

ECONOMIC GROWTH AND STRUCTURAL CHANGES IN REGIONAL EMPLOYMENT

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Abstract

In a recent paper, Professor Dobrescu (2011) analyses the relationship between sectoral structure and economic growth, using data on the world economy for the period 1970-2008. In this paper, we try to extend this relationship at regional level. Concretely, using the Toda-Yamamoto version of the Granger causality test, we analyse the factors underlying the process of deep structural change in regional employment in Romania. The hypotheses tested regarding the causality process are the following: at regional level, economic growth causes structural changes in employment; structural changes in employment boost the economic growth or there is a mutual conditioning (a feedback relation). We tested the robustness of these hypotheses by using the panel data analysis and we found that growth causes structural changes in total regional employment and for regional activities in manufacturing, real estate activities, wholesale and retail, education, mining and quarrying, financial intermediation and insurance, health and social assistance, administrative services, construction. Further, we reject the hypothesis that structural changes in regional employment cause regional GDP to grow. We also found that there may be an asymmetry between the effect induced by economic growth and recession-induced effect on the intensity of structural changes in regional employment.

Keywords: regional employment, structural changes, regional growth, Toda-Yamamoto causality test

JEL Classification: C21, C23, R11, R12

1. Introduction

There is a vast literature on the relationship between growth and economic structure. Dobrescu (2011, pp. 18, 21, 22 and 26) cites and examines this literature (he says: "famous binomial - sectoral structure and economic growth"), starting with Fisher (1939) and Clark (1957), Rostow (1960) up to Echevarria (1997), Dietrich (2009), and

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Memedovic and lapadre (2010). Furthermore, Memedovic and lapadre (2010, pp. 3-5) descends in time until the Physiocrats and the beginning of classical economics. They said: "Since its origin, economic theory has given significant attention to structural change (Quesnay, 1758; Turgot, 1766; and Steuart 1767). For Adam Smith (1776), structural features were strongly related to the level of economic development, while for Ricardo (1817) changing composition of the productive system was a requisite for economic growth". In his paper, Professor Dobrescu (2011) analyses the relationship between sectoral structure and economic growth using data on the world economy spanning the period 1970 to 2008. Sectoral structure is calculated as shares of gross domestic product for the gross value added in three sectors: agriculture, industry and services. As an indicator of the similarities between a given sectoral structure and another, Professor Dobrescu defines and uses the so-called *structural coefficient* (SC). For assessing it, Dobrescu (2011, pp. 5-11) widely describes ten possible computational algorithms and then accepts and uses five of them: the Manhattan distance (Euclidean 1-norm structural coefficient), the Bhattacharyya coefficient, the Hellinger structural coefficient, the Cosine structural coefficient and the Jaccard structural coefficient.

Regarding the structural impulse transmission mechanisms on economic growth and other way round, the findings of the analysis are: (1) "... in a short run, a possible causal relationship between economic growth and structural changes does not exist or, at least, cannot be revealed" (p. 25), and, "plausible preponderantly in a long run", "the causality relationship seems to come rather from the structural changes towards the economic growth, and not *vice versa*" (p. 26).

In the present paper, using the Toda-Yamamoto version of the Granger causality test, we analyse the factors underlying the process of deep *structural change in regional employment in Romania*. From this perspective, we note that, besides the works cited above, in the literature there are also significant papers on the relationship between economic growth and regional economic structures.

Combes (2000, p. 352) shows that "the local economic structure significantly affects local employment growth" in French areas, though "there are sharp differences between industrial and service sectors". Rogut and Tokarski (2002) analysing the regional labour markets in Poland conclude that the regional employment structure has a strong impact on outflows from unemployment to employment.

Marelli (2004) demonstrates that the structural differences are important in explaining the different level of development of the European regions, meaning that the "income growth is *ceteris paribus* lower in the still agricultural regions and higher in the industrial ones" (p. 53) and "while it is true that for a small number of regions, normally the capital-city regions, high degrees of tertiarisation are associated with very high income levels, higher-than-average per capita incomes can generally be found in regions specialised in manufacturing and industrial activities, in accordance with Kaldor's view" (p. 45). The International Labour Organization's 2013 Report on Global Employment Trends says that structural change (the reallocation of jobs across sectors) plays a significant role in economic growth, especially in developing regions, over the last two decades (p. 100). On large areas, "Central and South-Eastern Europe has experienced significant productivity gains due to structural change only in

1999–2007, but not much before and after this period. For the Developed Economies region, productive structural change is negligible, which is explained by the marginal role that agricultural employment plays in this region" (p. 100). During the global economic crisis (2007-2011), the structural change contribution to economic growth has slowed down considerably, in all the world regions, and even has become negative in Central and South-Eastern Europe (non-EU) and CIS regions. The ILO Report covers 163 countries, and the economic structure includes three sectors: agriculture, industry and services.

By examining the empirical properties of urban growth in a dynamic panel setting for the USA, Bieri (2012, p. 22) finds evidence for the role of industry concentration, employment specialization and sectoral diversity in shaping the urban economic development process.

