Employment in Romania: evidence from a panel data analysis

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EMPLOYMENT IN ROMANIA: EVIDENCE FROM A PANEL DATA ANALYSIS

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Abstract - The labour market in Romania is facing some imbalances arising from the negative demographic trends, legislative instability, poor correlation between the educational programs with the labour market, low labour productivity. The European Union labour market strategy aims at achieving 75% employment rate by 2020, for Romania the objective being 70% (Europe 2020). Although Romania has enjoyed robust economic growth for the most part of the 2000s, the labour market was experiencing large and increasing shortages of labour and skills, which coexisted with low participation rates, as well as excess supply of labour in declining sectors (mainly agriculture). The negative growth rate of the Romanian population, which has started in the early 1990s has already reduced the population. On top of this, there is the migration of the work force - most of the migrants are still included in the labour market statistics, as inactive, but are absent from the Romania's labour market and might be partly responsible for the slow progress of employment rate in Romania. In this context, we aim to examine the employment rate in Romania, considering a panel data analysis over the period 1996-2009. The explanatory variables are the net migration rate, the mortality and birth rates, the unemployment rate, the real earnings, the secondary and tertiary education graduates.

Keywords: labour supply, migration, education, panel data, Romania
JEL Classification: C23,O15, J20, J61

1. Introduction

Generally speaking, the labour supply forthcoming from any population depends on the size of the population, broken down into different sex and age groups, and the participation rates for each of those groups. Whereas population size by age and sex is directly determined by population growth (and more specifically, by the history of fertility, mortality, and migration patterns), participation rates tend to be more economically and culturally determined.

Any influence which changes the proportion of workers in the total population tends to affect the labour supply. There are two main aspects regarding the interrelationship between changes in population growth and labour supply: (1) fertility and mortality levels are important determinants of labour supply, independently of their relation to each other; and (2) changes in fertility and mortality rates are likely to have an immediate effect on labour supply through their "behavioural" effects on labour force participation rates.

The Member States of the European Union (EU) are facing essential socio-demographic changes. Europe witnessed in the last 20 years the emergence of unprecedented low fertility levels with a total fertility rate at or below 1.3 children per woman. Kohler et al. (2006) have labelled these patterns as lowest-low fertility to emphasize the dramatic implications of these low levels of fertility. In the early 1990s, Italy and Spain were the first countries to attain and sustain lowest-low

fertility levels, and in 2002 there were 17 lowest-low fertility countries in Southern, Central and Eastern Europe.

High fertility leads to a profound change in the age structure of the population. Moreover, a high fertility rate may also enlarge the labour force and boost output of the countries. Thus, it is straightforward the conclusion that the decline in the fertility will lead to a decline in the birth rate and from here to a decline in the labour supply.

The average total fertility rate in the European Union (EU-27) has been calculated at 1.59 children per woman in 2009, whereas the population replacement level is 2.1 (in Romania, the total fertility rate was 1.38 in 2009). Also, the decline in fertility ("baby crash") which followed the baby boom is the cause of the large proportion of 45-65 year-olds in Europe's population, and poses a number of problems in terms of pension funding (COM 2006).

Social, economic, political and environmental problems are root causes for migration. Regarding the labour market, migration is a symptom of imbalances in sending countries, such as high rates of unemployment, underemployment among low-skilled workers and low wages for skilled workers. One major reason for migration is the earnings gap between the host and the home country; hence most of the migrants leave their home countries for more remunerative work. Another important reason for mobility is education and the acquisition of skills which are also related to employment and labour markets.

The effects of migration on employment have many facets. The migration of low-skilled workers might result in rising wages or a relaxation of the local labour market. The outflow of skilled workers deprives developing countries of their human capital and results in brain drain with serious consequences on the delivery of key services like education or health care, and on economic productivity (Dayton-Johnson et al., 2009).

On the other side, international migration can help reduce poverty and raise economic growth rates in the migrants' countries of origin (an increase of remittances is generally associated with a reduction of overall poverty).

While the link between migration and economic development receives special attention, the particular dynamics of migration and its effects on the labour markets of sending countries are still poorly understood due to the lack of reliable data.

