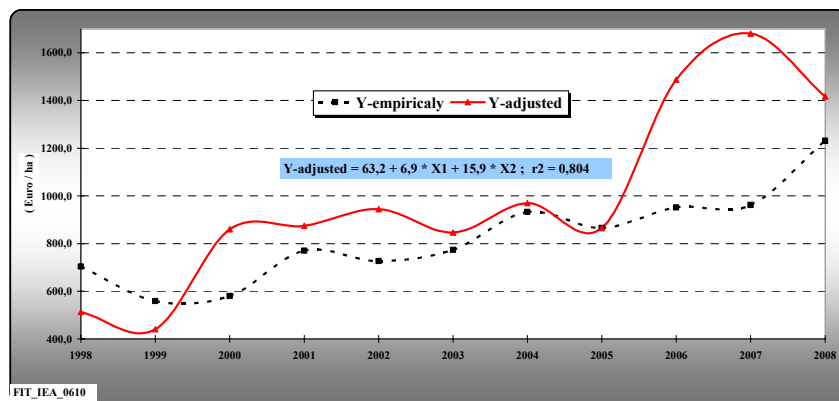


Source: own calculations on the Eurostat data, 2010;

Graph 10. Gross agricultural output, in Romania and certain European countries, 1980–2008 (euro/ha).

In this respect, the results of multiple correlations between the gross agricultural output (Y), average yield in cereals ($X1$) and gross investment ($X2$) converge to the conclusion that our agriculture has performance potential, measurable by assigning desired levels to each of the two explanatory variable of the gross agricultural output, in the multiple regression determined for Romania's agriculture in the period 1998–2008 (Table 7 and Graph 11).

The bi-factorial regressional adjustment of the gross agricultural output per hectare, for which a determination coefficient of 80.4% was determined, confirms one of the characteristic features of Romania's agriculture, namely its high dependence upon grain production, which does not confer very high performance stability *per se*.



Source: own calculations on the Eurostat data, 2010;

Graph 11. Multiple correlation between VPAha (Y), qCERha ($X1$) and FBCFha ($X2$) in Romania's agriculture, 1998–2008.

Table 7
Multiple correlation between the gross agricultural output (VPAha), average yield in cereals (qCERha) and gross agricultural investment (FBCFha), in Romania, 1998–2008

RO	FBCFha (X2)	qCERha (X1)	VPAha (Y)		Y-empirical	Y-adjusted
1980				1980		
1981				1981		
1982				1982		
1983				1983		
1984				1984		
1985				1985		
1986				1986		
1987		28.7		1987		
1988		32.7		1988		
1989		30.6		1989		
1990		30.2		1990		
1991		32		1991		
1992		21.3		1992		
1993		24.2		1993		
1994		27.7		1994		
1995		30.8		1995		
1996		24.3		1996		
1997		34.9			Y-empirical	Y-adjusted
1998	17	26.1	703	1998	703.0	513.5
1999	10	31.7	559	1999	559.0	440.6
2000	42	18.5	580	2000	580.0	859.3
2001	38	30	770	2001	770.0	874.8
2002	45	23.9	726	2002	726.0	944.2
2003	39	23.6	774	2003	774.0	846.6
2004	40	39.2	932	2004	932.0	969.9
2005	36	33.2	865	2005	865.0	864.9
2006	76	31	951	2006	951.0	1486.7
2007	95	15.3	962	2007	962.0	1681.2
2008	71	32.4	1231	2008	1231.0	1416.7
Average	46.3	27.7	823			
Stand. deviation	25.2	7.0	193.3			
Var. coef. %	54.4	25.2	23.5			
LINEST	FBCFha (X2)	qCERha (X1)	VPAha (Y)			
mX; b	15.9	6.9	63.2			
se m; se b	4.6	1.3	158.1			
r2; se Yest	0.804	95.6	#N/A			
Fstat; df	16.4	8.0	#N/A			
ss reg; ss resid	300480.1	73097.9	#N/A			

3.6. EUROPEAN CONVERGENCE THROUGH REAL INCOME FROM AGRICULTURE

One of the essential synthetic variables of agri-food economy, according to which Romania can be placed in the European convergence competition, is the *real income from the agricultural activity*, measured by the so-called “A Indicator” (net value added to the factor cost per annual work unit).

Compared to the EU–27 average and to certain countries under consideration, the annual index of “A Indicator” in Romania has the highest relative instability, revealed by the variation coefficient of about 27.8%, from 1.5 times to over 4.7 times higher than in Germany and EU–27 average respectively (Table 8).

