Resilience to crisis and GDP recovery at county level in Romania

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Abstract. The paper focuses on the issue of regional resilience against the recent financial and economic crisis in the case of Romania, taking the county as territorial unit of observation. Based on the idea that the shock of a crisis impact spreads asymmetrically in the territory, with different contagion effects, the study advance a new approach of the speed and duration of GDP decline recovering. Data analysis showed that, at macroeconomic level, Romania has not proved resilient to the crisis impact, after two years of recession and a recovery period of 4 years succeeding barely in 2014 to return to the GDP level achieved in 2008. The research highlighted the differentiated recovery duration of the economic decline in territory, in 2014 many counties having to recover in the coming years remained GDP gaps, up to 10 pp or even more. The study paid a specific attention to the crisis impact on employment, focusing on R&D sector as revealing the endogenous growth generating potential at county level.

Key words: global crisis; regional economic resilience; economic decline recovery; employment; knowledge-based re-industrialization

JEL Classification: G01; I28; O18; O33; R10; R12; R58

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Resilience and post-crisis recovery at county level in Romania

1. Introduction

The economics has recently added a new component, namely the **economic resilience**, which means identifying ways of solving the problems of increasing resistance i.e. the ability to stop or recover the negative effects of external and internal shocks with severe consequences for the economic and social situation of a country (Zaman, 2012, Zaman and Vasile, 2014).

The term resilience comes from the Latin "*resiliere*" which means "return" (bounce back or rebound) and, in economics, refers to the ability of an economic activity to rapid recover following a shock, to resist against adverse shock effects, namely the capacity to avoid shocks in general (immunity, separation- firewall or shock-absorption).

The economic resilience refers to reducing the likelihood of failure or economic risks, assuming combined analytical and predictive approaches, ex-ante and ex-post and involves the identification of new internal and external resources, to a greater or less extent, to deal with the imbalances, shocks or disasters etc.

Increasing resilience is crucial for the economy, given that its evolution is based on a dynamic relationship between internal and external factors, including environmental and socio-human factors, marked by accelerating the globalization processes, but also those of rapid contagion effects following crises, recessions or disasters.

In economics, the resilience involves a complex of measures on short-, medium- and long term aimed, in a convergent manner, at both shock prevention, based on an effective system of early warning indicators and the absorption and recovery, in the sense of returning to the previous state of normality, with complementary features up-gradation, update, adjustment and flexibility.

Within the conceptual area of resilience, in addition to the ability of returning to the previous state of equilibrium and/or stabilizing toward a new equilibrium level (Pendall, Foster and Cowell, 2009), the vector of conversion, transformation, revamping and restoration capacity, which is, the capability to use the old and obsolete anthropic capital, for a new, more efficient, reconfiguration of the economy should also be included.

Strengthening the economic resilience as a complex process with a long term vision and strategic connotations should be a quasi-permanent concern, integrated into reform objectives upgrading and implementing of knowledge latest achievements, in the broad sense.

In our opinion, the issue of economic resilience arises not only at the level of countries, but also within their territorial units (regions, provinces, counties, rural and urban areas, etc.).

In this regard, we mention the work of some few authors who, if not in terms of endogenous development, distinguished between the economic resilience at national level and regional level (Blanchard and Katz, 1992, Briguglio et al. 2004, Feyrer, Sacerdote and Stern, 2007) or between large and small and medium countries (Crowards, 2000, Atkins et al, 2000, Cordina, 2004).

The evolution of economic thought trends regarding the new concept of economic resilience, occurred from the need to capture and underlie policies, tools and mechanisms in order to prevent, improve, offset, reduce and combat the negative effects of different types of environmental and / or economic and financial shocks was accompanied simultaneously by refining the concept of **economic vulnerability**.

All in all, the economic vulnerability of a country / region is understood as a set of (inherent) features having a permanent or temporary nature on which decision makers can not exercise a direct and decisive control and, therefore, can not be associated to governance errors (Zaman, 2012, Zaman and Vasile, 2014).

Vulnerabilities are a kind of *datum* of an economy existence and functioning that can not be directly invoked as a factor of the governance underperformance. This does not mean that obvious and demonstrable governance errors are automatically included in the whole vulnerability especially as negative effects (sometimes shocks!) of these errors grow exponentially to the extent of higher hierarchical decision levels.

2. The recovery following crisis: a matter of time or of pattern?

Generally speaking, the economic theory, methodological approaches and development policies were concerned more with the study of growth and the analysis of its fundamentals and drivers. Fewer researches focused on the issue of recessions caused by crisis impacts and on the related economic decline recovery. For the time being there is not a clear perception of differences between recovering and returning to pre-crisis levels, also because of the presence, more difficult to detect, of some economic flexibilities against rigidities that may hide the real impact localization. Some problems of clear-cut delimitation are also arising when is going more in-debt, in order to reveal differences between economic crisis, downturn and recession.

In the case of deep financial crises, Reinhart and Rogoff (2009) have shown that an economy usually needs more than four years to reach the pre-crisis GDP per capita. Some authors (Papell and Prodan, 2011) showed that in emerging countries,

although suffering from a greater magnitude of decline, the duration of returning to potential GDP is lower compared to advanced countries in the case of financial crises, such as the one triggered in 2007.

Most often, expectations regarding the decline recovery duration are not met. In this regard, referring to the economic recession following the last financial crisis, Bernanke (2013) argued that a stronger rebound has been hindered by a variety of headwinds (decreasing investments, credit conditions tightening, increasing risk aversion and uncertainty) which reduced the potential growth rate.

Questioning about the impact of severe downturns on GDP trend, Martin et al. (2014) found that recessions tend to depress the level of output on long run because of entrenching the crisis effects on demand, instead of returning to pre-crisis trend being more likely a sustained deviation from it. Otherwise, the experts of IMF (2014) have recently warned that the global economy may never return to the pace of pre-crisis growth.

In this context, arise a basic idea related to the required velocity rate i.e. an economy growth rate sufficiently fast for escaping recession or a sluggish recovery, similar to the speed needed to break from the gravitational attraction in physics.

Obviously, the economic recovery following a crisis depends mainly on the resilience to external or internal shocks, the magnitude of the recession, the development level, the stage of the business cycle, which is specific to each country. Moreover, the shock of a crisis impact spreads asymmetrically in the territory, with different contagion effects.

A study under EPSON Programme published in 2014 regarding the territorial dynamics following the financial crisis highlighted a series of factors associated with a higher resilience of EU regions, among them a more diversified exports, the presence of MNC, innovative and higher skill labor force. According to EPSON classification, not resilient regions in terms of GDP and employment has been defined those regions that have begun their recovery but not having achieved the pre-crisis levels and/or remained in decline. Across European territory, the peripheral regions of Southern Europe were affected by longer lasting and deeper seated crisis effects, including Romania.

The intention of this paper is not to design a typology of GDP decline by counties nor to point out the recovery ways, but mainly to draw attention that, for reasons of growth sustainability, of high importance is not only the expansion period of an economy but also the decline duration following crisis, from the viewpoints of development pattern and of influence factors under the circumstances of external and internal shocks.

The economic decline recovery can be assessed, from a statistical viewpoint, as returning to pre-crisis levels, but this recover take place in new circumstances

that suppose, to a lesser or greater extent, the occurrence of new seeds of growth and innovation, qualitatively upper.

As we shall further, in the case of Romania, relatively more developed counties as GDP per capita have not always proved also a higher resilience and recovery capacity against the crisis impact. As regards the counties registering a very long recovery delay, a specific attention should be paid to investments rebound, their efficiency increase and better local corporate and public governance.

All in all, the duration and amplitude of recovering process depend on several interconnected factors in a complex ”melting pot” of creative destruction activities.

3. The economic decline of GDP in Romania caused by the crisis: intensity and recovery by county

The territorial development of the national economy represents a major goal of any strategy of sustainable growth process, under nominal and real convergence objectives, in order to reduce the gaps between regions.

The recent international economic and financial crisis has had a severe regional impact in Romania, resulted in GDP decreases at county level, in a greater or lesser extent, which has undoubtedly weakened the resistance capacity, the economic resilience of the country and its territorial units.