In order to analyse the changes in the structure of the Romanian regional economy we have taken into account 42 NUTS-3 units (41 counties + Bucharest, the capital city). Data concerning employment refers to *civilian employment* (excluding the military and similar staff – the personnel of the Ministry of Defence, Ministry of Administration and Interior, Romanian Intelligence Office, conscripts – convicts and political and community organisations' employees). Civilian employment is examined by 14 types of activities: economy – total; agriculture, silviculture, forestry and fishing; mining and quarrying; manufacturing; electric and thermal energy, gas and water; construction; wholesale and retail; hotels and restaurants; transport, storage, post and communication; financial intermediation and insurance; real estate activities; activities of administrative services; education; health and social assistance; other service activities.

The data at national level cover the 1990-2011 period and only 1992-2010 for regional level and by counties and they are taken from the national statistics. Specifically, the data can be found at: National Institute of Statistics, Labour force balances - end of years; TEMPO-Online time series, FOM103A - economically active civil population by NACE Rev.1 activities of national economy, gender, macroregions, development regions and counties, for 1992-2007 and FOM103D (NACE Rev. 2), for 2008-2011. For *Gross domestic product growth variation* the data are taken from the National Institute of Statistics, *Statistical Yearbook 2011*, p. 319. Unemployment data are available at National Agency for Employment (ANOFM).

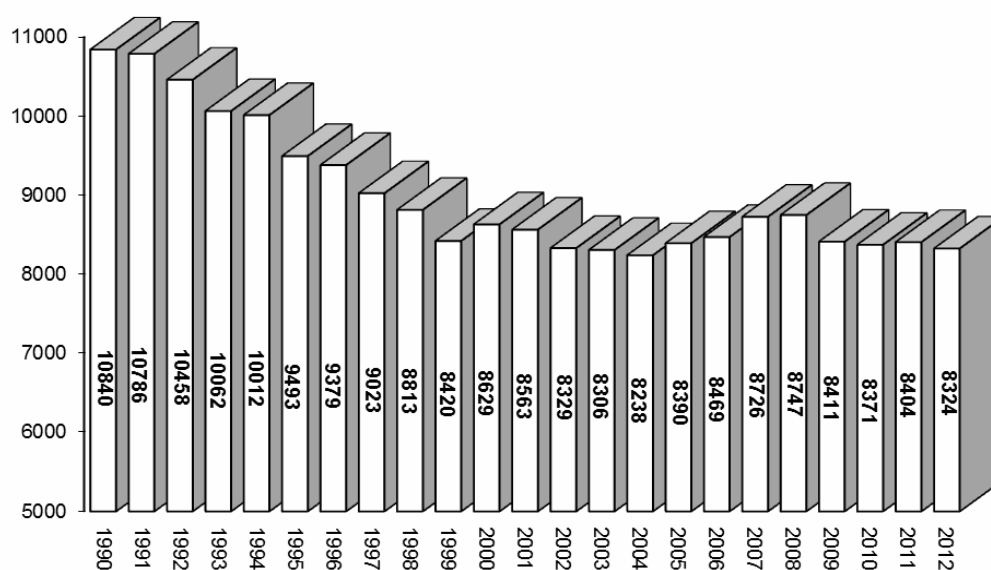
2. The Dynamics of Employment in Romania

Between 1990 and 2012, civilian employment in Romania has decreased by over 2.5 million persons, from 10.840 to 8.324 million (nearly one quarter of the total employment). Of which, 494 thousand persons means unemployment growth, and over 2 million stands for changes due to demographic reasons and net foreign migration. In Romania, unemployment has been recorded since 1991. The unemployment rate reached a local maximum in 1994 (over 1.2 million persons - nearly 11% of the labour force) and the unemployment rate exceeded 10% in 1993-1994 and 1998-2000 (with a maximum of 12% in 1999). In other years, the

unemployment rate was below 10% (even 4.4% in 2007). At the end of 2012, at national level, unemployment rate was 5.6% (493.8 thousand persons).

Figure 1

Romania – Total Civilian employment (End of Year, Thousands Persons)



Source: NIS, Civilian employment, by activity of national economy (end of year), Labour force balance - end of year, TEMPO-Online time series, FOM103A, FOM103D.

Between 1990 and 2010, decreases were accumulated in manufacturing (-2.14 million persons, i.e. -59.3% relative change), agriculture (0.7 million persons, i.e. -22.4%), mining and quarrying (-194 thousand persons, namely -74.9%), transport, storage, post and communication (-200 thousand persons, i.e. -26.7%), construction (-78 thousand persons, i.e. - 11%) and were attenuated by the slight increase in trade (+600 thousand persons, i.e. +112%), electric and thermal energy, gas and water (+63 thousand persons, i.e. +47%); financial intermediation, insurance and real estate activities (+94 thousand persons, i.e. +240%) and public services – administrative (+116 thousand persons, i.e. +132%), health, social assistance (+84 thousand persons, i.e. +27%).

