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REGIONAL ANALYSIS OF THE REAL EARNINGS IN ROMANIA

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Abstract

In this paper we investigated the impact of some indicators on the average earnings at county level in Romania for the period 2000-2012. After a short statistical analysis of the indicators used in this study and after excluded Ilfov and Bucharest, we grouped the counties into three main clusters by applied a Hierarchical cluster analysis. We then estimated three panel data models corresponding to each of the three clusters and the results indicated that the factors with positive influence are the number of graduates from tertiary education, the number of immigrants, the GDP, while the factors with negative influence are the civilian employed population level and the number of emigrants. The results of the Monte Carlo simulation suggests that, in general, for the period 2013 - 2014 the real average gross earnings in Romania is expected to keep a positive trend through the entire analysed period.

Keywords: earnings, regional analysis, panel data, numerical simulation
JEL classification: R15, J30

1. Introduction

The fundamental objective of regional development policies is to reduce the territorial disparities, to reach a balance between the economic and the social development of different areas by supporting the restructuring and economic recovery processes and by stimulating the competitiveness of regions. Clearly, reducing the gap between the developed and the less developed regions is a lengthy process which primarily involves economic efficiency. In addition to the differences between regions, there are disparities within regions where the predominantly agricultural counties coexist with the industrial ones (which are more developed). This phenomenon has worsened even further after the economic restructuring, especially in mono-industrial areas, where the population has been affected by unemployment, and especially by structural unemployment. The existence of these rather significant discrepancies also induced the migration phenomenon, which although seemingly can solve the unemployment issue, in the long run it leads to the depopulation of some areas which has a visible economic and social impact.

In this context, analysing the factors that influence the real average gross earnings at the county level is very important, especially in terms of achieving economic and social cohesion. The territorial differences in earnings are dictated primarily by the development of the county, but also by the job offers on the market. The higher level of earnings registered in the region Bucharest-Ilfov is due to a low rate of unemployment which forces employers to offer higher wages in order to keep their employees, but mostly it's due to the investments in this area (especially FDI).

In the last 23 years the labour market in Romania has been strongly influenced by economic and social changes. The transition problems prevented the market auto-regulation or accelerated negative trends - declining employment rate, high level of underemployment in agriculture (rural

areas), reduced mobility between geographical areas (development regions), labour migration especially to western European countries etc.

Given the economic crisis which still persists in the Romanian economy, the labour market is facing a new set of distortions, which are identified by the coexistence of a labour force shortage in certain economic sectors or geographical areas (regions), and of its overall low level of usage. From this perspective, the future national programmes for reform and the labour force policies in Romania will have to focus on attracting and retaining more people in employment, by trying to reduce the labour force migration, by correlating wages with productivity and by developing the education and training systems.

An important issue related to socio-economic cohesion, and thus the increase in the standard of living, is the lack of a coherent policy on regional development with a well-defined role to increase employment and earnings. Sometimes the regional development policy, including the components financed from the EU budget, seems to oscillate between economic development and social protection without achieving any of these objectives. There is no doubt that the funds for regional development, which are quite significant, should stimulate the economic environment by creating jobs, and by increasing productivity and earnings.

In the current economic conditions it is advisable not to overlook the fact that there must be a balance between the measures to protect the budget (which are usually short-term measures which focus mainly on reducing budget expenses) and the measures that stimulate mobility and flexibility on the labour market and eliminates the dysfunctions of this market, especially unemployment (which generally have medium and long-term effects). The mobility and flexibility of the labour force is significantly influenced by the level of labour earnings, which are the basis of the living standards of people employed.

The paper is organized as follows: Section 2 presents a description of the prior work; Section 3 offers the methodology applied, whereas Section 4 describes and analyse the data. The panel data models are presented in Section 5, while the Monte Carlo Simulation is presented in Section 6. Section 7 concludes.

2. Literature review

The global crisis has had significant negative repercussions for labour markets in many parts of the world and recovery is proving uncertain and elusive. At the global level, average wages have grown, but at lower rates than before the crisis. In spite of the slowing of wage growth, this change was generally smaller than the respective decline in labour productivity growth or GDP growth during the years of the crisis.

To what extent these economic trends affect wage developments is a major subject of interest. Atesoglu and Smithin (2006) investigated real wage and productivity dynamics in the G7 countries using annual data for 1960-2002. The empirical findings suggest that the level of labour productivity is positively related to GDP growth in all countries and real wages are positively related to growth in some of them.

A more recent study concerning the link between wages and GDP growth for the case of Bulgaria states that this relationship is not very strong. The authors observed that GDP grew more quickly compared to the real average wage: GDP increased by 57.2% in the period 2000–2008 and the real average wage increased only by 38.1%. The relationship between economic development and the growth rate of real wage is statistically significant, GDP having a positive influence on real wages. However, the correlation coefficient of 0.54 shows that this connection is not very strong. The final conclusion was that the economic growth had a moderate impact on the dynamics of real wages, during 2000-2008 (Loukanova and Tzanov, 2011).

The connection between employment and real wages has long been a controversial issue in economic theory. The classical theory supports the existence of a close relationship between the employment level and real wages in the sense that a decline of the real wages determines an increase in the employment level.

On the other hand, Keynes does not agree with the existence of a self-correcting market mechanism and suggests that competition is not capable of adjusting the price of labour and to eliminate the labour market supply or demand excess. It states that employment is determined by demand and the real wage by employment. If the marginal cost increases and wage rates are stable, employment could be increased resulting in a fall of wage rates to a level in equilibrium with the new level of employment. Employment does not increase because the wage rates decrease, but the other way round: as the demand increases, the employment will also increase and, as a consequence, the wage rates will fall (Keynes, 1936).

A recent empirical study investigated the existence and the direction of the relationship between employment and real wages using cointegration and causality tests. The results are in favour of the classical theory, indicating that a long-run relationship exists between real wages and the employment level, a reduction of the real wages leading to an increase in the employment level (Ozata and Esen, 2010).

Empirical studies supporting Keynes theory can be found in Belzil (2000), Buchinsky et al. (2005) and Apergis and Theodosiou (2008). Using data for ten different OECD countries for the period 1950-2005, Apergis and Theodosiou (2008) applied panel cointegration methodologies to investigate the existence and the direction of a relationship between employment and real wages.