OECD studies on this subject concluded that much of the work done to date suggests that migration has little or no impact on employment (a 1% increase in the number of immigrants reduces employment for low skilled workers by 0.04% and reduces employment on average by a 'negligible' 0.02%). However, there are differences between countries. The estimated effect on employment (although relatively small) tends to be higher in Europe than in the United States.

McDonald and Temple (2008) analysed the labour force market in Australia (1980-2000). They claim that the labour force has grown substantially as a result of the natural growth of the population in the last few decades (the baby-boom generation had its full impact on labour supply). But the baby-boom will start to retire and the labour force will start to decrease. They argue that immigrants will be important to the construction of productive infrastructure in Australia.

There is very little either in economic theory or in the recent empirical work to suggest that migration is having a significant negative impact on the UK labour market. The recent high levels of inward migration have, on balance, been a significant advantage for the UK economy (Coats, 2008). Is difficult to reconcile the benefits from migration with the general belief that immigration is an economic 'bad', but as Coats affirms, the UK's recent experience suggest that the availability of migrant workers, far from increasing labour market turbulence, has been a source of economic stability.

Peri (2009) and Peri and Sparber (2009) examined the impact of immigrants on the broader U.S. economy. The analysis finds no significant effect of immigration on net job growth for U.S.-born workers. Data on U.S.-born workers employment imply small effects, with estimates never statistically different from zero. Peri (2010) observed insignificant effects in the short run and a small significant positive effect in the long run.

Cohen-Goldner and Paserman (2011) study the short and medium run impact of highly skilled immigrants from the Former Soviet Union to Israel on natives' wages and employment. They consider that if immigrants are relatively good substitutes for native workers, the impact of immigration will be largest immediately upon the immigrants' arrival, and may become smaller as the labour market adjusts to the supply shock. Conversely, if immigrants upon arrival are poor substitutes for natives, the initial effect of immigration is small, and increases over time as immigrants acquire local labour market skills and compete with native workers. However, they do not find any effect of immigration on employment, neither in the short nor in the medium run.

A vast theoretical and empirical literature considers the labour market impact of immigration. In contrast, the literature on the labour-market impact of emigration or the outflow of workers is almost exclusively theoretical. The absence of an empirical literature on the labour-market impact of emigration is surprising because the shares of the labour force leaving many individual source countries is considerably higher than the proportionate changes in the labour force of many receiving countries due to immigration. For example, the labour force in El Salvador, Jamaica, Barbados, Guyana and Belize have been reduced by 15% or more due to emigration to the US between 1970-2000. In comparison, immigrants constitute about 12% of the US labour force (Davis and Weinstein, 2002).

For Romania, studies concerning the migration focus mainly on the migratory behaviour (Roman et al., 2010), on the profile of the migrant (Nitulescu et al., 2007) or on estimating the real migratory flows (Sandu, 2004; Andreescu and Alexandru, 2007).

Education is a key driver of economic and social success for individuals, employers and nations. Vast research literature indicates that education can enhance social welfare, impact upon economic growth and be a key factor in the design and implementation of economic and social policy. Also, education plays a central role in preparing individuals to enter the labour force and in equipping them with the skills needed to engage in lifelong learning experiences.

Empirical evidence from studies conducted by social scientists makes it clear that there is significant scope for education to play a role in influencing the economic and social situations of people (Machin, 2006). In cross-country comparisons of education and economic growth, formal schooling plays an important role in enhancing economic growth (Barro, 1997, Barro and Lee, 1993, and Krueger and Lindahl, 2001). Education has been shown to significantly raise labour market earnings and employment probabilities (Card, 1999).

The employment rates of graduates are significantly higher than for non-graduates for a wide range of countries. On average, across OECD countries, close to 85% of the population with tertiary education is employed. This falls to just over 76% for people with upper secondary and post-secondary non-tertiary education and to just 56% for those without an upper secondary education (OECD 2010).

A new focus on the roles of both quantity and quality of human capital in the development process has given policy makers new appreciation of the importance of education–labour market linkages. Economic policy interest in education is, in general, linked to its potential to increase earnings and reduce poverty. The role of education needs to be seen in a broader macroeconomic context to ensure that education contributes to the growth of a country's economy (Fasih, 2008).