The main objective of the research lies in highlighting the influence of the crisis on the GDP of Romania’s 42 counties, during peak periods 2009-2010. The evolution of GDP has been analyzed throughout the 2008-2014 period, based on the idea that, for a national economy, it is important to understand how the crisis affects the economic downturn, which may be higher or lower for longer or shorter time periods.

In this sense, a special importance of the regional economic resilience to crisis shocks and their ability to return to pre-crisis levels by implementing adequate recovery policies was considered, analyzed through the capacity of GDP decline recovery in the aftermath of the crisis.

As it is known, in Romania, the crisis has had one of the strongest adverse effects, in terms of the intensity and the duration of recovery time. Understanding the regional issues in this regard may provide essential guidelines for economic and social decision making policies in general and at territorial level in particular.

Our research tried to identify certain features of counties, depending on the size of annual and total economic decline during 2008-2014 and the recovery / non-recovery of that decline during different periods of time (1 to more than 6 years).

To this end, we used the real GDP indexes at county level, taking as base the year 2008 = 100, which was the pre-crisis year with an increase of 7.3% of GDP compared with 2007.

3.1 The intensity of the economic decline in 2008-2014 at county level

The analysis of data in Annex 1 enables the defining of some issues, aspects and conclusions, useful for understanding the impact of the crisis spread in Romania's territory, directly and indirectly related to the promotion of regional endogenous growth model.

The GDP pre-crisis decline in 2008 in 15 counties

Even if, in 2008, at the macroeconomic level, a GDP increase of 7.3% has been registered, in a number of 15 counties, the GDP has declined, as follows (in ascending order): Valcea (-6,5%); Dambovita (-5,1%); Alba (-4,8%); Suceava (-3,9%); Cluj (-3,8%); Arad (-3,3%); Covasna (-2,1%); Neamt (-1,8%); Salaj (-1,4%); Satu Mare (-1,3%); Caras-Severin (-1,2%); Maramures (-1,0%); Harghita (-0,8%); Botosani (-0,5%); Mures (-0,3%). This economic decline (between -6.5% and -0.3%) can be considered as preceding the crisis that would follow to include a larger number in the years that were to come.

The year 2009 - peak of the crisis affecting adversely 39 counties

The year 2009 witnessed a GDP decline of -6.6% at macroeconomic level, which meant for Romania a crisis peak, 39 counties registering a magnitude of the economic shock, between -12.2% and -1.1% compared to 2008, as follows (in descending order): Calarasi (-12,2%); Olt (-12,1%); Bucuresti (-11,7%); Galati (-11,4%); Valcea (-9,8%); Buzau (-9,7%); Bihor (-8,8%); Vaslui (-8,6%); Tulcea (-8,4%); Hunedoara (-7,8%); Mures (-7,7%); Alba (-7,5%); Timis (-7,3%); Vrancea (-6,9%); Arad (-6,7%); Neamt (-6,7%); Ialomita (-6,4%); Teleorman (-6,1%); Satu-Mare (-6,0%), Ilfov (-5,7%); Dambovita (-5,7%); Iasi (-5,7%); Bacau (-5,5%); Mehedinti (-4,8%); Salaj (-4,6%); Harghita (-4,5%); Botosani (-4,5%); Dolj (-4,4%); Cluj (-4,4%); Covasna (-4,3%); Maramures (-3,1%); Sibiu (-2,9%); Giurgiu (-2,9%); Bistrita Nasaud (-2,8%); Constanta (-2,5%); Prahova (-2,4%); Braila (-1,7%); Brasov (-1,4%); Suceava (-1,1%).

In 2009, modest GDP increases were recorded only in Arges (+0.5%), Caras Severin (+0.6%) and Gorj (+4.7%), leading thus to the conclusion of their relative resilience to external shock of the crisis. It is worth mentioning that counties with higher development levels recorded larger GDP decline (Bucharest, Galati, Timis, Ilfov, Iaşi).

The year 2010 - crisis effects continuing in 25 counties

Both at macroeconomic level and in 25 counties, in 2010 a further decline in GDP has been recorded, which highlights the extension of the crisis effects in Romania, while in other EU countries the economic recovery had started. The GDP decline in 2010 compared to 2009 has seen the range between -14.3% and -1.0%, affecting the following counties (in descending order): Braila (-14,3%); Prahova (-14,2%); Bistrita Nasaud (-11,4%); Arges (-10,5%); Covasna (-9,9%); Neamt (-8,1%); Harghita (-7,3%); Teleorman (-6,8%); Botosani (-6,5%); Suceava (-6,4%); Vaslui (-5,8%); Ilfov (-5,8%); Valcea (-5,7%); Mures (-5,3%); Dolj (-4,5%); Satu Mare (-5,3%); Hunedoara (-4,4%); Sibiu (-4,2%); Salaj (-3,8%); Bacau (-2,6%); Maramures (-2,4%); Caras Severin (-1,7%); Cluj (-1,5%); Bihor (-1,0%). The other 17 counties registered GDP increase in 2010 compared to 2009, which were mostly in the range of 7% - 0.2%, which means rather a slight recovery of economic growth after large decreases compared to the previous year.

The year 2011 - beginning of recovery

With a GDP growth of 2.2% at the national level, the year 2011 witnessed a beginning of the economic recovery, sustained by higher or lower GDP increases (between 7.9% in Buzau county and 0.3% in Bucharest) in 40 counties. Overall, the weak upturn of the economic growth in most counties revealed by relatively modest GDP increases has not been a strong economic recovery factor after the decline in post-crisis years. Only two counties recorded a rather high decrease in GDP in 2011 compared to 2010, respectively Cluj (-5.4%) and Mehedinti (-2%), which continued their prolonged economic downturn.

The year 2012 - a modest GDP growth

Whereas at national level the GDP stalled (a slight increase of 0.6%), in 25 counties the economic growth turned negative, only 17 counties have continued their upswing. Even if Bucharest Municipality witnessed a GDP increase of 3.3%, the prevalence of counties registering an economic decline in 2012, showed the prolonged nature of the crisis in most of the country's territory.

The year 2013 – re-launching growth in almost all counties

At macroeconomic level, GDP grew by 3.5%. Increases above the national average recorded the following counties (more important): Dolj (22.2%); Sibiu (8.4%); Arges (8.4%); Timis (6.8%); Prahova (4.4%); Brasov (4.2%); Arges (3.9%).

Counties that recorded a GDP decrease were Gorj (-6.8%), Valcea (-1.2%) and Bacau (-0.8%).

The year 2014 –continued recovery projected

The GDP growth macroeconomic level in Romania is forecasted to 2.6%, sustained by relatively modest increases in all counties between 0.8% (Tulcea) and 5.1% (Dolj). Most counties are foreseen to record GDP increases in the range of 2-3%. Only two counties are likely to register a slight GDP decrease, respectively Harghita (-0.5%) and Mehedinti (-1.0%).

3.2 The duration and speed of economic decline recovery

The analysis of GDP decline recovery at the county level, following the effects of the financial and economic crisis in 2009 and 2010, based on a set of relevant indicators, provides a series of benchmarks in terms of territorial economic resilience.

In order to assess the restoring capacity at county level we used **the indicator** of **the recovery duration**[1] **of GDP decline** between 2009-2014 compared to the base year 2008, on the following categories of duration: between 0 years (counties without crisis impact) and 5 years (counties without full recovering the GDP decline up to 2014):

a) without crisis: Gorj (1 county);
b) recovery in 2010: Brasov; Calarasi; Giurgiu (3 counties);
c) recovery in 2011: Alba; Caras Severin; Constanta; Dambovița; Iasi; Olt; Timis (7 counties);
d) recovery in 2012: Dolj (1 county);
e) recovery in 2013: Arad; Arges; Ialomita; Maramures; Sibiu; Suceava (6 counties);
f) recovery in 2014 (forecast): Mures (one county);
g) without total recovering up to 2014 (forecast): Bacau; Bihor; Bistrita Nasaud; Botosani; Braila; Buzau; Cluj; Covasna; Galati; Harghita; Hunedoara; Neamt; Prahova; Salaj; Satu Mare; Teleorman; Tulcea; Vaslui; Valcea; Vrancea; Bucuresti; Ilfov (23 counties).

[1] By the recovery period of GDP decline we understand the duration in years needed to the county to reach the level of the indicator recorded in 2008. This calculation can be done also for other outcome indicators such as exports, turnover, productivity or respectively effort indicators such as investment, employment etc.