The results indicated to firmly reject the hypothesis that real wages influence the employment level, the direction of the relation being the other way round.

The empirical literature analysing the effect of migration on the source countries is mainly focusing on the direct impact of remittances on the everyday life of the household by looking at their consumption and investment behaviour. However, the massive growth of emigration and remittances involves many other aspects, for instance the labour market shock from reduced labour supply, with significant policy implications for developing countries (Bouton et al., 2011).

Mishra (2007), using US and Mexican census data, finds that a 10% increase in emigration leads to an increase of almost 4% in average wage in Mexico. Analysing the effects of emigration on the wages of the Puerto Rican workers, Borjas (2008) found that a 10% decrease in the number of workers from a particular skill group, caused by emigration, raises the average Puerto Rican wage by about 2%.

The evidence from a number of developing countries suggests that high emigration rates are not necessarily associated with rising wages or even declining unemployment (OECD, 2007). Aydemir and Borjas (2007), using data from the US, Canadian and Mexican Censuses, found that a 10% change in labour supply because of migration leads to a 3 to 4% change of the average wage, but in the opposite direction.

Recent papers on the labour market effects of emigration include Docquier et al. (2011), Elsner (2011) and Dustman et al. (2012). Elsner (2011) uses a calibrated structural model of labour demand to simulate the effect of Lithuanian emigration on the wages of non-emigrant workers, the result suggesting that emigration increased the wages of young workers by 6%, while it had no effect on the wages of old workers. Dustman et al. (2012) analyses the effect of emigration from Poland around the time of EU accession on the Polish labour market and found that emigration led to a slight increase in wages overall but that workers at the low end of the skill distribution made no gains and may actually have experienced slight wage decreases. Docquier et al. (2011) used an aggregate production function model to simulate the effect of immigration and emigration on wages and employment in OECD countries. They found that emigration had a statistically significant negative effect on the long-run, ranging from 0 for the United States to -0.8% in the United Kingdom and that immigration had, on the long-run, a small positive effect on the wages of native workers, ranging from 0 for the case of Italy to +1.7% in Australia.

As for the impact of immigration on labour market most studies are referring to United States or United Kingdom. Ottaviano and Peri (2010) calculated how immigration affects the wages of native US workers in the period 1990-2006 and found that immigration had a small positive effect on average native wages (+0.6%). Dustman et al. (2008) analysed the impact of immigration upon

the wages of native born UK workers, the results indicating that the overall wage effect of immigration is slightly positive.

Barrett et al. (2009) estimated the effect of immigration on the wages of natives in Ireland and the results showed a positive, as well as a negative impact of immigrants upon the wages of the native workers depending on how the skills of the workers were defined: in terms of occupation or education.

In this era of globalization and information technology, education plays an essential role in achieving better employment opportunities and improving the quality of life. Education is an important factor in increasing the wealth and the competitiveness of a nation. Education is generally seen as a key investment in human capital being often much more important than capital investment. Human capital refers to the idea that individuals acquire the skills and knowledge needed to increase their value on the labour market. Human capital is an essential factor for labour market participation and labour productivity and in the same time, at the aggregate level, it influences consumption, gross domestic product and community wellbeing.

The impact of education on earnings has been widely investigated. A higher level of education was found to have a statistically significant positive effect on wages. Gunawan (2012) found that the effect of education on wages is greater as the level of education increases, the return to tertiary education being the highest return among other levels of education. People who have a high school diploma earn wages by up to 45% higher than those who have not completed 12 years of school (Forbes et al., 2010).

For Romania, when investigating the effect of education on wages, Pauna (2009) concluded that an additional year of education has a coefficient of 0.0469 for men, 0.0409 for women and 0.0061 for the entire sample. A recent study emphasizes the importance of education as a determinant of earnings, the result showing a coefficient of 0.081652 for the year 2009 (Ion, 2013).

3. Methodology

In this paper several panel data models were estimated using STATA software. A panel data model differs from other regressions in that it has a double subscript on its variables:

$$y_{it} = a + X'_{it} b + u_{it}, \quad \text{with } i = 1, \ldots, N; \; t = 1, \ldots, T \tag{1}$$

where *i* refers to the cross-section dimension and *t* denotes the time-series dimension. In general, panel data applications use a one-way error component model for the disturbances, with: $u_{it} = \alpha_i + \varepsilon_{it}$ (Baltagi, 2008).

In the case of the static models we distinguish two main types of models: fixed-effects (FE) and random-effects (RE) models. In the FE model, the α_i can be correlated with the regressors x_{it},

while the x_{it} is assumed to be uncorrelated with the idiosyncratic error ε_{it}, while in the RE model, the α_i are considered purely random (Cameron et al., 2009).

The main advantage of panel data consists in obtaining better and more reliable estimates of the parameters of the model. When deciding whether to pool or not the data, there is a simple poolability test that has the null hypothesis the OLS model and as the alternative the FE model (Kunst, 2009).

In order to decide if a FE or RE model is more suitable for a particular analysis there are several tests that can be applied, the Hausman test being the most common.

The most common estimator for the FE model is the "within estimator" that eliminates the fixed-effect through mean-differencing. Through this procedure any time-invariant variable will be eliminated from the model. The within model or mean-difference model it looks like the following equation:

$$(y_{it} - \bar{y}_i) = (x_{it} - \bar{x}_i)'b + (\varepsilon_{it} - \bar{\varepsilon}_i) \quad (2)$$

The default standard errors assume that the error ε_{it} is independent and identically distributed (i.i.d) and also homoskedastic having the same variance across individuals and time. This hypothesis may be a restrictive one for the case of panels. If the errors are heteroskedastic then the standard errors of the estimates will be biased and robust standard errors that correct for the possible presence of heteroskedasticity will be needed (Baum, 2001).

Moreover, serial correlation in this type of models biases the standard errors and leads to less efficient results. Therefore we need to identify serial correlation in the residuals of a panel-data model (Drukker, 2003). One common test for serial correlation in panel-data models, easy to implement and which requires few assumptions was discussed by Wooldridge **(**2002).