As regards **sectoral macro structures**, we note that in 2010 employment in agriculture was about 29% of the labour force and that amount was roughly at the 1990 level (reaching a maximum of 40% in 1999-2001). The share of services increased from 28% in 1990-1993, to over 43% in 2007-2010, due to the decline in the share of industry from 44% to 28% over the same period.

Figure 2

Sectoral Civilian employment Structure (%) in Romania, 1990-2010

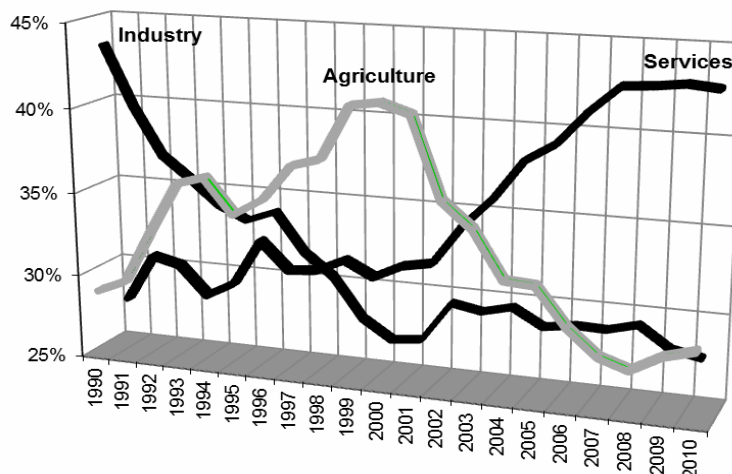
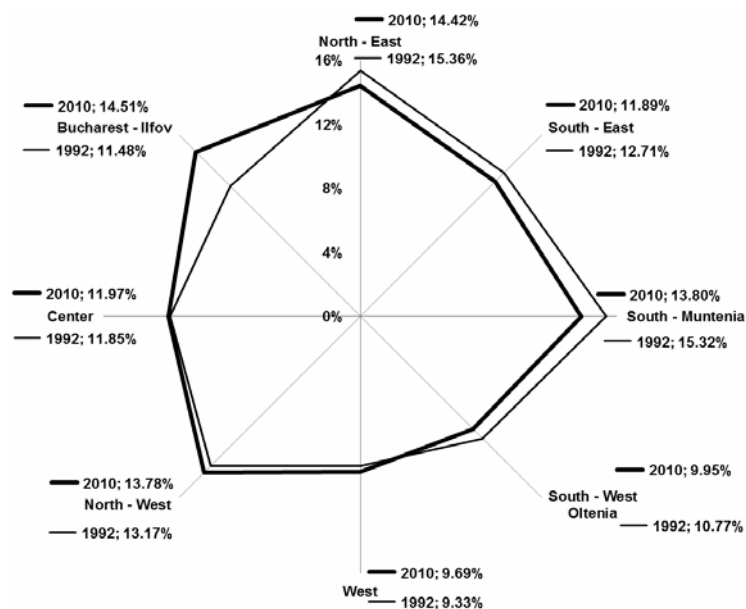


Figure 3

Share of Employment by Region in Total Employment (%), in 1992 and 2010



Source: For Figures 2 and 3, authors' calculations based on NIS, Civilian employment, by activity of national economy (end of year), Labour force balance - end of year, TEMPO-Online time series, FOM103A, FOM103D.

At regional level, the employment structure has only slightly changed. The cumulative share of the regions from the historical provinces Wallachia and Moldavia fell by about 4 percentage points between 1992 and 2010, and the share of the region that includes the Capital (Bucharest-Ilfov) increased by 3 percentage points and also one percentage point increase was recorded for the regions of Transylvania.

Except for București-Ilfov, the share of agriculture in regional employment is low in Transylvania and high in Sud and Nord-Est Regions. The share of services is over 40% in Vest, Centru and Capital Regions.

At county level, the structural changes are more important. The difference between the 2010 and 1992 share of employment in the county as compared to total employment (the amplitude of structural changes in employment at the county level) ranges from 2.57% (București - the capital city), to -0.56% (Galați County). The most affected ones were the counties which in the early '90s were relatively industrially developed (as compared to other Romanian counties). The collapse of the domestic industry over the last 20 years mainly affected these counties (Galați, Prahova, Bacău, Hunedoara, Argeș, Brașov, etc.).

3. Analysis of Structural Changes in the Romanian Regional Employment

3.1. Methodology

As in the paper of Professor Dobrescu (2011), the notion of structure used in this paper refers to the shares of different sectors or regions in an aggregate indicator such as population, employment, production, capital, consumption, etc. There are two vectors of regional weights: $w_0 = (w_{0,1}, w_{0,2}, \dots, w_{0,n})$ representing a chosen benchmark (the referential) and a given distribution $w_1 = (w_{1,1}, w_{1,2}, \dots, w_{1,n})$, characterizing the actual structure which is submitted to evaluation. The two vectors contain an identical number of non-negative elements (n), and $\sum w_{0,i} = \sum w_{1,i} = 1$. We explored the ten algorithms presented by Dobrescu (2011) which – unchanged or adequately transformed – could be used for estimating the similarity rank between two or more structural vectors. Finally, we used as a measure of structural changes the *uncentered coefficient of correlation between structural vectors*. This is because the concept of *mean* used in calculating the Pearson product-moment correlation coefficient does not make sense for such a definition of the economic structure.