Table 1 The recovery duration of GDP decline between 2009-2014, by counties

Recovery duration	0 years	1 year	2 years	3 years	4 years	5 years	Over 6 years
Number of counties	1	3	7	1	6	1	23

Source: authors calculations based on National Institute of Statistics and National Commission for Prognosis data

As results from the above mentioned data, **a number of 23 counties had not recovered from the crisis by 2014**, which means that their GDP is still below the level of 2008. This is why we believe that, in Romania, the consequences of the crisis have not yet been fully removed in territory i.e. the economy is suffering from fragility and lack of resilience.

The size of the gap in percentage points (pp) that counties have to recover in order to achieve the GDP level of 2008 is very important to support the programs and policies for sustainable territorial development, including the activating of endogenous factors.

In Table 2, the size of the gap for the 23 counties without total recovering the GDP decline up to 2014, grouped on 3 tiers is presented, in descending order.

Table 2: GDP gap to be recovered after 2014 to achieve the level of 2008, by counties

Gap to be recovered	Counties
Tier I **Low gap**: up to 5 pp	Tulcea (0,6 pp); Vrancea (0,6 pp); Bihor (0,8 pp); Galati (0,9 pp); Botosani (1,2 pp); Salaj (1,4 pp); Bacău (2,1 pp); Satu Mare (2,4 pp); Buzau (2,6 pp); Hunedoara (2,7 pp); Bucuresti (4,2 pp) – 11 counties
Tier II **Medium gap**: betwen 5-10 pp	Bistrita Nasaud (5,8 pp); Ilfov (5,4 pp); Prahova (5,7 pp); Neamt (7,4 pp); Harghita (8,2 pp); Teleorman (8,4 pp);– 6 counties
Tier III **High gap**: over 10 pp	Vaslui (10,5 pp); Covasna (12,5 pp); Mehedinti (13,6 pp); Cluj (14,8 pp); Braila (16,2 pp); Valcea (16,7 pp);– 6 counties

Source: authors calculations based on National Institute of Statistics and National Commission for Prognosis data

Hence, the economic recovery imposes urgent measures for all three categories of counties, mainly for those in tiers II and III, which were most affected by the negative impact of the crisis.

The data in Table 2 also highlights, in descending order, respectively the counties with low, medium and very low resilience in Romania, which requires the

development strategies specific to every region / county, aimed at strengthening the resilience to external shocks and at re-launching the sustainable endogenous growth.

The complex concept of economic resilience involves not only the resistance to external/internal shocks but also the recovery of social and economic damages, prejudices and losses caused by these shocks, in a certain period which implicitly leads to the characterization of the process by the indicator **speed of the decline recovery (SDR)**, calculated by using the average annual GDP growth (Table 3).

Table 3. Classification of counties depending on speed of the decline recovery

(%)

County	**Category I higher resilience**	**County**	**Category II lower resilience**
	Average annual rate 2008-2014		**Average annual rate 2008-2014**
Giurgiu	4.57	**Valcea**	-3.01
Dolj	4.43	**Braila**	-2.91
Brasov	2.40	**Cluj**	-2.64
Timiş	1.91	**Mehedinti**	-2.41
Constanta	1.78	**Covasna**	-2.21
Caras Severin	1.76	**Vaslui**	-1.84
Calarasi	1.74	**Teleorman**	-1.46
Alba	1.56	**Harghita**	-1.42
Iasi	1.42	**Neamt**	-1.28
Suceava	1.38	**Bistrita Nasaud**	-0.99
Gorj	1.33	**Prahova**	-0.98
Arad	1.28	**Ilfov**	-0.93
Maramures	1.19	**Bucuresti**	-0.72
Sibiu	1.10	**Hunedoara**	-0.46
Olt	0.84	**Buzau**	-0.45
Dambovita	0.55	**Satu Mare**	-0.40
Mures	0.31	**Bacau**	-0.36
Arges	0.20	**Salaj**	-0.24
Ialomita	0.12	**Botosani**	-0.21
		Galati	-0.16
		Bihor	-0.14
		Vrancea	-0.11
ROMANIA	**0.14**	**Tulcea**	-0.10

Source: authors calculations based on National Institute of Statistics and National Commission for Prognosis data

Thus, in Romania, positive values of SDR mean a total decline recovery, exceeding in 2014 the GDP by counties compared to 2008 (Category I - high economic resilience).

The higher these values, the faster the recovery and higher levels recorded exceeding GDP in 2014 compared to 2008.

On the contrary, negative values (Category II - lower economic resilience) mean an insufficient speed of the decline recovery for GDP to return in 2014 to its size recorded in 2008. The lower is the SDR, the larger decline to be recovered.

The counties from Category I, although different as regards the level of socio-economic development, showed a full recovery of the decline, having as common feature the higher economic resilience.

Category II, comprising a large number of counties, compared to Category I shows a slower and insufficient speed of the decline recovery.

This category also includes counties with different levels of economic and social development, among these Bucuresti, Cluj, Ilfov, Prahova which had failed to match in 2014 the GDP level of 2008.

At least the following conclusions can be drawn from this analysis:

- at the macroeconomic level, the counties of Category I had the largest contribution to the recovery after the downturn caused by the crisis effects, with relatively high rates of recovery and high resilience, unlike the counties of Category II, with an insufficient speed recovery;
- in Romania, the recovery of the economic decline caused by the crisis in the 2008-2014 period has been slow, fragile and sluggish (a number of 23 counties having still gaps to be recovered i.e. more than half of them), requiring focused analysis in each county, related to main factors of GDP decline, higher or lower, as well as to potential opportunities to strengthen resilience in the future;
- triggering the endogenous potential for sustainable growth in developing regions, counties and municipalities represents a factor of strengthening the economic resilience of a country *lato sensu*, of increasing its resilience and recovery capacity to internal and external shocks which, in the context of globalization, can bring about speeds and intensities of contagion and spreading at the international scale.

4. The economic downturn effects on employment in Romania's territory

The effects of the global crisis and the downturn of the Romanian economy in 2009 have severely impacted on the employment situation, namely by rising unemployment, which weakened the resilience at micro and macroeconomic levels.

The data presented in Annex 2 shows that in 2009, when the first shock of the crisis on the economy occurred, an unemployment rate of 7.8% has been recorded, almost double compared to the pre-crisis year of 2008.

In territory, all counties without exception, were affected by raising unemployment in 2009, to a greater or lesser extent, in 12 counties this rate reaching more than 10% (10.2% Caras-Severin; Salaj 10.3%; Harghita 10.5%; Hunedoara 10.7%; Covasna 11.1%; Ialomita 11.2%; Dolj and Galati 11.3%; Teleorman 11.5%; Alba 12.5%; Mehedinti and Vaslui 13.9%). The less resilient to rising unemployment in 2009 compared to 2008 i.e. more than 5 percentage points were Ialomita (from 4.9% to 11.2%), Alba (from 7.1% to 12, 5%), Bistrita-Nasaud (from 2.8% to 8.2%) and Prahova (from 3.8% to 8.9%).

In 2010, following the first impact of the crisis, marked by the economic recession, more moderate, the unemployment rate fell to 7% throughout the economy, most counties recording stagnation or a modest decline in the unemployment rate compared to 2009. Only in the counties Braila, Buzau and Giurgiu the unemployment situation continued to deteriorate.

In the period 2011-2013, even though at the level of the economy, there has been some recovery of the situation, the unemployment rate gradually decreasing to 5.7%, this level remained at about 1.3 percentage points higher compared to 2008. This means the inability of post-crisis recovery in terms of employment, during the analyzed period.

In 2013, except for two counties (Caras Severin and Iasi, that recorded a slight recovery, respectively of 0.3 pp and 0.2 pp) any county did not return to pre-crisis levels of rate unemployment. In most of the less developed counties, the unemployment rate remained between 1 and 2 pp above that of 2008, in some counties maintaining to over 10%: Alba (10.2%); Mehedinti (10.5%); Vaslui (10.7%); Teleorman (10.8%). These counties showed a weak capacity of post-crisis recovery and, consequently, to enter trajectories of endogenous development models in which the potential of intellectual capital plays a primary role.

Completing the analysis of the unemployment rate evolution at the economy and county levels with the one of employment situation, can reveal more significantly the impact of the recession on the Romanian economy and the resilience of counties to the crisis effects.