Table 8

Annual indices, variation coefficients and average yearly rates for A Indicator, in Romania and in the European Union, 2000–2008

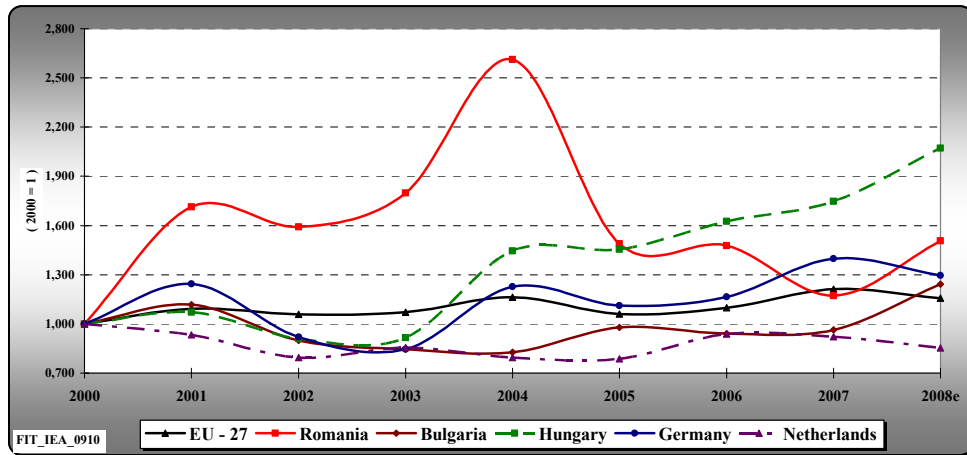
	EU–27	Romania	Bulgaria	Hungary	Germany	Netherlands
2000	1.000	1.000	1.000	1.000	1.000	1.000
2001	1.093	1.713	1.118	1.071	1.245	0.934
2002	0.968	0.930	0.805	0.850	0.739	0.852
2003	1.012	1.130	0.941	1.007	0.920	1.075
2004	1.087	1.451	0.977	1.577	1.451	0.930
2005	0.911	0.570	1.184	1.006	0.905	0.990
2006	1.037	0.993	0.960	1.117	1.048	1.193
2007	1.104	0.793	1.026	1.074	1.200	0.980
2008e	0.954	1.284	1.289	1.186	0.927	0.928
<i>Average</i>	1.018	1.096	1.033	1.099	1.048	0.987
<i>StDev</i>	0.064	0.326	0.136	0.191	0.204	0.093
<i>CV%</i>	6.26	29.77	13.13	17.35	19.43	9.45
<i>Σ var. rel.</i>	0.057	0.078	0.315	0.260	0.127	–0.092
2001–04 (2000 = 1)	3.86	27.12	–4.64	9.66	5.26	–5.56
2005–08 (2004 = 1)	–0.16	–12.85	10.74	9.41	1.36	1.81

Source: Own calculations, on the basis of Eurostat data, 2010.

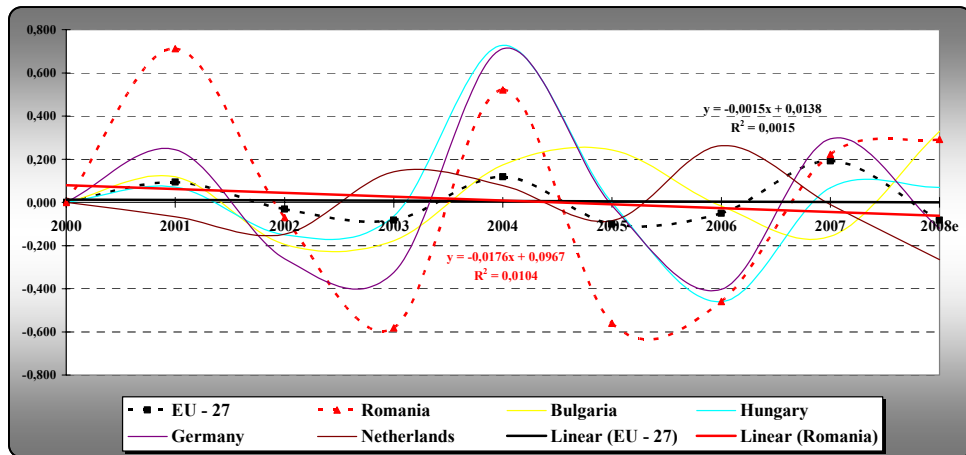
In relative cumulative terms, the real income from the agricultural activity in Romania was by only 7.8% higher in 2008 compared to the year 2000; by comparison, in Netherlands it declined by 9.2% in this period, while in Bulgaria it increased by 31.5%. In Romania’s case, the amplitude of the average yearly modifications is quite impressive, from 27.12% in the period 2001–2004 (2000 = 1), to –12.85% in the period 2005–2008 (2004 = 1), *i.e.* the highest difference in rates among the compared countries (Graph 12).