Some authors have proposed a series of tests in order to identify such problems (Drukker, 2003, Baum, 2001, Green, 2000). For the Stata program that we used in our analysis, there are procedures that correct the error structure, based on Driscoll and Kraay (1998) nonparametric covariance matrix estimator.

4. Data description

We used annual data for the period 2000-2012, regarding the 42 counties in Romania. The variables employed in this paper are: the average gross monthly earnings (*earn*), the gross domestic product (*gdp*), the employed civilian population (*empl*), the number of immigrant (*imig*) and emigrants (*emig*) and the number of tertiary education graduates (*tert_educ*). The first two variables are expressed in Lei, while the remaining variables are in persons. The data was collected from

National Institute of Statistics database. For the econometric analysis we need the data to be comparable, and therefore we used the CPI and the GDP deflator to deflate the average monthly earning and the GDP respectively. The series of GDP was restricted to 2010 in NIS databases, which is why we decided to enlarge the series with the predictions of National Forecast Commission (2013) for 2011 and 2012.

In Romania, the real earnings have increased at least sevenfold since 2000. The average annual growth rate was 58.5% for Hunedoara county (the lowest recorded) and 90.9% for Timis county (the highest rate). In 2012, the lowest earnings were obtained in Harghita (1408 Lei), while the highest earnings were obtained in Bucharest (2925 Lei), the latter being more than two times the former.

When grouping the counties into regions, one region stands out: Bucharest-Ilfov. In this special region the real earnings are the highest in the country, well above the other regions. This can be explained by the facts that it concentrates many industrial areas, many firms have headquarters in Bucharest or in the surroundings and it is also an important educational centre that attracts many students that after graduating remain in the capital city becoming a high qualified work force.

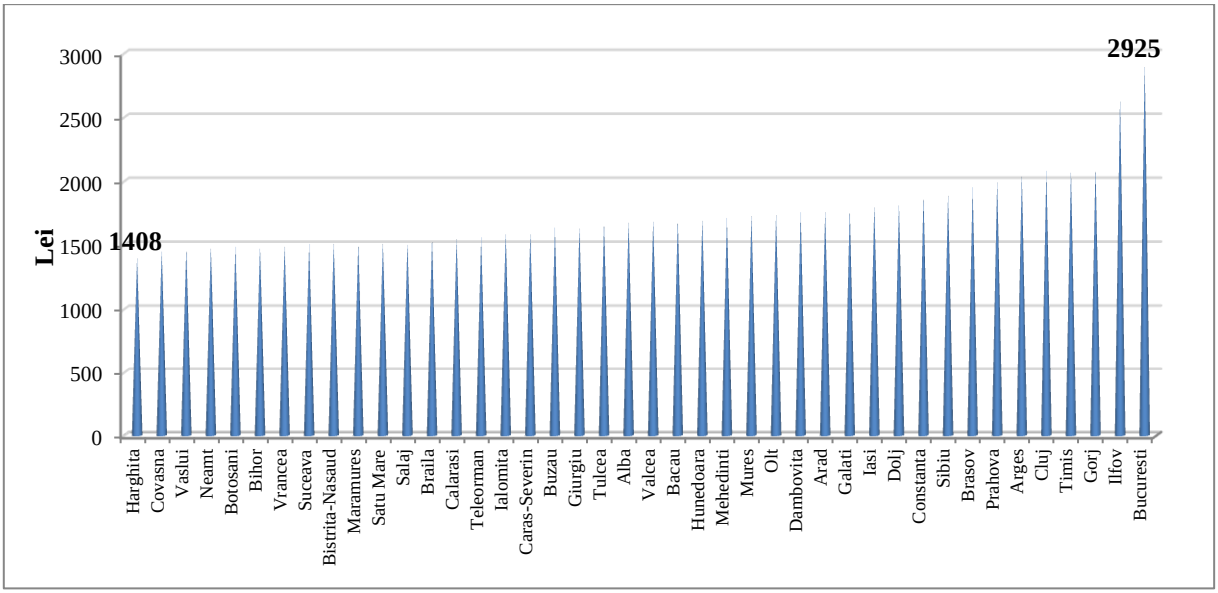

Figure 1 Real gross earnings in 2012, county level

At the opposite pole, although the differences are not that significant, one can find the North-East region together with the North-West region. These regions comprise counties with the smallest earnings in Romania, Cluj (North-West) being the only county with a high potential of development through investments made until now. Also Bacau (North-East) has a high probability to become an industrial centre in that area, since there are some on-going projects.