The employed population is one of the most important potential factors of endogenous growth at the region or county level. The analysis of employment by counties in Romania highlights a number of issues and problems that policy makers should consider in general and the labor market and employment policies in particular.

The premise from which we start our research focuses the favorable effects induced by the increase of employed population on endogenous economic development. In the period 2008-2013, after the peak of the economic crisis in 2009 and 2010, in Romania, the number of employed persons declined sharply in almost all counties.

The data presented in Annex 3, show that, if in 2008 there were 8.75 million persons employed in Romania, in 2009 their number was down to 8.41 million persons, and in 2010 to 8.37 million persons.

In just two years, the employed population fell by nearly 400,000 persons i.e. about 4.3% (Table 4), which shows an unfavorable trend compared to other EU countries where the share of employed population in total active population is considerably higher.

Table 4 Index of average employed population in 2009, 2010 and 2013 compared to 2008 (%)

County	2009/ 2008	2010/ 2008	2013/ 2008	County	2009/ 2008	2010/ 2008	2013/ 2008
Alba	94.9	93.00	96.86	**Hunedoara**	94.61	92.48	93.10
Arad	95.92	96.25	101.06	**Ialomita**	97.30	95.40	97.60
Arges	94.38	94.10	96.41	**Iasi**	96.79	96.59	96.62
Bacau	95.62	93.34	93.12	**Maramures**	98.64	98.54	101.57
Bihor	97.64	96.52	96.66	**Mehedinti**	95.80	93.56	94.19
Bistrita Nasaud	97.11	97.58	101.56	**Mures**	96.88	96.37	98.56
Botosani	97.59	97.12	99.53	**Neamț**	97.16	98.56	97.16
Brasov	95.78	95.20	100.88	**Olt**	95.10	95.45	96.57
Braila	96.07	93.05	92.44	**Prahova**	96.39	94.84	95.87
Buzau	97.20	97.54	98.21	**Salaj**	96.62	96.72	100.70
Caras Severin	97.02	94.21	92.73	**Satu Mare**	97.02	96.22	100.20
Calarasi	95.56	98.91	97.53	**Sibiu**	94.29	97.29	102.49
Cluj	96.83	97.13	100.96	**Suceava**	96.89	98.72	96.73
Constanta	95.70	94.37	95.50	**Teleorman**	98.90	98.64	99.68
Covasna	95.52	92.76	95.63	**Timis**	94.89	95.28	100.00
Dambovita	97.28	97.53	97.48	**Tulcea**	95.16	92.40	95.51
Dolj	95.48	96.78	94.97	**Vaslui**	96.69	95.51	96.06
Galati	92.97	89.00	90.31	**Valcea**	97.94	97.94	97.76
Giurgiu	98.30	96.82	99.89	**Vrancea**	97.03	98.34	98.13
Gorj	98.64	95.05	96.41	**Bucuresti**	94.85	94.25	97.23
Harghita	96.72	98.81	100.15	**Ilfov**	97.74	98.50	103.95
				ROMANIA	**96.16**	**95.7**	**97.53**

Source: Authors calculations based on NIS data (TEMPO-Online, Time series)

The analysis of data in Table 4, show that Bucharest, which holds the largest share in the country's employment, 12.8% respectively, suffered the most severe reduction in 2009 and 2010 (by about 65,000 persons cumulated in the two years, down by about 5.7%).

Other counties with low resilience to the crisis impact, which recorded significant reductions in their employed population in 2010 compared to 2008 i.e. of over 10 thousand persons, holding also an important share in both employment

and in productive economic system were: Galati (22.7 thou. persons, i.e. 11%); Constanta (17.4 thou. persons, i.e. 5.6%); Timis (15.8 thou. persons, i.e. 4.7%); Prahova (15.6 thou. persons, i.e. 5.1%); Arges (15.1 thou. persons, i.e. 5.9%); Bacau (14.9 thou. persons, i.e. 6.6%); Hunedoara (14.5 thou. persons, i.e. 7.5%); Brasov (11.5 thou. persons, i.e. 4.8%); Iasi (10.1 thou. persons, i.e. 3.4%).

So, we can conclude that, in absolute terms, the employment was adversely affected in counties with a relatively high degree of development, which emphasizes again the under-utilization of human capital, directly and indirectly involved in starting and strengthening the endogenous growth models.

In the period 2011-2013, the improvement of employment situation was rather modest, the number of employed persons increasing slightly to 8.53 million people in 2013, but still lower by 2.5% compared to 2008.

Apart from 10 counties, including some with a relatively high share in total employment (Arad, Brasov, Cluj) which recorded an increase in employed persons in 2013 compared to 2008, in other important counties (Arges, Bucharest, Constanta, Dolj, Galati, Iasi, Mures, Prahova, Suceava) the figures of employment remained below compared to the pre-crisis period, noting that the county Timis recovered the level of 2008.

The comparative analysis of the situation of gaps to be recovered i.e. of the 23 counties that had failed to return in 2014 to the GDP levels of 2008 (Table 2), as regards the employment, it seems that some of these counties, especially those of Category III (with GDP gaps of more than 10 pp) also faced high and persistent unemployment rates, and the decrease of employed population: Vaslui (10.5 pp GDP gap to be recovered and 10.7% unemployment rate, i.e. number of employed population by 4% lower); Mehedinti (13.6 pp GDP gap to recovered and 10.5% unemployment rate, i.e. number of employed population by 6% less).

By economic activities (NACE Rev. 2), in terms of employment, the shock of the crisis was felt mainly in manufacturing sector, about 200 thousand people i.e. more than half of the reduction in employment in 2009 compared to 2008 being located in this sector (Annex 4). Thus, although all counties, without exception, have recorded a reduction in employment in the manufacturing sector, the counties characterized by systemic industrial structures, were more affected, including Bucharest (down 14.2 thousand people), Timis (13.5 thousand people), Prahova (10.5 thousand people), Galati (9.4 thousand people), Cluj (8.4 thousand people), Arges (8.2 thousand people). Other sectors affected by the reduction of employment in 2009 compared to 2008 were the constructions (decreasing by about 54 thousand people at the level of the whole sector, of which over 15% in Bucharest-Ilfov), commerce (30 thousand people, of which over 25% in Bucharest-Ilfov), hotels and restaurants (36.5 thousand people, of which over 50% in Arges, Brasov, Constanta, Dolj, Neamt, Prahova, Timis, Bucharest-Ilfov).

A sector that suffered, in an indirect way, because of the economic crisis, but also due to the manifestation of specific phenomena, was education, where the number of employees diminished in 2009 and 2010 (about 42 thousand people cumulative in 2 years, compared to 2008). Considering that more than half of this reduction occurred in counties with reference schools and universities centers (Arges, Brasov, Bucharest, Cluj, Constanta, Mures, Suceava), we believe that the main cause of the employment decline was due to the decrease in number of students enrolled in secondary/tertiary education.

Beside the low level of expenditures related to this activity, from both budgetary funds and the private sector, which places Romania well below the European average, the average number of employees in R&D activities suffered a severe decline following the impact of the crisis in the economy, diminishing by about 4,500 people in 2010 compared to 2008, i.e. by more than 10%.

In Table 5 the classification of counties depending on the number of employees in R&D activities is presented. Although most counties recorded a decrease in the number of employees, the configuration of the four groups according to their R&D potential suffered no major changes in 2010 compared to 2008 as concerns the number of counties in each group, several changes occurring only in their ranking, because of some counties moving to other groups. However, major territorial discrepancies showed by this endogenous development factor are revealed, the counties with up to 100 employees in R&D activities (weak potential) i.e. 14 counties, which recorded also a decrease in the number of employees from 451 people to 261 people, representing only about 1% of R&D employees, compared with the 8 counties with over 1000 employees in R&D activities (significant potential) holding more than 80% of total employees in this sector.

The Hunedoara county, as a result of reducing the number of employees in R&D activities from 462 persons working in 2008 to 390 persons in 2010, went into the group 101-400 employees (modest potential).

The Prahova county, which witnessed a decrease in the number of employees in R&D activities from 1158 people in 2008 to 533 in 2010 went from the group with over 1000 employees (significant potential) into the group 401-1000 employees (medium potential) and on the other hand, the Timis county, which recorded an increase from 915 persons to 2805 persons in the number of R&D employees in the same period, advanced in the group with over 1000 employees.