The uncentered coefficient of correlation between structural vectors corresponds to the *cosine of the angle* between these vectors.

$$\cos(w_0, w_1) = \frac{\langle w_0, w_1 \rangle}{\|w_0\| \|w_1\|} = \frac{\sum w_0 w_1}{\sqrt{\sum w_0^2} \sqrt{\sum w_1^2}} \in [0, 1]$$

(weights w_i are non-negative). The angle between structural vectors is

$$\alpha = \arccos(w_0, w_1) \in [0, 90^\circ]$$

For easier interpretation, we get the indicator in the range [0, 100] by a simple linear transformation:

$$\alpha^* = \alpha \cdot 100/90 \in [0, 100]$$

where:

$\alpha^* = 0$ means that there is no structural change, the corresponding structures can be considered as an identity (the vector w_1 is a copy of the vector w_0).

$\alpha^* = 100$ means the maximum dissimilarity.

Romanian Civilian employment is examined for 42 counties, total economy and 14 types of activities:

R₀ – Economy – total

R₁ – Agriculture, forestry and fishing

R₂ – Mining and quarrying

R₃ – Manufacturing

R₄ – Electric and thermal energy, gas and water

R₅ – Construction

R₆ – Wholesale and retail

R₇ – Hotels and restaurants

R₈ – Transport, storage, post and communication

R₉ – Financial intermediation and insurance

R₁₀ – Real estate activities

R₁₁ – Activities of administrative services

R₁₂ – Education

R₁₃ – Health and social assistance

R₁₄ – Other service activities

3.2. Results

a. Intensity Changes in Regional Employment Structures

The angles between the structural vectors, by counties and economic activities (100 means incongruity and 0 means structural identity) are shown in Table 1.

Table 1

Intensity Changes in Regional Employment Structures

	R ₀	R ₁	R ₂	R ₃	R ₄	R ₅	R ₆	R ₇	R ₈	R ₉	R ₁₀	R ₁₁	R ₁₂	R ₁₃	R ₁₄
1993/1992	2.1	2.4	8.0	3.1	3.7	9.8	11.7	15.6	2.8	14.3	2.1	6.4	3.1	4.5	9.3
1994/1993	1.7	2.3	8.0	3.7	3.2	12.7	13.6	39.1	3.8	9.0	3.3	6.0	2.9	8.6	7.6
1995/1994	3.0	2.9	2.7	5.2	3.4	9.8	19.2	44.4	5.2	6.1	8.5	5.2	2.2	5.1	15.1
1996/1995	2.1	1.9	1.5	3.2	4.0	4.1	8.9	23.1	3.3	3.3	4.9	5.3	4.2	4.5	8.0
1997/1996	2.8	1.7	11.4	4.0	5.4	7.2	16.2	33.1	4.1	8.8	5.2	6.5	5.1	4.1	9.0
1998/1997	3.0	1.1	4.0	4.3	5.0	8.0	17.8	26.8	6.4	11.4	4.3	8.9	2.2	5.0	7.4
1999/1998	5.6	1.1	7.4	8.2	5.1	9.8	16.2	17.9	4.1	11.7	8.0	8.9	1.4	11.0	7.7
2000/1999	4.0	0.8	4.2	7.2	2.3	7.9	14.5	16.3	4.1	3.8	6.8	2.6	2.0	10.0	9.9

	R ₀	R ₁	R ₂	R ₃	R ₄	R ₅	R ₆	R ₇	R ₈	R ₉	R ₁₀	R ₁₁	R ₁₂	R ₁₃	R ₁₄
2001/ 2000	1.4	0.6	2.0	3.7	3.0	5.0	5.2	14.4	4.1	5.5	3.5	4.1	1.9	3.8	5.2
2002/ 2001	3.8	0.6	3.1	3.9	4.2	6.7	6.2	15.3	3.1	3.7	3.0	3.9	2.3	3.4	3.9
2003/ 2002	1.9	0.5	2.7	3.3	5.5	4.2	3.0	8.2	3.0	2.5	2.0	2.1	2.2	2.5	3.6
2004/ 2003	1.9	0.5	5.1	3.5	4.1	4.6	1.7	10.7	3.9	2.3	2.4	3.4	1.3	3.0	3.1
2005/ 2004	2.0	0.5	6.6	2.7	3.7	9.7	3.7	5.0	2.7	2.0	2.8	5.0	1.2	3.3	4.2
2006/ 2005	2.0	0.3	10.5	2.0	4.7	2.3	1.1	2.9	2.2	4.7	1.8	1.5	1.4	2.0	4.5
2007/ 2006	1.5	0.4	6.8	3.0	4.4	2.2	2.2	3.6	1.9	1.4	2.4	2.7	2.0	1.3	2.5
2008/ 2007	2.0	0.4	4.7	1.5	3.4	2.9	3.1	3.9	3.6	1.5	2.1	1.9	0.9	1.5	9.4
2009/ 2008	0.8	0.8	4.5	2.8	11.2	2.0	1.9	7.5	6.4	1.5	1.7	3.3	1.8	1.8	10.2
2010/ 2009	0.7	1.6	4.3	2.9	3.2	1.5	1.4	5.7	2.8	5.5	1.9	1.9	1.3	2.5	1.9
2010/ 1992	9.2	4.6	30.7	20.5	17.4	8.2	9.1	11.5	22.6	31.7	11.8	6.5	4.3	6.9	13.6