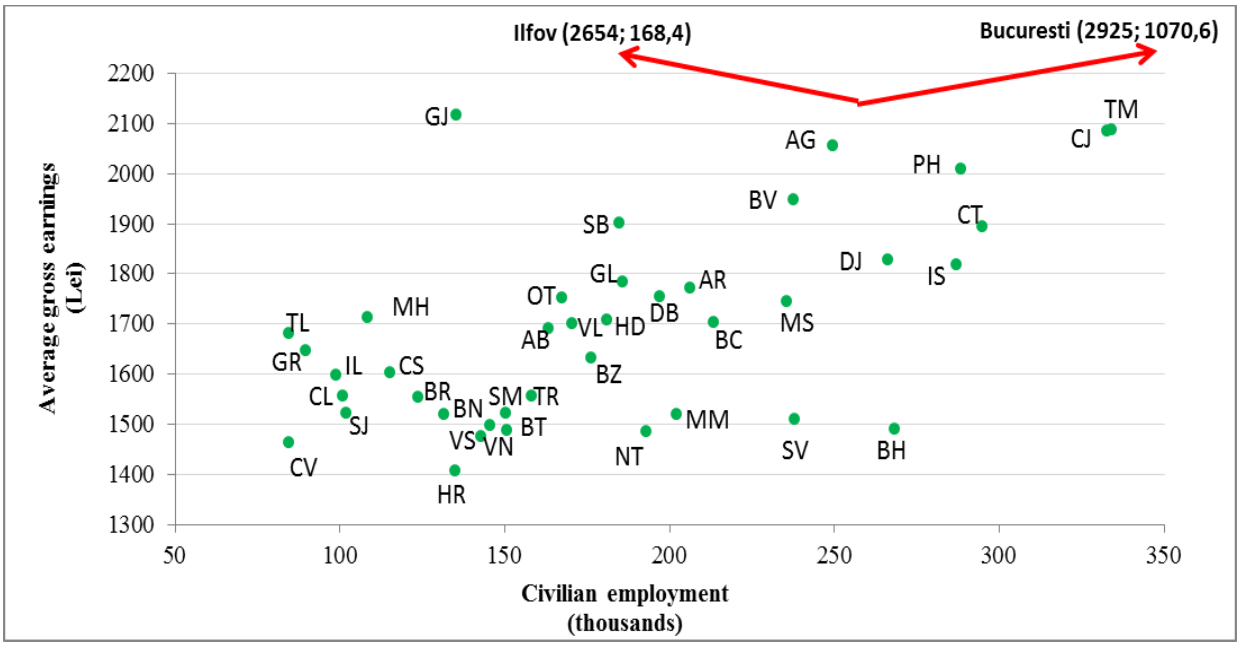

Figure 2 Gross earnings against civilian employment in 2012, county level

We plotted the level of real earnings against the civilian employment in order to see the position of counties: whether high earnings attract high employment or not. As can be noticed in figure 2, Bucharest and Ilfov, the two leading counties in terms of earnings, are left outside the figure for a better view of the other counties.

Regarding the counties with high earnings, the majority of them have also high civilian employment, exceptions are Gorj and Sibiu. It is worth noticing that a county like Bihor, with relatively low earnings has a relatively high civilian employment (comparable with Prahova, Iasi, Dolj). The poorest counties have also low civilian employment.

The gross domestic product at county level in 2012 is illustrated in Figure 3. Covasna has the smallest GDP of 4322 million Lei. Excluding Bucharest, the highest GDP is achieved in Timiș county, being seven times that of Covasna. On the other hand, the GDP registered in Bucharest is about 5 times higher than that of Timiș, reflecting the high purchasing power in Bucharest compared to that of the rest of counties, the market value of goods and services produced locally.

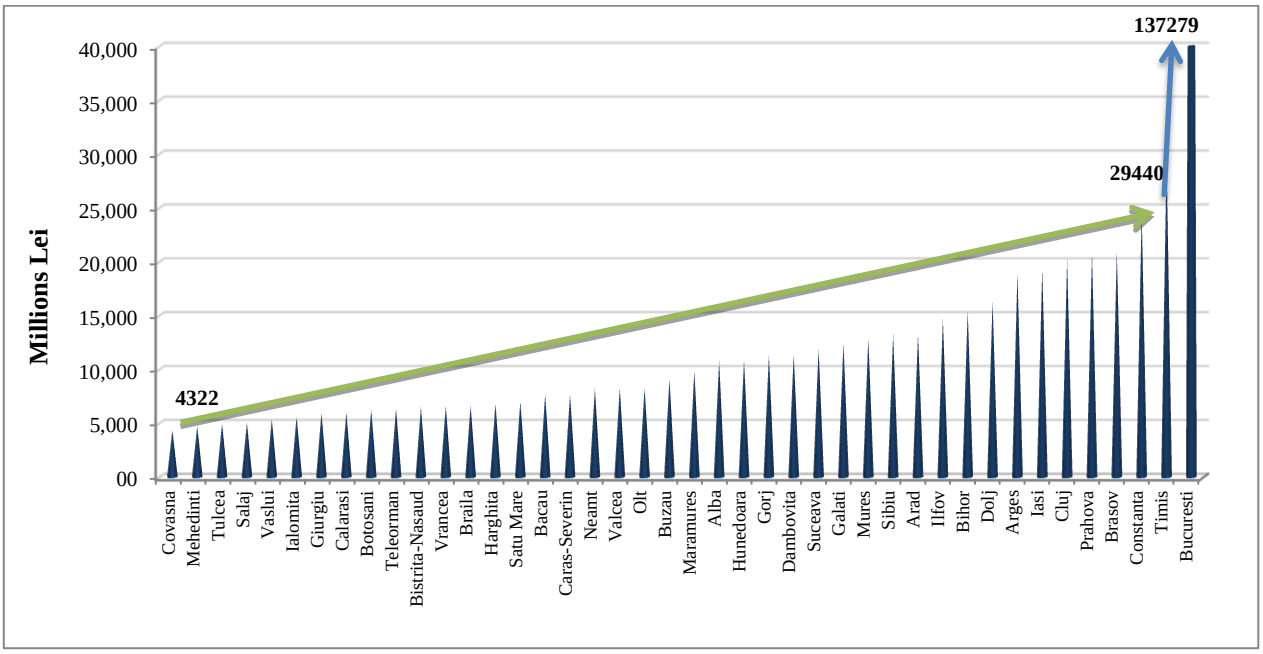

Figure 3 Gross domestic product in 2012, county level

In terms of growth rates, in 2012 the GDP grew at least 4 times since 2000, but for more than half of counties this growth was of more than 9 times (even 13-14 times for Giurgiu, Timiș and Ilfov). In average, annually the GDP grew with at least 35% in Bacau, and with no more than 122% in Ilfov.

Concerning the migration pattern, in Romania there are more people leaving the country than establishing the residence here: the official numbers show that 18307 people have left the country and 15538 people have entered our country in 2011. And this is a natural behaviour, given that the standard of living in Romania is lower than in most of European Union countries, where most Romanians leave (more than 50% of the emigrants from Romania leave for a country in European Union). The majority of immigrants entering Romania are from Republic of Moldova.

Officially registered emigration only captures a part of actual outflows (the statistics of the main destination countries may provide a better approximation). An example in this sense is provided by OECD (2012) in a Country note about Romania where it is mentioned that "the Romanian population residing in Italy increased by around 80000 (to a total of 969000) in 2010, and the corresponding increase in Spain was of 33000 (to a total of almost 864300)".

At county level, in Giurgiu, Ialomița, Gorj there are fewer people leaving than in other areas (less than 100 persons in 2011). At the opposite pole we find Iasi, Suceava, Timiș and Bucharest (with more than 700 persons leaving these counties). Regarding the number of immigrants in 2011, in 20 counties their number was below 100 and in other 17 counties was below 500. Iasi (1748) and

Bucharest (6672) together attract more immigrants than the rest of the counties. The explanation may consist in the fact that Iasi is located near the border with Republic of Moldova (from where each year many immigrants are arriving) and Bucharest, being the capital city, with an important educational centre and a great opportunity to find a job, acts like an attractor.