Neoclassical and Keynesian theories have substantially different implications for how changes in employment level can be influenced by changes in real wages. The neoclassical model assumes that all markets, including labour markets, operate in a perfect manner, unless distorted by institutional impediments. In this context, employment rises if real wages are reduced. Thus, the existence of wage rigidities due to the imposition of minimum wages or trade union activities leads to persistent unemployment. In contrast, Keynesian models predict that such changes in real wages are not likely to change the level of employment. According to the arguments advanced by Keynes (1936) although the demand for labour increases when real wages fall, there is no mechanism by which the mutual willingness of employers to hire more workers at this level of real wages and the unemployed persons to accept employment can be declared and realised (Christopoulos, 2005).

Over the last years a number of econometric studies have been devoted to the relationship between real wages and employment. For example, Arestis and Mariscal (1994), Carruth and Schnabel (1993), Smith and Hagan (1993), and Suedekum and Blien (2004) found a significantly negative relationship between wages and employment for the UK, West Germany and Australia. On the other hand, no consistent relation is found between the variables in Darby and Wren-Lewis (1993) and Bender and Theodossiou (1999), for the UK.

Christopoulos (2005) empirically examined the long run relationship between real wages and employment in a time series and cross sectional data set using data for 12 European Union countries over the period 1961-1996. The basic point that emerges from the empirical analysis is that in the long run there is no relationship between real wages and employment.

On the other hand, Apergis and Theodosiou (2008) found statistical evidence for a long run relationship between these two variables. However, their study firmly rejects the hypothesis that wages influence employment in the short-run. The results imply that real wage reduction is not sufficient to induce an expansion of output and employment.

A more recent study (Özata and Esen, 2010), using quarterly data from 1988:1 to 2008:4 for Turkish private manufacturing industry, indicates the existence of a negative long-run relationship between real wages and employment level. These results support the view of neo-classical economists; therefore, a reduction in real wages will increase the employment level. The policy implication of this finding is that reductions in real wages can be considered as an additional channel through which employment growth can be accelerated.

2. Economic Context and Data Description

Romania entered the 1990s as a relatively poor country by European standards. However, the collapse of the Communist regime in 1989, reforms in the 2000s and its entry to the European Union have led to an improved economic outlook.

Between 2002 and 2008 the Romanian economy grew strongly, with above-potential real GDP growth rates averaging 6.3%. Economic growth was primarily driven by domestic demand, as strong credit and wage growth boosted private consumption and investment (European Commission, 2011). However, labour market participation did not reflect the favourable economic conditions, the employment rate remaining practically at the same level for the whole period and being one of the lowest in the EU: 59% in 2008 as against 65.8% in the EU average.

The boom, which was fuelled by foreign capital inflows also led to overheating and unsustainable external and fiscal imbalances. The current account deficit peaked at 13.6% of GDP in 2007 and decreased only marginally to 11.4% of GDP in 2008. In addition, economic activity contracted by 7.1% in 2009 after having increased by 7.3% in 2008 in a context of an already low employment rate (60.6% in 2009). The main macroeconomic indicators for Romania in the period 1995-2009 are presented in table 1.

In this paper we aim to examine the labour supply in Romania. The size of the labour resources is under the influence of two main sets of factors: demographic and socio-economic factors. The demographic factors are referring to: birth rate, mortality rate, life expectancy, migratory flows. As for the socio-economic factors, we could include here the education, the economic development – earnings, GDP per inhabitant, but also labour legislation.

Therefore, the variables used in this study are: the employment rate (*empl*), the net monthly real average earnings (*lwage*), the mortality rate *(mr)*, birth rate *(br)*, the unemployment rate *(ur)*, the net migration rate *(netmig)* and the secondary *(educ2)* and tertiary education graduates *(educ3)*[1]. The analysis was conducted over a period of 14 years (1996-2009), using panel data for the 42 counties of Romania. The source of our data is the National Institute of Statistics, the main collector and publisher of statistical data in Romania.

[1] In the econometric analysis we considered the natural logarithm of the real net earnings, while the secondary and tertiary education graduates were calculated as proportion from total population in each county.

To measure labour supply, we used the employment rate of labour resources, which represents the ratio, expressed as percentage, between the civil employed population and the labour resources.