The Bucharest Municipality, which concentrated in 2008 about 43% of the total number of employees in R&D activities, had the most drastic reduction in 2010 as the impact of the crisis, i.e. by 4363 persons, which led to the decrease of its share in total at about 37%.

Table 5 Classification of counties depending on the number of employees in R&D activities in 2008, 2010 and 2013

R&D employees	No counties	Counties
Year 2008 Total employees in R&D activities: 43, 502 persons		
Up to 100 employees (weak potential)	14	Salaj, Mehedinti, Ialomita, Giurgiu, Vrancea, Olt, Teleorman, Harghita, Buzau, Covasna, Satu-Mare, Botosani, Braila, Vaslui **(Subtotal: 451 employees – 1% of Total)**
101-400 employees (modest potential)	11	Maramures, Caras-Severin, Neamt, Bistrita-Nasaud, Valcea, Tulcea, Gorj, Alba, Calaraşi, Bacau, Dambovita **(Subtotal: 2624 employees – 6% of Total)**
401-1000 employees (medium potential)	9	Bihor, Hunedoara, Mures, Suceava, Sibiu, Arad, Constanta, Galati, Timis **(Subtotal: 5559 employees – 12.8% of Total)**
Over 1000 employees (significant potential)	8	Prahova, Brasov, Dolj, Ilfov, Arges, Iasi, Cluj, Bucuresti **(Subtotal: 34868 employees – 80.2% of Total)**
Year 2010 Total employees in R&D activities: 39,065 persons		
Up to 100 employees (weak potential)	14	Giurgiu, Mehedinti, Salaj, Ialomiţa, Olt, Vrancea, Teleorman, Satu-Mare, Harghita, Braila, Botosani, Covasna, Buzau, Vaslui **(Subtotal: 361 employees – 0.9% of Total)**
101-400 employees (modest potential)	12	Caras-Severin, Tulcea, Maramures, Neamt, Gorj, Bistrita-Nasaud, Valcea, Alba, Bacau, Calarasi, Dambovita, Hunedoara **(Subtotal: 2658 employees – 6.8% of Total)**
401-1000 employees (medium potential)	8	Mures, Suceava, Prahova, Bihor, Sibiu, Constanta, Arad, Galati **(Subtotal: 4747 employees – 12.2% of Total)**
Over 1000 employees (significant potential)	8	Brasov, Dolj, Arges, Ilfov, Iasi, Timis, Cluj, Bucuresti **(Subtotal: 31299 employees – 80.1% of Total)**
Year 2013 Total employees in R&D activities: 43,375 persons		
Up to 100 employees (weak potential)	17	Mehedinti, Ialomita, Olt, Botosani, Giurgiu, Harghita, Vrancea, Teleorman, Maramures, Salaj, Covasna, Buzau, Vaslui, Bihor, Braila, Gorj, Satu-Mare **(Subtotal: 663 employees – 1.5% of Total)**
101-400 employees (modest potential)	11	Caraş-Severin, Neamt, Tulcea, Valcea, Bistrita-Nasaud, Alba, Bacau, Dambovita, Mures, Calarasi, Galati **(Subtotal: 2881 employees – 6.6% of Total)**
401-1000 employees (medium potential)	6	Sibiu, Prahova, Suceava, Hunedoara, Arad, Constanta **(Subtotal: 3614 employees – 8.3% of Total)**
Over 1000 employees (significant potential)	8	Brasov, Dolj, Timis, Cluj, Iasi, Ilfov, Arges, Bucuresti **(Subtotal: 36217 employees – 83.5% of Total)**

Source: Authors calculations based on National Institute of Statistics data

In the post-crisis period, at the level of Romania's economy, the average number of R&D employees increased to 42.3 thou. persons in 2011, to 42.7 thou. persons in 2012 and to 43.4 thou. persons in 2013.

This partial recovery of the situation proved asymmetric, the severe regional disparities maintaining and even worsening if it is taken into consideration that in 2013 the number of counties with weak endogenous potential (less than 100 employees in R&D activities) increased from 14 to 17 by the entry into this group of counties Bihor, Gorj and Maramures, and that two other counties (Mures and Galati) went from medium potential group (401-1000 employees) into the modest potential group (101-400 employees).

The endogenous growth potential of a country is represented by several indicators among which the employed population and the employees in R&D activities.

As regards the ratio of employees in R&D activities by counties, expressed as a percentage of employment, we believe that such an indicator provides more relevant information in terms of both the intensity of territorial endogenous growth and the development of economic and financial policies and mechanisms appropriate to the endogenous regional development requirements.

The analysis of the indicator for the years 2008-2013 provide the possibility of deducing some trends in its developments, including in the crisis peak years of 2009 and 2010.

Based on data from Annex 5, we can draw some relevant aspects regarding the differentiation of counties as concerns the labor force endowment in the R&D sector, considered a core in order to promote the endogenous development.

A first remark to data from 2013, focuses on the extremely low percentage of R&D employees in the total employment i.e. below 1% in all counties except for Bucuresti Municipality (1.6%), Ilfov (1.9%), Arges (1 4%) and Iasi (1.1%).

There are a number of counties where this share is practically zero. These counties, *ipso facto*, only starting from now have to design a vision and to set up targets and action plans meant to the implementation of sustainable endogenous development strategies at county and local levels, valorizing the human, natural, financial and administrative potential, among them an important place being hold by centers and diffusion poles of technological progress and of increasing total productivity factor.

The economic crisis has shown its impact on reducing the size of the indicator, particularly in 2009, after which a slow improvement being recorded, many counties recovered the decline from previous years.

However, significant reductions of the percentage share of R&D employees in the total employment in 2013 compared to 2008 in 14 counties has been recorded: Cluj (0.787% against 0.998%); Galati (0.436% against 0.208%); Gorj

(0.063% against 0.170%); Prahova (0.383% against 0.164%); Sibiu (0.220% against 0.299%).

Bucuresti Municipality has also registered a decrease in the share of R&D employees, which, even if small (1.635% against 1.686%), reflected the deterioration of the indicator in the center with the most important endogenous development potential.

The decrease in the share of R&D employees in the local employment without being recovered during the analyzed period in the abovementioned counties, among others, was caused by the de-industrialization of those areas, which meant the dissolution of many centers and research institutes.

The territorial disparities in terms of research and development endogenous potential is more obvious when examining the classification of counties depending on the percentage share of employees in R&D activity in employment (Table 6).

Table 6 Classification of counties depending on the percentage share of R&D employees in total working population in 2013

Share Ranges	Number of counties	Counties	R&D Employees (persons)	Employment (persons)	R&D employees/ employment (%)
below 0.05%	15	Bihor, Botosani, Buzau, Braila, Covasna, Giurgiu, Harghita, Ialomita, Maramures, Mehedinti, Olt, Salaj, Teleorman, Vaslui, Vrancea	**478**	**2,122,200**	**0.0225**
0.06% - 0.5%	19	Alba; Arad; Bacau; Bistrita-Nasaud; Caras-Severin; Calarasi, Constanta, Dambovita, Galati, Gorj, Hunedoara Mures, Neamt, Prahova, Satu Mare, Sibiu, Suceava, Tulcea, Valcea	**6,680**	**3,442,300**	**0.194**
over 0.5%	8	Arges, Brasov, Cluj, Dolj, Iasi, Timis, Bucuresti, Ilfov	**36,217**	**2,966,100**	**1.221**
TOTAL			**43,375**	**8,530,600**	**0.508**

Source: Authors calculations based on NIS data (TEMPO-Online, Time series)

It was found that in 2013, the 15 counties where this ratio is below 0.05% cumulate only 478 employees, which, compared with the number of employed population of 2,122,200 persons in these counties, it represents only 0.0225%.

These counties recorded in 2013 the lowest share of employees in R&D activities in the total employment, as follows: Bihor (0.028%); Botosani (0.003%); Buzau 0.039%); Braila (0.064%); Covasna (0.046%); Giurgiu (0.008%); Harghita

(0.011%); Ialomita (0.00); Maramures (0.016%); Mehedinti (0.00%); Olt (0.001%); Salaj (0.038%); Teleorman (0.017%); Vaslui (0.05%); Vrancea (0.018%).