Analysing the period 2000-2011 the number of emigration fluctuated around an average value specific to each county/region. Only the year 2011 somehow stands out, because compared to 2010 there are some counties with significant increases: Ilfov (213%), Suceava (318%) and Bucharest (321%). For the case of immigrants, their number was also fluctuating around an equilibrium value, excepting Ilfov, Vrancea, Olt that registered large increases in 2011 compared to 2010.

The tertiary education graduates constantly increased since 2000, reaching almost 235 graduates in 2007, after which the trend was descending until 2011 when the number of graduates was of 136671, at national level. At county level, there is an obvious discrepancy between the counties with a recognized university centre and the other counties. Therefore the overwhelming majority of graduates are found in Brasov, Constanta, Iasi, Cluj, Timisoara and Bucharest.

5. Econometric results

We decided to estimate a panel data model because panel data control for the individual heterogeneity (Hsiao, 2003) and also because panel data analysis is more efficient, since it provides the opportunity to identify and measure effects that would not be detectable by cross-sectional analysis or time series analysis.

We already mentioned that the series of GDP was completed with predictions for 2011 and 2012 from National Forecast Commission. In order to have series of similar length, we decided to fill up the gaps (the year 2012) in the series of immigrants, emigrants and tertiary graduates by using the exponential smoothing methods.

In Romania, the counties are grouped in regions by geographical and historical reasons. Because the reality showed that the counties in a region are not very alike from an economic point of view, we decided to start this analysis with a cluster analysis. Also, because Bucharest and Ilfov have a great probability to bias the results we have excluded them from the econometric analysis.

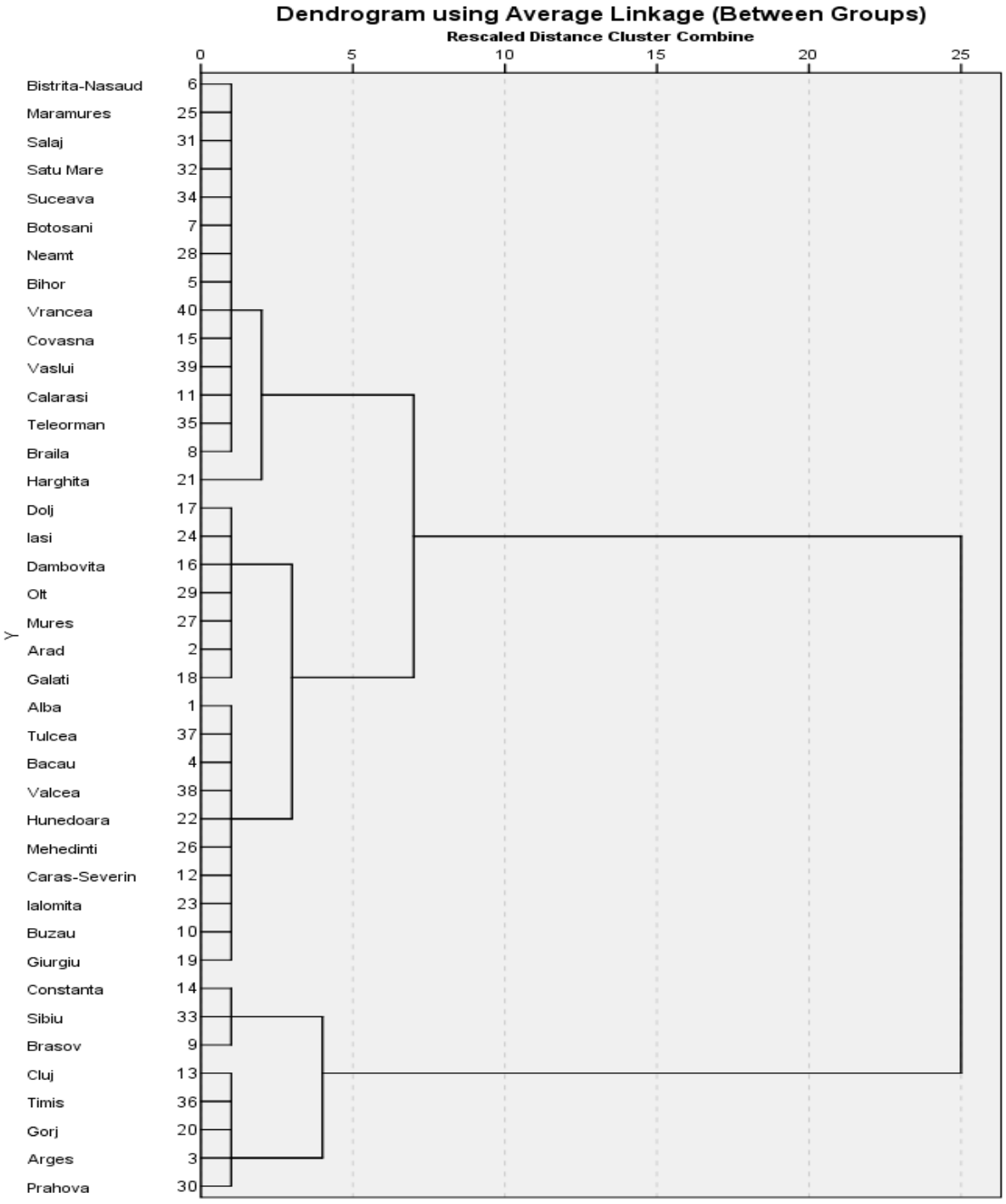

Figure 4 Dendrogram

Therefore, we applied a Hierarchical cluster analysis based on the variables real average earnings and civilian employment, using a method of unsupervised learning that allows assigning a set of observations into clusters so that observations in the same cluster are similar. The cluster technique was built on the between groups linkage cluster method, while the intervals were

calculated using the squared Euclidean distance. Based on the dendrogram (figure 4), we notice that the 40 counties in Romania can be assigned into three main clusters, as following:

Cluster 1 - 15 counties – Bistrița Năsăud, Maramureș, Sălaj, Satu Mare, Suceava, Botoșani, Neamț, Bihor, Vrancea, Covasna, Vaslui, Călărași, Teleorman, Brăila, Harghita.