The confirmation of the presence of a European convergence process through the real income from agricultural activity is revealed by the adjustment of cumulative yearly relative modifications of this indicator in Romania and EU–27 (Graph 13).

Although with weak determinations, the linear trends of the cumulative yearly variations of “A Indicator” in Romania’s agriculture and EU agriculture reveal a relatively divergent behaviour, which confirms the real difficulties experienced by the Romanian agri-food sector in the process of reaching European economic convergence.



Graph 12. A Indicator dynamics in Romania's agriculture, compared to certain European countries, 2000–2008 (2000 = 1).



Graph 13. Linear trends of the cumulative yearly relative modifications of A Indicator, in Romania's agriculture and EU-27, 2000–2008.

4. CONCLUSIONS AND OPENINGS

1. The empirical studies on the regional economic growth indicators in the last two decades were (explicitly or not) based upon the so-called convergence theory, trying to apply to the regional context certain models and methods initially developed for the study of long-term growth of the economies from larger countries.

2. The methodological opening necessary to approach the economic convergence issue was based on a series of recent empirical studies, both at national level, at EU level at agri-food sector level, versus the overall Romanian economy.

3. The convergence-generating competitiveness, regardless of its definition, is usually related to tangible results, such as continuous productivity growth, high real wages and standard of living, innovating processes with driving effect.

4. The general frame-picture of the macro-economic evolution, on long-term (1989–2014), as presented preliminarily to the methodological approaches meant to reveal the presence of the European economic convergence process in Romania, targeted two statistical modalities: the dynamic correlation between the main activities contributing to GDP creation; the quantification of the absolute average yearly growth (decrease) of the newly created value in Romania's economy, throughout the period 1990–2010 and by different time periods considered relevant.

5. The economic convergence issue was approached, in the first instance, through two reference macro-economic variables, each of them targeting two levels (EU level and national level): energy intensity of the economy and the “wages – productivity” correlation.

6. The lack of domestic economic convergence of the Romanian agri-food sector can be quantified by measuring the intensity of economic flows between the two main “aggregates” of the agri-food economy (“agriculture” – consisting of six activities and “food economy” – consisting of ten activities), through the identification of two modalities: measurement of the intensity of the two simultaneous flows (deliveries and intermediary acquisitions); measurement of the shares of deliveries and intermediary acquisitions in the corresponding total.

7. The persistent lack of economic convergence was also the result of the “erosion” of the technical-economic performances from the Romanian agri-food sector, together with the agri-food disintegration.

8. At the end of the year 2009, the domestic production (as measured by the GVA of the main activities and total GDP) was by 20.6% higher than that of the year 1989, in total GDP, and by 27.8% in total GVA, with great dynamic discordances between the three main activities (according to NACE classification), *i.e.* from still a 5.9% decline in GVA – industry, to a 192.6% growth in GVA – constructions, while GVA – agriculture was by about 20% higher.

9. The disarticulation present in the Romanian economy dynamics in the last two decades is confirmed by the strong relative instability, measured by the variation coefficients (CoV%), oscillating from 6.03% (in total GVA) to 14.83% (in agriculture), while the other three activities are in the middle of this range (14.01% – constructions, 7.39% – industry and 6.20% – total GDP).

10. The fragmentations produced in the evolution of the newly created value in Romania's economy, in the period 1990–2010 (1989 as reference year), from periods of decline (1990–1992; 1997–1999; 2009–2010), to growth periods (1993–1996 and 2000–2008), seriously put under debate the consistency of convergence realization at macro-economic level.

11. Practically, throughout the period 1990–2010, the yearly average of the absolute modification of total GDP was about 3.5 billion lei RON, explainable by the differential (of 74.5 billion lei RON) between the cumulative total GDP gain (of 257.4 billion lei RON), in the 12 years of economic growth and the cumulative decline of the same indicator (of 182.9 billion lei RON), in the 9 years of economic decline, from the 21 years under investigation.

12. The energy intensity – in principle considered as a measure of the energy efficiency of a nation's economy – has a strong regressive trend in Romania, compared to EU–27 average.

13. A main consequence of the differences in the modification levels and rates resides in the unusual large time periods needed for the recovery of the level gaps existing in the year 2008 (at the rates of the period 1997–2000, in 121.2 years; at the rates of the period 2001–2004, 32.7 years, while at those from the period 2005–2008, in 42.4 years).