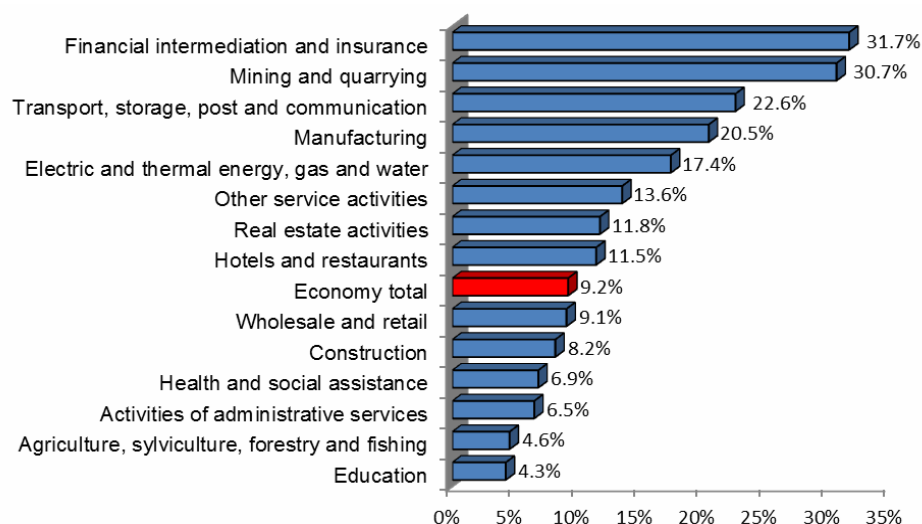
Source: Authors' calculations based on NIS, Civilian employment, by activity of national economy (end of year), Labour force balance - end of year, TEMPO-Online time series, FOM103A, FOM103D.

First of all, we notice a slowdown of structural changes in the election years (presidential elections). Index of structural changes in employment for the whole economy (R₀) recorded local minimum values in those years (1996, 2000, 2004, and 2009). "This could be explained by the fact that structural changes are linked to reform and implies the adoption of measures having usually unpopular effects. And such effects are, without doubt, undesirable for the incumbents, mainly in the election years" (Jula, 2008, p. 27; Jula and Jula, 2009).

For the whole 1992-2010 period, the most significant changes were recorded in financial intermediation and insurance (R₉), mining and quarrying (R₂), transport and communication, manufacturing and energy (R₈). The smallest changes were registered in agriculture (R₁) and in public services (education, health and social assistance, administrative services).

Figure 4

Intensity of Structural Changes (%) in Regional Employment, 1992-2010



Source: Table 1.

b. The Causality Problem - The Toda-Yamamoto Version of Granger Causality Test

The literature dedicated to economic development has treated the growth in strong connection to the structural (especially sectoral, but also regional) reallocations of productive factors. Across history, practically nobody contested the connection between the rising trend of the GDP and the changing distribution of employment (and other resources) among branches and regions.

The causal factors that induce periodically deep structural restructuring of employment (and capital) are:

- structural shifts in demand, induced by the increasing income per capita, which accompanies the economic growth (demand-side explanation);
- varied and manifold effects of technical progress in different segments of economy – productivity hypothesis (supply-side explanation);
- institutional explanations and other factors.

We considered the following problems of causality:

Hypothesis 1: Does economic growth cause structural changes in regional employment?

Hypothesis 2: Do structural changes in regional employment determine the economic growth?

Hypothesis 3: Is there a mutual inter-conditioning (a feedback relationship)?

Hypothesis 4: Do structural changes in primary industries determine structural changes in the rest of activities?

Hypothesis 5: Structural changes in secondary and tertiary sectors determine changes in the primary activities?

Test for Hypothesis 1: Does Economic Growth Cause Structural Changes in Regional Employment?

The classical Granger test of causality cannot be directly applied to data on GDP and dynamics of regional structures by activities, since not all these variables are stationary.

To determine the nature of Data Generating Process (DGP) we used the Augmented Dickey–Fuller (ADF) and Phillips-Perron tests. Data Generating Process (DGP) for real growth of GDP is $I(0)$. For other variables, the order of integrability is presented in Table 2. Under these conditions, the Toda–Yamamoto (1995) version of the Granger test of causality was used.

We found that growth causes structural changes in total regional employment and as regards regional activities in manufacturing, real estate activities, wholesale and retail trade, education, mining and quarrying, financial intermediation and insurance, health and social assistance, administrative services, constructions, other services. For them, the probability of the type II error ("accepting the null hypothesis when it is false") is less than 1%.