Cluster 2 - 17 counties – Dolj, Iași, Dâmbovița, Olt, Mureș, Arad, Galați, Alba, Tulcea, Bacău, Vâlcea, Hunedoara, Mehedinți, Caraș-Severin, Ialomița, Buzău, Giurgiu.

Cluster 3 - 8 counties – Constanța, Sibiu, Brașov, Cluj, Timiș, Gorj, Argeș, Prahova.

Once we obtained the three clusters we continued with the econometric estimation for each cluster. The following general employment equation was considered:

$$ln\_earn_{it} = intercept + \beta_1 * ln\_gdp_{it} + \beta_2 * ln\_empl_{it} + \beta_3 * ln\_tert\_educ_{it} + \quad (3)$$

$$+ \beta_4 * ln\_imig_{it} + \beta_5 * ln\_emig_{it} + \alpha_i + \varepsilon_{it}$$

where all the variables are expressed in logs. The subscript *i* stands for each of the 40 Romanian counties, while *t* stands for the years 2000-2012.

From the variance decomposition of the data we noticed that each of the explanatory variables have within variation, indicating that a panel data estimation should be adequate. The starting point is the poolability test which suggests the rejection of the null hypothesis and the estimation of the employment equation as a panel data model. When running the Hausman test we obtained that we have fixed effects in all models. We also checked for the presence of autocorrelation and heteroskedasticity of the residuals and both tests indicated that we must apply robust estimation. Therefore we had to estimate robust fixed effects models and in order to do this we employed Driscoll and Kraay standard errors for all three models.

For the first cluster we obtained the following equation:

$$ln\_earn = -1.729 + 0.029*ln\_tert\_educ + 0.025*ln\_imig + 0,977*ln\_gdp - 1.121*ln\_empl \quad (4)$$

The greatest influence on the real average gross monthly earnings comes from the civilian employment (-1.121). The sign of this relation is negative, which supports the hypothesis that reducing employment generally affects those with low earnings, and thus the total wage fund is not significantly changed

At the same time, we could say that any improvement in the employment rate occurs in lower paid work activities (especially in the tertiary sector).

The influence that the immigrants have on wages is positive (+0.025) which shows that the development of new economic sectors in these counties need to attract highly-qualified and highly-aid labour force from other countries (need for specialists).

The GDP influence is normal both as the sign and the magnitude of the correlation coefficient (+0.977), and it is a kind of confirmation of the "law of markets" (J.B. Say) - any supply creates its own demand, or in other words – the value of production (supply) attracts an equal income distribution (demand), including earnings.

The contribution of higher education graduates is normal as a sign, even if it has a modest effect (+0.029). The positive relation between the real earnings and the tertiary graduates might suggest a hold-back of the graduates based on the development of better paid work activities.

The earnings equation for the second cluster is:

$$ln\_earn = -8.100 + 0.047*ln\_tert\_educ - 0.080*ln\_emig + 0.973*ln\_gdp – 0.557*ln\_empl \quad (5)$$

The influence of the employment rate on the real gross average earning loses from intensity, so the impact is half the level obtain of the previous case (-0.557 to -1.121). This might indicate that reducing employment affects both people with minimum wages, and those with earnings slightly above the minimum. On the other hand, we could say that employment increases in sectors with lower earnings, but also in activities that generate slightly higher earnings.

However, the influence of the GDP almost unchanged compared to the first cluster (0.973 to 0.977 - cluster 1) thus confirming the hypothesis regarding the earnings driving effect.

This time, the influence of the tertiary education graduates increased (+0.047 to +0.029) but the contribution of immigrants to the wage growth disappeared. Instead, the emigrants variable is an influence factor suggesting that these counties 'export' low-qualified labour force (which receives low wages), as shown by the negative sign of the coefficient associated with this variable (-0.080).

The following equation was obtained for the third cluster:

$$ln\_earn = -15.400 + 0.035*ln\_imig + 0.966*ln\_gdp \quad (6)$$

Within this cluster only two variables remained valid in terms of the influence on the real monthly gross earnings – the GDP and the immigrants. The GDP (+0.966) holds the greatest influence, indicating a drive of earnings and a correlation between labour productivity and earnings.

The impact of immigrants on earnings (+0.035) is higher than in the case of the first cluster (+0.025). This shows that these counties succeed in attracting foreign people in economic activities with earnings above the minimum level. A favourable factor for this phenomenon may be the fact

that most county residences included in this cluster have university centres. On the other hand, these counties succeed in attracting most FDI and thus specialized foreign personnel.

6. Monte Carlo Simulation

The study continued with a Monte Carlo simulation where the three real earnings equations corresponding to the three main Romanian county clusters were taken into consideration. A simulation scenario was built with the purpose to short term predict the real average earnings in Romania for the period 2013- 2014 by considering the impact of GDP, employment, the number of emigrants and immigrants, as well as the number of tertiary education graduates upon earnings.

According to Albulescu (2010), a stochastic simulation, which is generally called a Monte-Carlo simulation, is built on repeated random number generation to compute the results. In the stochastic case, uncertainty is included in the model by adding random variation to the coefficients, in comparison to the deterministic case, where the model's inputs are fixed at known values and one path is determined for the output variables.

There are several studies in the international literature that argue that Monte Carlo simulation is one of the most efficient methods to predict macroeconomic variables based on econometric dependencies (Dobrescu, 2010; Andreica et al., 2011; Nicolae et al., 2010).

That is why, in our study we took into consideration the particularities of the three Romanian county clusters resulted from the Hierarchical Cluster analysis and then built the numerical simulation scenario accordingly, by formulating several hypotheses concerning the random variation of each explanatory variable of the models.

When building the Monte Carlo simulation we made the assumption that the annual variations of the explanatory variables for the period 2013-2014 follow a uniform distribution between distinct intervals, calculated accordingly to their previous trend. A uniform distribution is one of the simplest and most commonly used distributions in macroeconomic predictions, working very well in most cases and being easily understood in practice.

The uniform distributions for the following macroeconomic indicators: GDP, employment, the number of emigrants and immigrants and the number of tertiary education graduates, for each of the 3 main Romanian county clusters for the horizon 2013-2014 are presented in table 1.