The counties in the first category, in terms of R&D activity can be regarded as "disadvantaged areas" that requires measures to promote specific endogenous development measures adequate to their profile, mainly agriculture. It is worth mentioning that a number of 12 between these 15 counties belong also to the group with up to 100 R&D employees (weak endogenous potential).

The second group includes a total of 19 counties where the percentage of R&D employees in employment is between 0.06% and 0.5%, the total number of 6680 employees of the group representing 0.2% of the employed population in these counties, below the national average (0.508%).

The counties belonging to this group have average share ranging between 0.06% and 0.5%, including: Arad (0.358%); Alba (0.170%); Bacau (0.154%); Calarasi (0.355%), Caras-Severin (0.108%); Constanta (0.288%), Bistrita-Nasaud (0.178%); Dambovița (0.165%), Hunedoara (0.326%), Galati (0.208%); Gorj (0.063%); Mures (0.147%); Neamt (0.079%); Prahova (0.164%); Satu Mare (0.066%); Sibiu (0.220%); Suceava (0.233%); Tulcea (0.210%); Valcea (0.125%).

In the counties from this group a series of research activities have been started within higher education institutes and certain companies or local government units. Compared to the first group of counties, one can assert that the counties belonging to this group have better chances of recovery and of endogenous growth potential triggering in the medium and long terms.

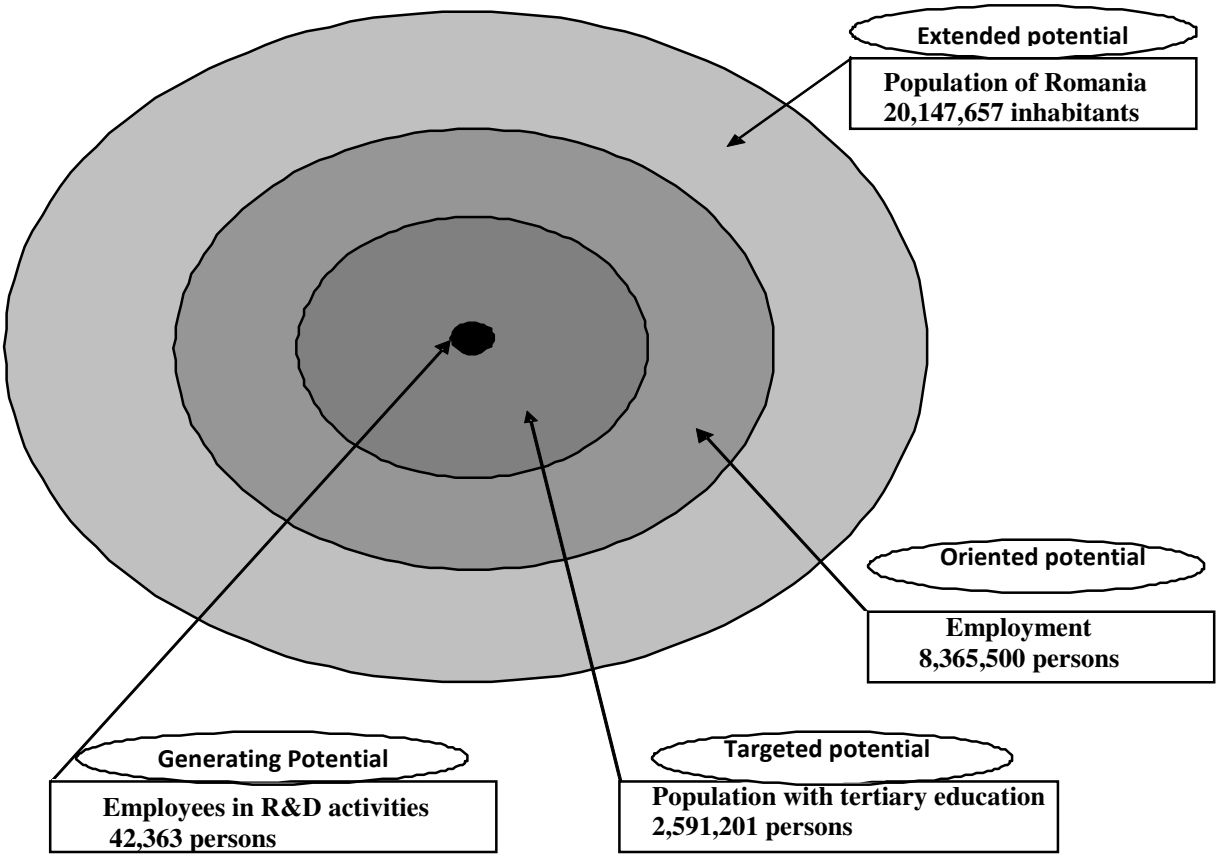
The third group refers to counties with a share of employees in R&D activities in employment more than 0.5% and refers to: Brasov (0.664%); Cluj (0.787%); Arges (1.384%); Dolj (0.671%); Iasi (1.134%); Timis (0.719%); Bucuresti (1.635%) and Ilfov (1.986%).

We mention that Bucuresti Municipality and Ilfov county are far exceeding the share of other counties, contributing substantially to the national average of 0.508%.

The third group includes the largest cities of the country, with traditional public and private research centers and having the largest endogenous development opportunities and potential. These counties are able to generate a number of positive externalities for endogenous development and spillover effects for counties with relatively low potential and endogenous factors.

The 8 counties with a percentage share of employees in R&D activity in employment over 0.5% are the same with the ones that have more than 1,000 R&D employees (significant endogenous potential of research and development), their cumulative number of 36,217 persons representing 1.221% of the total employment in these counties and contributing decisively to sizing the national average.

Figure 1



Source: Based on National Institute of Statistics data for the year 2011

As shown highly suggestive in Figure 1, in 2011, compared to the population (extended potential of endogenous development), the employment (oriented potential of endogenous development) was 2.5 times smaller, the population with tertiary education (targeted potential of endogenous development) 8 times lower and the employees in R&D activities (generating potential of endogenous development) of about 500 times less.

The endogenous development of all counties of Romania can be boosted by promoting knowledge-based re-industrialization strategies and policies for smart specialization, according to the industrial profile and vocation at the county and local levels.

5. Concluding remarks

The global economic and financial crisis has had a negative impact on the Romanian economy, especially as concerns the severe GDP decline at macroeconomic and at county levels, and the longer duration of the economic downturn recovery.

The main conclusions from our analysis focuses on stressing that the decline generated by the crisis effects since 2008 has been recovered only in 2014 at the national economy level, i.e. after a period of 6 years, which shows a low recovery and resilience capacity of Romania. In other words, Romania has just managed to recover the GDP level achieved in 2008, after a period of economic decline for two years, followed by a recovery period of 4 years, which basically means a longer recovery period compared to that of other countries.

The research highlights the differentiated recovery duration of the economic decline in 42 counties, a number of 23 counties, Bucharest Municipality included failing to achieve by 2014 the GDP level recorded in 2008. Thus, after 2014, a number of 11 counties have to recover GDP gaps between 0-5 pp, other 6 counties within 5-10 pp and 6 counties over 10 pp.

Among counties with GDP gaps to be recovered in the following years, there are some counties of systemic importance such as Bucharest, which have to recover more than 4.2 percentage points, Prahova - 5.7 pp, Cluj - 14.8 pp.

One of the factors to be considered for catching the calculated gaps is related to the increase of total factor productivity in the implementation of endogenous regional growth strategies, based on internal economic and natural potential, efficiently combined with external factors of economic growth.

Enhancing regional economic resiliencies is an extremely complex task which depends on a multitude of economic, social, technological factors, both external and internal.

Among these factors, the local capacity to effectively absorb R&D results from abroad or inside the country under the circumstances of rapid changes of scientific and technological activities.

The external economic openness of regions, their well defined specialization strategies, environmental investments represent important factors supporting the resilience and re-launching sustainable regional economic development.