We accept the null hypothesis (growth does *not* cause structural changes in regional employment) for the other four groups of activities: agriculture, forestry and fishing, transport, storage, post and communication, electric and thermal energy, gas and water, hotels and restaurants. The main reasons why structural changes in these activities are not correlated with economic growth are presented in Table 2.

Regarding agriculture, structural response is not coupled with economic growth due to some demographic reasons (high percentage of elderly people), foreign migration of the agricultural workers (especially the emigration to Spain) and the national migration from city to village recorded in the '90s, after land reversion and restoration of agricultural property. In fact, Romania has the largest population employed in agriculture within the European Union (about 29% in 2010). Total employment decreased from 3.65 million persons in 1994 (36% of total employment) to 2.44 million in 2011 (29% of total employment).

The relative importance of *agriculture*, as share in total employment, has slowly diminished in all the regions, and in 2010 it varies between 55.5% - in Teleorman County and 13.6% - in Braşov County (we excluded from presentation the capital city - Bucureşti).

In *transport, storage, post and communication*, employment showed a U-shaped evolution: dropped between 1990 and 2002 following the decrease in agriculture and industry activities and increased after 2003 as a result of growth in GDP. Employment does not fall after 2008 (in economic recession) due to growth in communication activities. A similar trend was recorded in *hotel and restaurant* activities.

Also, changes in employment for *electric and thermal energy, gas and water* activities were small and were influenced mostly by some institutional change and were less related to economic growth.

The *manufacturing* sector is also regressing in all counties, because of the widespread tertiarisation processes, but it remains significantly below the European Union average. The lowest shares are found in Teleorman (27%) and, excluding București (72%) and Ilfov (50%), the highest are in Brașov, Constanța, Cluj (around 48-49%).

Table 2

Toda-Yamamoto Version of Granger Causality Test – Hypothesis 1

GDP does *not* Granger cause structural changes in regional employment

	DGP	Chi-sq	df	Prob.	
Total regional employment	I(1)	7.9286	2	0.0190	GDP growth causes structural change in regional employment
Manufacturing	I(1)	164.3496	4	0.0000	
Real estate activities	I(1)	150.5454	4	0.0000	
Wholesale and retail	I(1)	31.7948	5	0.0000	
Education	I(1)	188.2294	4	0.0000	
Mining and quarrying	I(0)	31.8401	5	0.0000	
Financial intermediation and insurance	I(0)	10.46371	1	0.0012	
Health and social assistance	I(1)	15.4062	3	0.0015	
Administrative services	I(1)	13.9671	3	0.0030	
Constructions	I(0)	17.6560	5	0.0034	
Other services	I(1)	12.0305	4	0.0171	
Agriculture, forestry and fishing	I(0)	6.2747	5	0.2804	GDP does <i>not</i> Granger cause structural change in regional employment
Transport, storage, post and communication	I(0)	1.1508	1	0.2834	
Electric and thermal energy, gas and water	I(0)	0.3191	1	0.5721	
Hotels and restaurants	I(0)	0.4857	5	0.9926	

Notes: DGP means the nature of Data Generating Process

Chi-sq means the chi-square distribution. For I(0) series: F-stat.

df – degree of freedom

Prob. – probability of H₀ (GDP does *not* cause from ...)

We then tested the robustness of the hypothesis that "Economic growth causes structural changes in regional employment" by using the panel data analysis. For this purpose, we consider only the total national level and the activities with the largest share in regional employment, namely *manufacturing*.

To verify the hypothesis that *economic growth cause structural changes in regional employment* we build the panel data model like:

$$EMPL_{it} = a_{0i} + a_1 EMPL_{i,t-1} + a_2 GDP_t + e_{it}$$

where: $EMPL_{it}$ is total regional employment, i is the index for region, t - for the time, and e is error variable, while GDP_t is real growth (%) of gross domestic product (in year t). Coefficients $a_{0,i}$ estimated the individual (regional) effects, and a_1, a_2 - the common effects.

By Pool Unit Root test on regional total employment (EMPL) variable we reject the null hypothesis (common or individual unit root process). Therefore, we accept the alternative – the $EMPL_i$ variables are stationary. The hypothesis that "economic growth cause structural changes in regional employment" is accepted if coefficient a_2 is significant.

We found a significant connection between total regional employment and GDP growth, with fixed regional effects. All the estimators are significant and the results support the hypothesis of a link between growth and regional employment.

Similarly, by Pool Unit Root test on Manufacturing (MAN) variable, we reject the null hypothesis (common or individual unit root process). Therefore, we accept the alternative – the MAN variables are stationary. We find also that there is a significant connection between total regional employment in manufacturing and GDP growth, with, again, significant regional fixed effects. For that reason, we test a model like:

$$MAN_{it} = a_{0,i} + b_1 \cdot GDP_t + e_{it}$$

where: i is the index for region, t - for the time and e is error variable. Coefficients $a_{0,i}$ estimated the individual (regional) effects, and a_1 - the common effects. The hypothesis that "economic growth causes structural changes in manufacture employment at regional level" is accepted if b_1 coefficient is significant.