Table 1 Simulation hypothesis of uniform distribution for the explanatory variables

Years	Clusters	GDP variation	Civilian employment variation	Emigrants variation	Immigrants variation	Tertiary education variation

2013	***Cluster 1***	[-2%; 2%]	[-1%; 2%]		[-4%; 8%]	[-10%;10%]
	Cluster 2	[-2%; 4%]	[-1%; 3%]	[-5%;15%]		[-5%; 5%]
	Cluster 3	[-1%; 3%]			[0%; 15%]	
2014	***Cluster 1***	[3.5%; 9%]	[-0.5%;0.5%]		[-3%; 6%]	[-5%; 15%]
	Cluster 2	[7%; 14%]	[-1%; 1%]	[-2%; 6%]		[-5%; 10%]
	Cluster 3	[10%;15%]			[-5%; 5%]	

We assumed that the lowest and the highest interval limits of the uniform distributions assigned to each explanatory variable are annual variation percentage of the macroeconomic indicators compared to the previous year. When predicting the explanatory variables for the year 2014, the variations were determined using the simulated values for the year 2013.

There are various software that implement Monte Carlo simulation. In this case we used Crystal Ball software which extends the Excel spread sheet forecasting capability by providing the tools required to conduct a risk analysis. When applying Monte Carlo simulation, the software displays the results in a chart that includes the range of possible outcomes, as well as the likelihood of achieving each outcome. This method is very efficient for a scenario analysis by providing a vast range of possibilities.

The results of the numerical simulation computed after 1000 iterations based on Crystal Ball software are presented in fig. 5, 6 and 7. According to this scenario, the results suggest that the real average earnings in Romania are more likely to maintain its upward trend and to encounter higher levels on the simulation horizon, as compared to previous years.

In fig. 5 we present the Monte Carlo simulation results for the first Romanian county cluster for which there are the lowest values of the real earnings and of employment.

Some Romanian counties are expected to have higher upward trends in 2013 and 2014, namely: *Călărași, Bihor, Harghita, Covasna, Suceava* and *Bistrița-Năsăud,* while *Satu Mare* and *Vrancea* were identified to keep a moderate positive trend for the entire period 2000 - 2014. There are, however, some exceptions of moderate fluctuations (slight reductions in 2013, then followed by an increase in 2014) of the real earnings predicted for 2013-2014 for the counties *Botoșani, Neamț, Teleorman* and *Vaslui.*

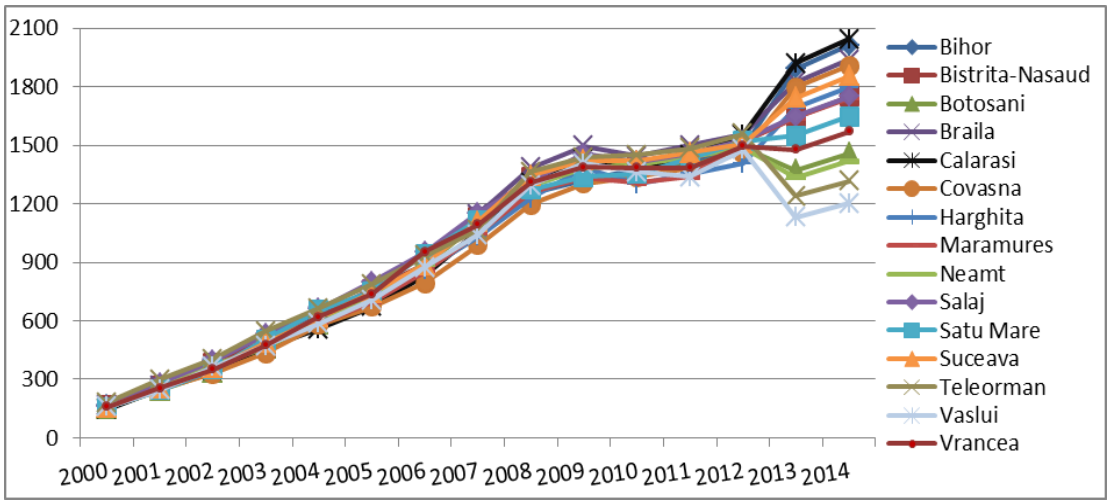

Figure 5 Short term prediction of real earnings for the first cluster

When considering the second group of Romanian counties, with moderate values of the real earnings and of employment (see fig. 6), one can notice that the positive trend of the real earnings is generally expected for the horizon 2014. Some alternating fluctuations were however noticed for the cases of *Ialomița, Bacău, Mehedinți*, *Olt, Valcea* and *Giurgiu*. The highest increase in earnings is expected in Iasi (48.6% in 2013 and 10.1% increase in 2014), followed by Dolj and then by Arad.

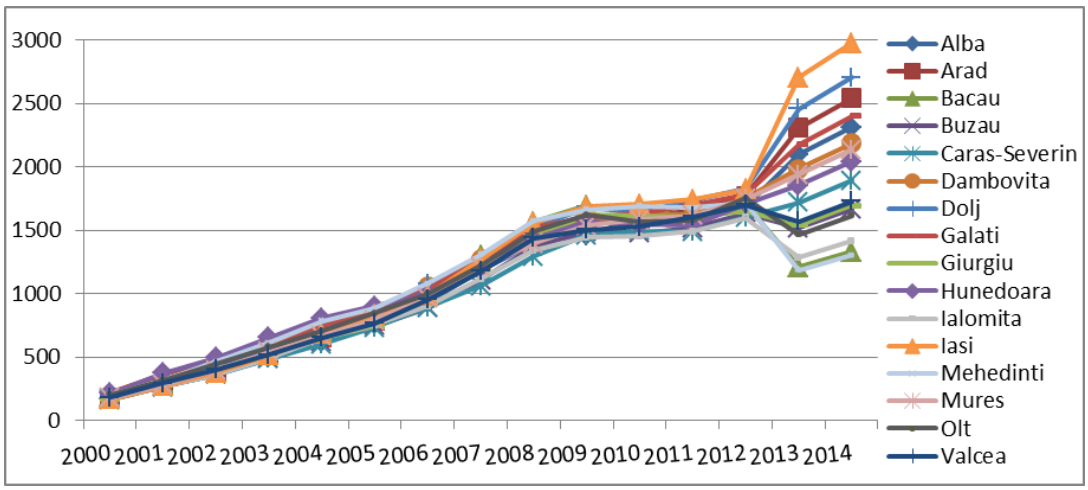

Figure 6 Short term prediction of real earnings for the second cluster

When considering the last Romanian county cluster, presented in fig. 7, once again positive trends of the real earnings are predicted for the period 2013 - 2014. In the cases of *Sibiu* and *Gorj*, however, one can notice some alternating fluctuations. The highest increase in earnings is expected in Timiș (60.4% in 2013 and 12.1% increase in 2014), followed by Constanta.