As can be observed in figure 1, the employment rate declined in the analysed period. In 1996 the national average was about 70%, while in 2009 was 60.6%, with approximately 10 percentage points lower. At county level, the situation is predominant the same. Figure 1 presents the counties with the lowest and the highest employment rate, ordered considering the values in 2009. Bacau, Galati and Tulcea are the counties with the lowest employment rates, and they follow the national decreasing trend. In Bihor, the employment rate was higher than the national average for the entire period, while the employment rate in Ilfov exceeded the national average starting with 2000. The capital city, Bucharest, has registered an employment rate of about 80% in 2009, with near 17 percentage points higher than in 1996.

The registered unemployment rate represents the ratio between the number of unemployed (registered at the agencies for employment) and civil economically active population (unemployed + civil employment, defined according to the methodology of labour force balance) [2].

In 1996, the unemployment rate was lower than in 2009, but the maximum was recorded around year 2000. Regarding the regional evolution of the unemployment Vaslui, Mehedinti and Alba counties registered the highest unemployment rates (in 2009, the registered unemployment rates exceeded 12%). At the opposite pole Ilfov, Timis, Bihor, Bucharest are registering the lowest rates. Ilfov and Bucharest have an unemployment rate of 2.4% (the minimum value in 2009 and among the lowest values in the entire analysed period).

Regarding the education in Romania, we considered in our analysis the secondary (the high school and vocational education graduates) and tertiary education graduates, as proportion of total population. As can be seen form figure 2 there are more graduates from secondary education than from tertiary education (the difference is greater in 1996). Still, the situation improves in time: both series have an upward trend, but the tertiary education graduates are more than double in 2009 compared to 1996 (an increase of 149%), while the secondary education graduates had an increase of 14%.

Romania's migration pattern is mainly characterised by emigration.

In the period 1996-2001 the development of several parallel trends and increases in emigration is making this a complex phenomenon to analyse:

- Permanent migration increasingly in the USA and Canada, rather than legal migration to European countries (OECD 2001);
- The emergence, especially since 1999 of illegal incomplete or circular migration to European countries, for illegal work (Sandu et al., 2004);
- From 1999, a small usage of labour recruitment agreements with various European countries (Germany, Spain, Portugal, Italy) (Diminescu, 2004, Barbin 2004)
- Some return migration of Romanians, notably from Moldova (OECD 2004), as well as a developing circular migration of Romanians between Germany and Romania (OECD 2005).

From 2002 since 2006, the elimination of Schengen visa requirement promotes a rapid growth in circular migration. With the possibility of 3 months' legal tourist stay, a sophisticated circular migration system developed, focused primarily on Italy and Spain (Baldwin-Edwards, 2005).

The accession to the European Union on 1 January 2007 was accompanied by a significant increase in migration movements. The number of Romanians working abroad in 2009 is estimated to be around 3 million persons. However, data on emigration of Romanian citizens is limited (OECD 2011). Only a small fraction of actual outflows is captured by officially registered

[2] According to the legislation in force, unemployed position is held by person who fulfils the following cumulative conditions: he is looking for a job from 16 years old at least to pension age; his health, his physical and psychical capacities make him able to work; he has no job, he gets no income or, from legal activities, he gets an income lower than the value of reference social indicator according to the Law no.76/2002; he is available to start work in the next period if he finds a job.

emigration. The number of newly registered emigrants increased in 2009 by 17%, to 10000. The main destination countries of officially registered emigration are Canada (20%), Germany (19%), and the United States (18%).

A better approximation of actual emigration is provided by the statistics of the main destination countries. For example, the Romanian population residing in Italy increased by around 90 000 (to a total of 887800) in 2009, and the corresponding increase in Spain has been 33 000 (to a total of 751700).

According to the Romanian Office for Immigration, the immigrant population in Romania increased from 2008 to 2009 by 4%, to a total of 88500. Most immigrants legally staying in Romania are non-EU citizens, mainly from Moldova (21%), Turkey (11%) and China (15%). The main immigrants from EU countries originate from Italy and Germany (7% and 6%, respectively).

The net migration rate is the difference of immigrants and emigrants of an area in a period of time divided per 1,000 inhabitants. A positive value represents more people entering the country than leaving it, while a negative value means more people leaving than entering it.

In Romania the net migration rate is predominant negative (figure 3). At the beginning of the analysed period (1996), the net migration was -0.86 migrants per 1000 inhabitants, while in 2009 the net migration was -0.07 migrants per 1000 inhabitants. In 2009 there are 5 counties in which this rate is positive Ialomita (0.02), Vrancea (0.05), Suceava (0.19), Ilfov (0.4) and Bucharest (0.82). The lowest negative value is registered in Sibiu, where the net migration rate is -0.81 migrants per 1000 inhabitants in 2009.