The results are significant and support the hypothesis that there is a link between growth and regional employment in manufacturing.

Table 3

Economic Growth Causes Structural Changes in Regional Employment - Panel Data Model

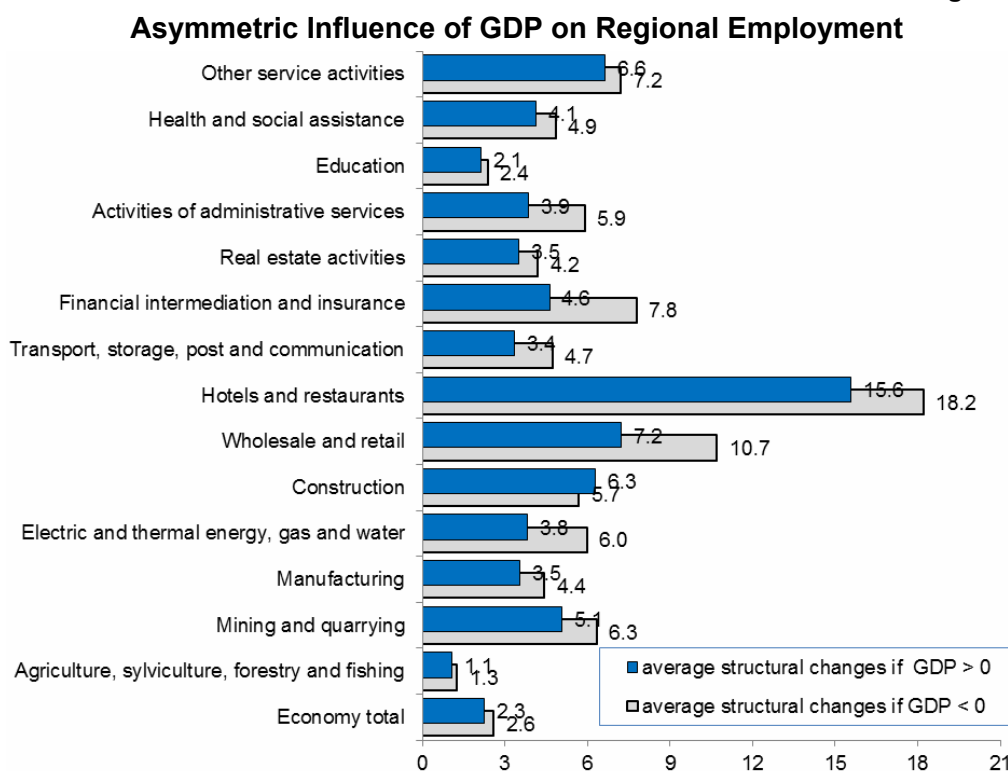
Explanatory variables	EMPL _{it}	MAN _{it}
EMPL _{i,t-1}	0.904164 (0.0170) [53.3406]	
GDP _t	2.471610 (0.2857) [8.6524]	1.498470 (0.1915) [7.8251]
MAN _{i,t-1}		0.855651 (0.0213) [40.2175]
Specific effect for North - East Region, $a_{0,NE}$	102.9862 (23.0489) [4.4682]	20.95171 (6.2957) [3.3280]
Specific effect for South - East Region, $a_{0,SE}$	79.45291 (18.7956) [4.2272]	18.75875 (4.9742) [3.7712]

Explanatory variables	EMPL _{it}	MAN _{it}
Specific effect for South Muntenia Region, $a_{0,SM}$	93.52357 (21.8888) [4.2727]	25.50770 (6.8100) [3.7456]
Specific effect for South- West Oltenia Region, $a_{0,SV}$	69.95796 (16.1045) [4.3440]	12.14875 (3.5730) [3.4001]
Specific effect for West Region, $a_{0,VE}$	63.09466 (15.0285) [4.1983]	21.78862 (4.8479) [4.4944]
Specific effect for North- West Region, $a_{0,NV}$	100.8330 (20.4666) [4.9267]	28.55686 (6.4630) [4.4185]
Specific effect for for Center Region, $a_{0,NE}$	78.92203 (18.5622) [4.2518]	30.89232 (7.7055) [4.0091]
Specific effect for Bucharest -Ilfov Region, $a_{0,BI}$	96.96783 (18.0993) [5.3575]	16.90838 (6.6195) [2.5543]
R-squared	0.989180	0.980576
Adjusted R-squared	0.988453	0.979272
Durbin-Watson stat	2.044974	2.106694

Notes: in round parentheses (std. error), in brackets [t-Statistic]
 Method: Pooled EGLS (Period weights)
 Sample (adjusted): 1993 2010. Included observations: 18 after adjustments.
 Cross-sections included: 8
 Total pool (balanced) observations: 144
 Linear estimation after one-step weighting matrix

We also detected an asymmetric influence of GDP on regional employment. When the GDP rates are positive, the regional structural changes in employment are smaller than when GDP rates are negative.

Figure 5



Test for Hypothesis 2: Do Structural Changes in Regional Employment Determine the Economic Growth?