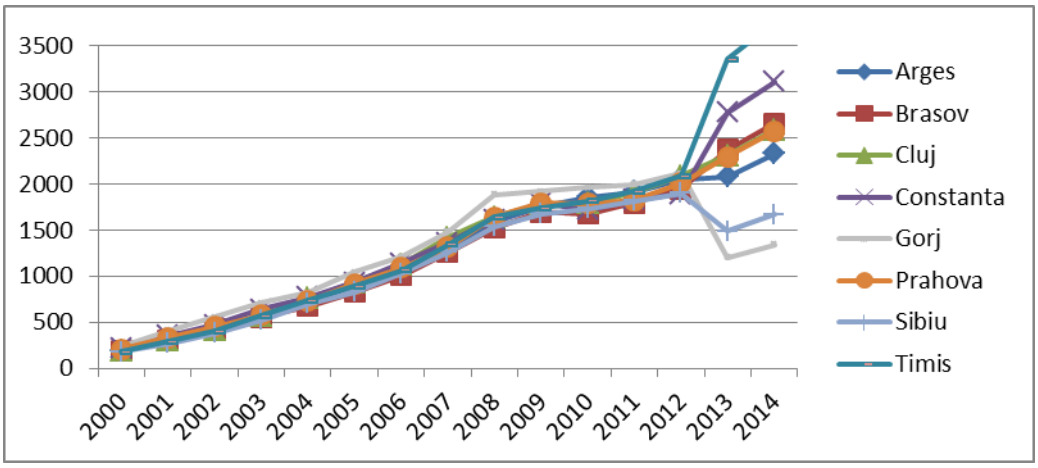

Figure 7 Short term prediction of real earnings for the third cluster

7. Conclusions

In this paper we focused on explaining the variation of the real average gross monthly earnings in Romania for the period 2000 - 2012 by considering the following macroeconomic factors: GDP, employment, the number of emigrants and immigrants, as well as the number of tertiary education graduates.

The statistical analysis revealed that since 2000 the real earnings have increased at least sevenfold. In 2012, the lowest earnings were obtained in Harghita (1408 Lei), while the highest earnings were obtained in Bucharest (2925 Lei), the latter being more than two times the former. The gross domestic product at county level in 2012 pointed out that Covasna has the smallest GDP, of 4322 million Lei, while the highest GDP (excluding Bucharest) is achieved in Timiș county, being seven times that of Covasna (the GDP registered in Bucharest is about 5 times higher than that of Timiș). The civilian employment decreased over the analysed period, the only counties with increases being Ilfov and Bucharest. Concerning the migration pattern, in Romania there are more people leaving the country than establishing the residence here and this is a natural behaviour, given that the standard of living in Romania is lower than in most of European Union countries, where most Romanians leave. The tertiary education graduates constantly increased since 2000, reaching almost 235 thousands graduates in 2007, after which the trend was descending until 2011. At county level, the overwhelming majority of graduates are found in Brașov, Constanța, Iași, Cluj, Timișoara and Bucharest.

Considering GDP the main determining factor of earnings is normal because it reflects the economic strength of each county. Moreover, we can say that the relationship between earnings and GDP is bijective, as the causality relationship is mutual. The GDP growth supports earnings growth, and earnings growth increases incomes and hence the GDP.

The factors with positive influence are the number of graduates from tertiary education, the number of immigrants, the GDP, while the factors with negative influence are the employed population level and the number of emigrants.

Regarding the factors with a positive influence, the graduates' contribution shows there is a capacity of local economies to integrate these graduates with positive effects. The interpretation of the immigrants' contributions is slightly more delicate, because it shows that counties in the extreme categories of the clusters are able to attract higher-qualified labour force. The situation could be normal in most counties in cluster 3 and probably for some counties in cluster 1.

Regarding the factors with a negative influence, the employed civilian population has a significant importance, suggesting structural changes against less-qualified labour force and implicitly with lower wages. The interpretation is also correlated through the significance of the negative contribution of the emigrants' variable, suggesting that the decreasing of the employed population happened mostly because of the emigration of the less-qualified labour force (consistent with the hypothesis that the wage differences are a stimulating factor for emigration).

Based on the estimated panel data models concerning the impact of several macroeconomic variables upon the real earnings for each of the three main Romanian county clusters, the study continued with a Monte Carlo simulation to short term predict the real earnings in Romania for the horizon 2013- 2014. As expected, the results of the Monte Carlo simulation suggests that, in general, for the period 2013 - 2014 the real average gross earnings in Romania is expected to keep a positive trend through the entire analysed period. However, some alternating fluctuations were also noticed in some cases, but in general, the evolution of the real earnings is assumed to be healthy and it is naturally expected to keep an upward trend.

Measures to stimulate wage growth:

- Supporting structural reforms of GDP growth, mainly on account of higher value-added activities.
- Increasing the territorial mobility of labour force so as to encourage attracting highly-qualified labour force and to encourage the emigration of lower-qualified workers (including abroad, due to the favourable effect of opening the labour market for Romanians in other member states of the EU).
- Encouraging tertiary education graduates to work for the local economies.
- Increasing the employment rate especially by creating high value added activities.

In recent years, the actual wage increases were significantly lower than those in the pre-crisis period and this trend is likely to persist in the near future. This reflects both the strengthening of inflation expectations in a smaller area, but also the preservation of a cautious attitude, as employers

are very attentive to the economic development and no longer willing to increase wages unless within the limits of productivity incomes.

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