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Annex 1 The GDP growth rate during the period 2008-2014, by counties

County	GDP growth rate (% compared to previous year)							Average 2008-2014 (%)
	2008	2009	2010	2011	2012	2013	2014*	
Alba	100.0	92.5	104.6	104.0	99.7	105.3	103.9	1.56
Arad	100.0	93.3	101.4	101.2	104.0	103.9	104.3	1.28
Arges	100.0	100.5	89.5	103.9	98.6	108.4	101.3	0.20
Bacau	100.0	94.5	97.4	103.7	102.1	99.2	101.2	-0.36
Bihor	100.0	91.2	99.0	101.7	102.5	102.6	102.7	-0.14
Bistrita Nasaud	100.0	97.2	88.6	101.6	101.1	104.7	101.7	-0.99
Botosani	100.0	95.5	93.5	103.4	99.3	104.8	102.8	-0.21
Brasov	100.0	98.6	102.1	104.4	101.7	104.2	103.5	2.40
Braila	100.0	98.3	85.7	105.0	89.9	104.1	101.2	-2.91
Buzau	100.0	90.3	101.4	107.9	95.9	101.4	101.3	-0.45
Caras Severin	100.0	100.6	98.3	103.0	101.2	105.0	102.6	1.76
Calarasi	100.0	87.8	119.6	102.9	95.4	105.8	101.7	1.74
Cluj	100.0	95.6	98.5	94.6	90.4	103.0	102.7	-2.64
Constanta	100.0	97.5	102.5	103.0	100.9	102.5	104.4	1.78
Covasna	100.0	95.7	90.1	101.8	94.9	102.0	102.9	-2.21
Dambovita	100.0	94.3	105.9	103.4	96.9	100.4	102.9	0.55
Dolj	100.0	95.6	95.5	101.0	109.5	122.2	105.1	4.43
Galati	100.0	88.6	107.1	101.6	97.6	103.4	101.8	-0.16
Giurgiu	100.0	97.1	127.7	102.2	98.7	102.4	102.1	4.57
Gorj	100.0	104.7	105.0	103.7	99.9	93.2	102.0	1.33
Harghita	100.0	95.5	92.7	103.9	99.9	100.4	99.5	-1.42
Hunedoara	100.0	92.2	95.6	102.5	100.7	104.2	102.6	-0.46
Ialomita	100.0	93.6	100.2	103.9	99.0	103.7	100.7	0.12
Iaşi	100.0	94.3	103.0	105.7	101.7	101.6	102.6	1.42
Maramures	100.0	96.9	97.6	102.5	102.2	105.4	102.8	1.19
Mehedinti	100.0	95.2	93.0	98.0	98.4	102.2	99.0	-2.41
Mures	100.0	92.3	94.7	104.6	103.0	104.6	103.4	0.31
Neamţ	100.0	93.3	91.9	103.9	99.1	102.4	102.4	-1.28
Olt	100.0	87.9	110.0	105.6	97.9	103.3	101.8	0.84
Prahova	100.0	97.6	85.8	102.5	100.4	104.4	104.8	-0.98
Salaj	100.0	95.4	96.2	103.5	97.7	103.7	102.4	-0.24
Satu Mare	100.0	94.0	94.7	102.3	99.8	105.3	102.0	-0.40
Sibiu	100.0	97.1	95.8	101.0	102.7	108.4	102.1	1.10
Suceava	100.0	98.9	93.6	103.2	103.2	107.0	102.9	1.38
Teleorman	100.0	93.9	93.2	102.5	96.3	104.2	101.7	-1.46
Timis	100.0	92.7	105.7	102.9	101.3	106.8	102.7	1.91
Tulcea	100.0	91.6	106.2	105.0	93.2	103.6	100.8	-0.10
Vaslui	100.0	91.4	94.2	102.6	98.7	100.7	101.9	-1.84
Valcea	100.0	90.2	94.3	104.7	93.7	98.8	101.0	-3.01
Vrancea	100.0	93.1	101.1	102.7	98.5	103.0	101.3	-0.11
Bucuresti	100.0	88.3	100.8	100.3	103.3	101.4	102.4	-0.72
Ilfov	100.0	94.3	94.2	102.0	100.3	101.4	102.6	-0.93
ROMANIA	**100.0**	**93.4**	**98.9**	**102.2**	**100.6**	**103.5**	**102.6**	**0.14**

*Forecast

Source: Calculations based on National Institute of Statistics and National Commission for Prognosis data

Annex 2 The unemployment rate during the period 2008 – 2013, by counties

- % -

County	2008	2009	2010	2011	2012	2013
Alba	7.1	12.5	10	7.7	8.4	10.2
Arad	3.1	6.8	5.2	3.5	3.6	3.2
Arges	4.9	9.5	7.6	5.7	6.1	7.0
Bacau	5.3	9.0	7.8	6.2	6.4	7.2
Bihor	3	5.8	5.9	4.2	4.2	3.7
Bistrita Nasaud	2.7	8.2	6.4	4.9	4.8	4.9
Botosani	3.6	7.2	6.4	4.0	4.4	5.3
Brasov	4.3	8.7	7.2	5.1	4.9	4.7
Braila	4.4	8.0	8.7	5.8	6.5	7.0
Buzau	5.7	9.4	9.7	8.0	7.9	8.6
Caraş Severin	6	10.2	9	5.6	5.5	5.7
Calarasi	5.1	9.2	8.8	6.3	7.2	8.2
Cluj	2.9	6.3	4.9	3.8	3.8	3.5
Constanţa	3	6.4	5.8	4.3	4.5	4.4
Covasna	7.2	11.1	10.0	8.6	7.6	7.4
Dambovita	5.6	8.5	8.5	6.5	7.5	8.1
Dolj	8.1	11.3	9.8	8.9	9.4	9.7
Galati	6.6	11.3	10.4	7.9	8.9	9.2
Giurgiu	4.5	7.2	8.4	5.7	5.9	6.2
Gorj	7.3	10.7	10.1	7.8	7.7	8.2
Harghita	6.5	10.5	8.8	6.5	7.3	7.0
Hunedoara	6.7	10.7	8.5	6.0	6.6	7.5
Ialomita	4.9	11.2	9.9	7.6	7.7	7.5
Iaşi	5.4	7.4	7.0	5.4	5.1	5.2
Maramures	3.7	6.4	6.0	4.1	4.1	3.9
Mehedinti	9.3	13.9	10.5	9.7	9.5	10.5
Mures	4.7	8.0	8.0	6.0	6.0	5.5
Neamt	4.1	7.9	7.7	5.2	5.4	6.2
Olt	5.3	8.9	8.2	6.9	7.7	8.2
Prahova	3.9	8.9	8.6	5.7	5.6	5.8
Salaj	5.5	10.3	8.4	6.5	6.2	6.2
Satu Mare	3.0	6.5	6.1	4.6	4.8	4.6
Sibiu	3.1	8.3	5.8	4.3	4.5	4.8
Suceava	4.3	7.9	7.3	4.9	5.5	6.5
Teleorman	8.1	11.5	10.9	9.1	9.6	10.8
Timis	1.6	4.5	3.7	1.9	2.0	1.9
Tulcea	4.4	8.9	8.1	5.8	5.9	5.9
Vaslui	10.2	13.9	11.8	9.8	10.1	10.7
Valcea	4.7	7.9	7.7	5.2	6.1	6.8
Vrancea	4.4	7.4	7.4	5.5	5.5	5.9
Bucuresti	1.6	2.4	2.3	2.0	2.0	2.0
Ilfov	1.3	2.4	2.7	1.6	1.8	1.9
ROMANIA	**4.4**	**7.8**	**7.0**	**5.2**	**5.4**	**5.7**

Source: National Institute of Statistics data (TEMPO-Online, Time series)