We use, as before, the Toda-Yamamoto version of Granger causality test (Table 4). We find that it does not reject the hypothesis that *a structural change in regional employment does not Granger cause economic growth*. Therefore, we do not have arguments to support the hypothesis that structural changes in regional employment determined economic growth.

Table 4

Toda-Yamamoto Version of Granger Causality Test – Hypothesis 2

Structural changes in regional employment does *not* Granger cause GDP

	DGP	Chi-sq	df	Prob.	
Total regional employment	I(1)	0.205827	2	0.9022	} Structural change in regional employment <i>does not</i> Granger cause GDP
Real estate activities	I(1)	7.598574	4	0.1074	
Other services	I(1)	6.647265	4	0.1557	
Health and social assistance	I(1)	5.111667	3	0.1638	
Construction	I(0)	7.480919	5	0.1873	
Hotels and restaurants	I(0)	6.701511	5	0.2438	
Education	I(1)	4.799746	4	0.3085	
Agriculture, forestry and fishing	I(0)	5.738022	5	0.3326	
Wholesale and retail	I(1)	5.248979	5	0.3863	
Transport, storage, post and communication	I(0)	0.521714	1	0.4701	
Financial intermediation and insurance	I(0)	0.301082	1	0.5832	
Mining and quarrying	I(0)	3.392915	5	0.6396	
Administrative services	I(1)	0.792441	3	0.8513	
Manufacturing	I(1)	1.232285	4	0.8728	
Electric and thermal energy, gas and water	I(0)	0.009132	1	0.9239	

Notes: See notes on Table 2.

Test for Hypothesis 3: Is There a Mutual Inter-Conditioning (a Feedback) between Structural Changes in Regional Employment and the Economic Growth?

We also reject the hypothesis of mutual inter-conditioning (a feedback relationship) between structural changes in regional employment and the economic growth, because:

Generally, we reject the hypothesis that economic growth does not cause structural change in regional employment,
but ...

We do not reject the hypothesis that structural change in regional employment *does not* Granger cause GDP.

Test for Hypothesis 4: Do Structural Changes in Primary Industries Determine Structural Changes in the Rest of Activities?

We test if *structural changes in primary industries (agriculture, forestry and fishing, mining and quarrying, electric and thermal energy, gas and water) determine structural changes in the rest of the activities*. We found few reasons for this hypothesis for the case of Romanian regions. Only agriculture is linked (in the Granger sense) to some other activities.

The probability that structural changes in regional employment of *agriculture, mining and quarrying, electric and thermal energy, gas and water* **does not Granger cause** structural changes in regional employment of other activities are presented below:

	Agriculture, forestry and fishing	Mining and quarrying	Electric and thermal energy, gas and water
Manufacturing		Unoccupied cells means a probability of null hypothesis (... does not cause ...) greater than 5%.	
Construction			
Wholesale and retail	0.0021		
Transport, storage, post and communication			
Hotels and restaurants	0.0004		
Financial intermediation and insurance	0.0494		
Real estate activities	0.0111		
Education	0.0012		
Health and social assistance			
Activities of administrative services			
Other service activities			

Test for Hypothesis 5: Do Structural Changes in the Secondary and Tertiary Sectors Determine Changes in Primary Activities?

We test if *structural changes in regional employment in secondary and tertiary sectors determine changes in primary activities (demand effect)*. We found little evidence for this hypothesis.

	Manufacturing	Construction	Hotels and restaurants	Real estate activities	Health and social assistance
Agriculture, forestry and fishing		0.0290	0.0279	0.0070	
Mining and quarrying			0.0150		
Electric and thermal energy, gas and water	0.0240				0.0366

For other activities (as well as for the unoccupied cells in the table) the hypothesis of *demand effect* is rejected for a standard threshold of significance.

Conclusion

We found evidence that aggregate economic growth is causing structural change in regional employment and not the reverse. Why? Structural changes precede economic growth only if the government's efforts were directed towards stimulating these transformations. This would involve great financial resources, more or less complex legislation, in other words an increasing state intervention (Dobrescu, 2011). The opposite situation – a causal relationship from economic growth to structural changes – appears when a contradictory behaviour of macroeconomic management was adopted. And, in Romania, under the pressure of the IMF and the conditions imposed by the European integration, the state withdrew from the economy.

There is an asymmetry between the effect induced by economic growth and the recession-induced effect on the intensity of structural changes in regional employment. Yet we cannot test such a hypothesis, since the data series are too short: after 1990, Romania recorded eight periods of economic decline (1990-1992, 1997-1999 and 2009-2010) and 14 years of growth. Average intensity values recorded for structural changes in regional employment is 2.3 in economic growth, and 2.6 in economic decline conditions. These values suggest an asymmetric response of regional structures to the sign of growth: a stronger reaction when the economy is in decline and an attenuated one when the economy grows, in all the activities.

Structural changes in regional employment of *agriculture, mining and quarrying, electric and thermal energy, gas and water* **are not caused** by structural changes in regional employment of secondary and tertiary sectors **and** structural changes in secondary and tertiary sectors **are not caused** by structural changes in employment in primary activities.

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