14. In the period 1990–2009 (1989 = 1), out of the 20 years under investigation, only in two years (1990 and 1991) the real wages index exceeded the productivity index; beginning with 1992, the ratio of the two correlation terms was reversed.

15. The fact that, out of the six time periods considered as relevant for comparative judgments of economic performance, only in two (1993–1996 and 2001–2004) the “real wages – productivity” correlation was within the economic rationality limits, reflects the relatively fragile tendency of the Romanian economy to set up in a sustainable manner one of the “engines” generating convergence and social cohesion through internal competitiveness.

16. The intensity of intermediary deliveries of agriculture to the food industry diminished by over 35 percent (from 65.1% in 1989 to only 29.9% in 2007, with a peak of 67.0% in 1990 and a variation coefficient of 27.6%), while those of the food industry to agriculture declined by over 14.5 percent (from 19.1% in 1989 to 4.6% in 2007, with a maximum of 28.4% in 1993 and a variation coefficient of 60.7%).

17. The intensity of intermediary acquisitions of food industry from agriculture decreased by 46.7 percent (from 76.7% in 1989 to 30.0% in 2007, with a variation coefficient of 35.8%), while those of agriculture from food industry by 11 percent (from 18.0% in 1989 to 7.0% in 2007, with a maximum of 23.7% in 1990, with a variation coefficient of 46.7%).

19. The technological performance gaps, in terms of average cereal yield per hectare are also significant, not only by its low level, but also by the strong instability, measured by the variation coefficient, of 25.2%, almost double compared to other investigated countries.

20. The gross agricultural output per hectare in Romania has the highest variation coefficient in the seven investigated countries, *i.e.* 23.5%, compared to only 6.5% in Germany, in the conditions of a large technological performance gap between Romania and the compared countries.

21. The regression bi-factorial adjustment of the gross agricultural output per hectare, for which a determination coefficient of 80.4% was established, confirms

one of the characteristic features of Romania's agriculture, namely its high dependence on the cereal production, which *per se* cannot confer a very high stability of performances.

22. The real income from agricultural activities in Romania was by only 7.8% higher in the year 2008 compared to 2000, in cumulative terms; by comparison, in Netherlands it declined by 9.2%, while in Bulgaria it increased by 31.5%. In Romania's case, the amplitude of the average yearly modifications is also quite impressive, from 27.12% in the period 2001–2004 (2000 = 1), to –12.85% in the period 2005–2008 (2004 = 1), *i.e.* the highest difference in rates among the compared countries.

REFERENCES

1. Artis M. *et al.* (1994), *El sistema agroalimentario catalan en la tabla Input – Output de 1987*, in “Investigation Agraria – Economia” (IAE), INITAA, vol. 9, no. 1.
2. Barro, R.J. and Sala-i-Martin, X., (1995), *Economic Growth*, McGraw-Hill.
3. Bussoletti, S., Esposti, R. (2003), *Structural funds, regional convergence and agricultural employment in the enlarged EU. A panel – data Approach*, in 87th EAAE – Seminar, “Assessing Rural Development of the CAP”.
4. Enciso J.P. *et al.* (1995), *Una vision del complejo de produccion agroalimentario espanol en la decada de los ochenta*, in Investigation Agraria – Economia (IAE), INITAA, vol. 10, no. 3.
5. Islam, N. (2003), *What Have We Learnt from the Convergence Debate?*, in “Journal of Economic Surveys”, no. 3, vol. 17, pp. 309–362.
6. Krueger, A. (2009), *Narrowing spread in regional GDP*, “Eurostat Statistic in focus”, 75, p. 8.
7. Pecican, E. St. (2009), *Indicatori privind convergența reală și aplicațiile acestora*, in Iancu, A. (coord.) “Convergența economică”, Ed. Academiei Române, Bucharest, pp. 11–43.
8. Quah, D.T. (1996), *Regional convergence clusters across Europe*, “European Economic Review”, vol. 40.
9. Toderoiu, F. (2001), *Sectorul agroalimentar în România – mutații structurale multicriteriale comparative*, IEA – INCE, Bucharest.
10. Toderoiu, F. (2002), *Agricultura – resurse și eficiență – o retrospectivă semiseculară*, Ed. Expert, Bucharest.
11. Toderoiu, F. (2003), *Sectorul agroalimentar în România – corelații macroeconomice ale competitivității*, IEA – INCE, Bucharest.
12. Toderoiu, F., (2009), *Real Economic Convergence – European and National Dimensions*, in: “Agricultural Economics and Rural Development”, vol. 6, no. 2, Romanian Academy Publishers, Bucharest, pp. 159–180; ftp://www.ipe.ro/RePEc/iag/iag_pdf/AERD0902_159-180.pdf.
13. Toderoiu, F., (2010), *Convergența economică reală – dimensiuni europene și naționale*, in: “Economie Agrară și Dezvoltare Rurală”, Serie nouă, Anul VII, nr.1, Ed. Academiei Române, Bucharest, pp. 17–40.
14. Toderoiu, F. (2010a), *Regional Disparities in Rural Development and the Implications on the Socio-Economic Cohesion in Romania*, Paper presented on the Polish – Romanian Symposium, Bucharest, September, 22–23.
15. Voinea, L. (coord.) *et al.* (2007), *Manual de evaluare a competitivității regionale*, GEA, Bucharest.
16. Votteler, M. (2004), *Wachstum und Konvergenz in den europaischen Regionen*, in “Standort (Ost) Deutschland”, ifo Bericht, pp. 19–27.
17. Zaman, Gh., Georgescu, G. (2009), *Structural fund absorption: a new challenge for Romania*, in: “Romanian Journal of Economic Forecasting” (RJEF), nr. 1, pp. 138–154.
18. *** (2009) *Convergence Program 2008–2011*, Romania's Government, May 2009, 79 p.
19. *** (2005) *Policy guidelines for regions falling under the new competitiveness...*, vol. I, Statistical analysis, Csil Milano, dec. 2005.
20. www.wikipedia.org.