Annex 3 The employment during the period 2008-2013, by counties

- thousand persons -

County	2008	2009	2010	2011	2012	2013
Alba	168.6	160.0	156.8	158.1	163.4	163.3
Arad	208.2	199.7	200.4	201.3	206.2	210.4
Arges	256.0	241.6	240.9	241.7	249.4	246.8
Bacau	223.7	213.9	208.8	208.3	213.3	208.3
Bihor	275.6	269.1	266.0	263.0	268.3	266.4
Bistrita Nasaud	128.2	124.5	125.1	127.0	131.7	130.2
Botosani	149.3	145.7	145.0	146.6	150.8	148.6
Brasov	239.6	229.5	228.1	229.2	237.6	241.7
Braila	132.3	127.1	123.1	123.1	123.8	122.3
Buzau	178.6	173.6	174.2	173.4	176.4	175.4
Caraş Severin	121.0	117.4	114.0	112.6	115.1	112.2
Calarasi	101.3	96.8	100.2	99.2	100.9	98.8
Cluj	334.6	324.0	325.0	326.3	332.8	337.8
Constanţa	309.0	295.7	291.6	287.3	295.0	295.1
Covasna	87.0	83.1	80.7	81.9	84.4	83.2
Dambovita	198.5	193.1	193.6	193.3	196.9	193.5
Dolj	276.6	264.1	267.7	261.1	266.2	262.7
Galati	206.3	191.8	183.6	181.9	185.9	186.3
Giurgiu	88.0	86.5	85.2	87.5	89.8	87.9
Gorj	139.4	137.5	132.5	133.3	135.3	134.4
Harghita	134.0	129.6	132.4	132.0	134.9	134.2
Hunedoara	192.8	182.4	178.3	176.1	180.9	179.5
Ialomita	100.1	97.4	95.5	96.0	99.0	97.7
Iaşi	295.8	286.3	285.7	280.0	287.1	285.8
Maramures	198.0	195.3	195.1	196.6	202.1	201.1
Mehedinti	111.8	107.1	104.6	105.4	108.5	105.3
Mures	236.8	229.4	228.2	229.0	235.6	233.4
Neamt	193.8	188.3	191.0	186.5	192.8	188.3
Olt	169.3	161.0	161.6	162.6	167.4	163.5
Prahova	302.3	291.4	286.7	284.2	288.3	289.8
Salaj	100.6	97.2	97.3	98.2	101.9	101.3
Satu Mare	150.9	146.4	145.2	145.6	150.4	151.2
Sibiu	180.5	170.2	175.6	176.6	184.8	185.0
Suceava	241.5	234.0	238.4	232.7	237.9	233.6
Teleorman	154.8	153.1	152.7	152.6	158.3	154.3
Timis	334.4	317.3	318.6	325.1	334.2	334.4
Tulcea	86.8	82.6	80.2	80.0	84.4	82.9
Vaslui	144.8	140.0	138.3	138.7	142.8	139.1
Valcea	169.9	166.4	166.4	166.5	170.6	166.1
Vrancea	144.6	140.3	142.2	140.5	145.5	141.9
Bucuresti	1122.1	1064.3	1057.6	1062.0	1070.6	1091
Ilfov	159.6	156.0	157.2	162.5	168.4	165.9
ROMANIA	**8747**	**8410.7**	**8371.3**	**8365.5**	**8569.6**	**8530.6**

Source: National Institute of Statistics data (TEMPO-Online, Time series)

Annex 4: The percentage share of employment in manufacturing sector in total employment during the period 2008 – 2011, by counties

- % -

County	2008	2009	2010	2011
Alba	29.54	27.38	26.91	28.27
Arad	31.99	30.70	31.29	32.09
Arges	30.27	28.15	28.14	28.63
Bacau	22.53	20.48	19.35	19.68
Bihor	25.40	24.71	24.70	25.32
Bistrita Nasaud	25.27	22.89	23.02	23.62
Botosani	15.74	15.17	14.83	14.94
Brasov	27.13	25.53	25.52	26.35
Braila	24.94	22.82	21.93	22.42
Buzau	22.51	20.45	20.55	20.76
Caraş Severin	23.22	23.00	21.93	21.67
Calarasi	18.07	15.81	15.57	16.23
Cluj	22.71	20.93	20.58	20.96
Constanţa	19.51	18.57	17.90	17.86
Covasna	31.03	27.80	28.38	27.96
Dambovita	25.74	24.70	24.54	24.21
Dolj	18.00	15.94	15.20	15.59
Galati	22.98	19.71	18.52	18.14
Giurgiu	10.91	10.29	9.15	9.03
Gorj	27.76	26.62	25.36	25.73
Harghita	27.46	25.39	24.62	24.70
Hunedoara	30.91	29.39	29.50	29.47
Ialomita	15.98	15.20	15.92	15.63
Iaşi	18.36	16.91	16.21	16.46
Maramures	24.09	23.50	23.68	23.60
Mehedinti	19.23	16.06	15.97	15.28
Mures	25.84	24.24	24.45	24.50
Neamt	19.14	17.37	16.34	16.84
Olt	21.50	18.88	17.95	18.82
Prahova	30.20	27.63	26.86	27.20
Salaj	25.75	23.66	23.43	23.42
Satu Mare	25.65	23.84	24.04	24.18
Sibiu	32.80	30.79	30.92	31.48
Suceava	16.48	15.38	14.77	15.90
Teleorman	15.89	14.37	14.67	14.68
Timis	28.11	25.31	26.52	28.05
Tulcea	22.12	20.46	19.33	18.88
Vaslui	18.92	16.64	16.78	16.51
Valcea	22.84	21.88	21.51	21.62
Vrancea	20.19	18.46	17.86	18.15
Bucuresti	14.92	14.49	13.57	13.42
Ilfov	25.50	24.36	23.47	22.22
ROMANIA	**22.65**	**21.09**	**20.71**	**20.96**

Source: National Institute of Statistics data (TEMPO-Online, Time series)

Annex 5 The percetage share of R&D employees in total employment during the period 2008-2013, by counties

- % -

County	2008	2009	2010	2011	2012	2013
Alba	0.158	0.153	0.155	0.175	0.153	0.170
Arad	0.317	0.400	0.366	0.357	0.272	0.358
Arges	1.006	1.003	0.968	0.482	0.854	1.384
Bacau	0.152	0.201	0.140	0.190	0.162	0.154
Bihor	0.159	0.197	0.215	0.033	…	0.028
Bistrita Nasaud	0.131	0.160	0.145	0.088	0.098	0.178
Botosani	0.039	0.021	0.028	0.008	0.007	0.003
Brasov	0.645	0.855	0.789	0.986	0.768	0.664
Braila	0.063	0.057	0.024	0.011	0.158	0.064
Buzau	0.018	0.022	0.036	0.042	0.033	0.039
Caras Severin	0.122	0.123	0.111	0.113	0.100	0.108
Calarasi	0.322	0.312	0.303	0.423	0.337	0.355
Cluj	0.998	1.015	0.953	1.040	0.938	0.787
Constanta	0.217	0.249	0.227	0.274	0.270	0.288
Covasna	0.043	0.039	0.052	0.057	0.065	0.046
Dambovita	0.198	0.187	0.178	0.189	0.179	0.165
Dolj	0.667	0.705	0.722	0.723	0.742	0.671
Galati	0.436	0.414	0.442	0.252	0.209	0.208
Giurgiu	0.007	0.001	…	…	0.061	0.008
Gorj	0.170	0.150	0.125	0.121	0.051	0.063
Harghita	0.022	0.022	0.021	0.014	0.033	0.011
Hunedoara	0.240	0.230	0.219	0.321	0.277	0.326
Ialomita	0.003	0.011	0.008	0.003	…	…
Iaşi	1.028	1.013	0.839	0.919	0.997	1.134
Maramureş	0.074	0.070	0.071	0.077	0.061	0.016
Mehedinti	0.002	0.002	…	…	…	…
Mureş	0.203	0.217	0.180	0.164	0.153	0.147
Neamt	0.078	0.095	0.075	0.051	0.076	0.079
Olt	0.011	0.008	0.010	0.012	0.016	0.001
Prahova	0.383	0.191	0.186	0.097	0.116	0.164
Salaj	…	0.002	0.002	0.045	0.040	0.038
Satu Mare	0.036	0.020	0.018	0.016	0.057	0.066
Sibiu	0.299	0.569	0.337	0.311	0.238	0.220
Suceava	0.203	0.190	0.182	0.183	0.181	0.233
Teleorman	0.014	0.013	0.013	0.015	0.015	0.017
Timis	0.274	0.532	0.880	0.545	0.681	0.719
Tulcea	0.260	0.254	0.158	0.220	0.207	0.210
Vaslui	0.062	0.042	0.049	0.043	0.055	0.050
Valcea	0.129	0.125	0.120	0.128	0.004	0.125
Vrancea	0.011	0.011	0.013	0.006	0.029	0.018
Bucuresti	1.686	1.613	1.376	1.848	1.712	1.635
Ilfov	1.535	1.544	1.513	1.608	2.124	1.986
ROMANIA	**0.497**	**0.504**	**0.467**	**0.506**	**0.498**	**0.508**

Source:calculations based on National Institute of Statistics data (TEMPO-Online, Time series)