ANNEX 1
Energy intensity of European economies, 1995–2007 (2000 = 1)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
EU-27	1.113	1.131	1.091	1.070	1.031	1.000	1.002	0.988	0.999	0.986	0.968	0.938	0.903
Bulgaria	1.199	1.316	1.222	1.165	1.028	1.000	0.999	0.937	0.918	0.836	0.829	0.801	0.743
Czech Republic	1.104	1.094	1.100	1.068	0.985	1.000	1.000	0.993	1.040	1.002	0.912	0.892	0.838
Hungary	1.254	1.262	1.185	1.118	1.069	1.000	0.979	0.953	0.954	0.893	0.911	0.870	0.836
Poland	1.433	1.397	1.289	1.155	1.077	1.000	0.989	0.961	0.949	0.905	0.884	0.874	0.816
Slovakia	1.195	1.125	1.073	1.010	1.005	1.000	1.061	1.018	0.967	0.915	0.855	0.779	0.676
Romania	1.200	1.181	1.185	1.138	1.018	1.000	0.940	0.934	0.927	0.841	0.800	0.770	0.720
Denmark	1.196	1.305	1.181	1.129	1.065	1.000	1.026	1.002	1.048	0.995	0.947	0.979	0.939
Germany	1.098	1.123	1.091	1.066	1.027	1.000	1.019	0.997	1.007	1.001	0.984	0.959	0.915
Finland	1.130	1.166	1.163	1.124	1.065	1.000	0.998	1.041	1.080	1.045	0.939	0.980	0.926

Source: Own calculations based on Eurostat data, <http://epp.eurostat.ec.europa.eu/fgm/table>.

ANNEX 2

Labour productivity (WqT-f89) and real net wages (CSMnr-f89) – annual indices and annual average rates, in Romania's economy, 1989–2009 (1989 = 1)

	Labour productivity		Real net wages		Annual average modification rates (%)	
	WqT – f89	CSMnr – f89	CSMnr – f89	WqT – f89	CSMnr – f89	
1989	1.000	1.000	1.000			
90	0.953	1.050	1.050			
1991	0.835	0.858	0.858	-8.64		-7.39
1992	0.785	0.746	0.746	-5.98		-13.02
93	0.828	0.621	0.621			
94	0.865	0.624	0.624			
95	0.978	0.702	0.702			
1996	1.029	0.769	0.769	7.02		0.75
97	1.005	0.594	0.594			
98	0.979	0.615	0.615			
99	1.013	0.617	0.617			
2000	1.013	0.594	0.594	-0.40		-6.22
01	1.078	0.624	0.624			
02	1.165	0.639	0.639			
03	1.229	0.708	0.708			
2004	1.345	0.782	0.782	7.35		7.12
05	1.375	0.895	0.895			
06	1.470	0.975	0.975			
07	1.517	1.119	1.119			
2008	1.624	1.303	1.303	4.83		13.59
09	1.538	1.302	1.302			

Source: Own calculations based on NIS data, 2010; for 2009, Romania in Figures 2010.