The mortality rate is a measure of the number of deaths in a population, scaled to the size of that population, per unit time[3]. Mortality rate is typically expressed in units of deaths per 1000 individuals per year.

In Romania, the mortality rate decreased from a 12.7 deaths per 1000 inhabitants to 11.4 in 2000 and increased back to 12 deaths per 1000 inhabitants in 2009 (figure 4). At county level, the mortality rate is lower in Brasov, Iasi, Bistrita-Nasaud and Constanta and higher in Dolj, Giurgiu and Teleorman. In 2009, the highest mortality rate was registered in Teleorman of 17.6 deaths per 1000 inhabitants. In Bucharest, the capital city of Romania, the mortality rate was lower than the national value in the analysed period.

Birth rate (or crude birth rate) represents the ratio between the number of live-births in a year and the average population of the respective year and is expressed by the number of live births per 1000 inhabitants. When the crude mortality rate is subtracted from the crude birth rate, it reveals the rate of natural increase (RNI). This number is equal to the rate of population change (not factoring in migration). The birth rate is typically the main variable in assessing the rate of population growth[4].

The birth rate in Romania in 2009 was 10.4 live births per 1000 inhabitants (figure 4). The counties with lowest birth rates are: Teleorman (8.3), Hunedoara (8.4), Olt (8.4) and Gorj (8.5), while the highest birth rates were registered in Ialomita (11.7), Iasi (12.1) and Ilfov (13.1). In Bucharest the birth rate was 11.1 live births per 1000 inhabitants.

The net nominal earnings are calculated by subtracting from gross sums related to gross nominal earnings the following elements: afferent tax; employees' contribution to unemployment

[3] As of July 2009 the crude mortality rate for the whole world is about 8.37 per 1000 per year according to the current CIA World Factbook.
Note that the crude mortality rate as defined above and applied to a whole population can give a misleading impression. The crude death rate depends on the age (and gender) specific mortality rates and the age (and gender) distribution of the population. The number of deaths per 1000 people can be higher for developed nations than in less-developed countries, despite life expectancy being higher in developed countries due to standards of health being better. This happens because developed countries typically have a completely different population age distribution, with a much higher proportion of older people, due to both lower recent birth rates and lower mortality rates. A more complete picture of mortality is given by a life table which shows the mortality rate separately for each age.

[4] As of 2009, the average birth rate for the whole world is 19.95 per year per 1000 total population, a 0.48% decline from 2003's world birth rate of 20.43 per 1000 total population.

insurance budget; individual contribution to state social insurance; employees' contribution to health insurance.

The national real net average earnings in Romania in 2009 (figure 5) were about 1300 RON (approximately 300 EUR). In Bihor, Covasna and Maramures the earnings are around 1000 RON (near 235 EUR) being the lowest earnings in Romania. The highest net earnings are registered in Gorj (1411 RON – 333EUR), Ilfov (1607 RON – 380EUR) and Bucharest (1734 RON – 409 EUR).

3. Methodology

The econometric analysis is based on panel data estimation. A panel data regression has the form:

$$y_{it} = \alpha_i + x_{it}'\beta + \varepsilon_{it} \qquad \text{i} = 1...\text{N}, \text{t} = 1...\text{T} \tag{1}$$

The *i* subscript denotes the cross-section dimension and *t* denotes the time-series dimension. Most of the panel data application utilizes a one-way error component model for the disturbances (Baltagi, 2008):

$$u_{it} = \alpha_i + \varepsilon_{it} \tag{2}$$

There are several different linear models for panel data. The individual fixed effects may be either assumed to be correlated with the right hand side variables (fixed effects model: FEM) or be incorporated into the error term (random effects model: REM) and assumed uncorrelated with the explanatory variables (Baum, 2001).

One of the main motivations behind pooling a time series of cross-sections is to widen the database in order to get better and more reliable estimates of the parameters of the model. Baltagi (2008) considers that the question is "To pool or not to pool the data?" The simplest poolability test has its null hypothesis the OLS model: $y_{it} = \text{a} + b'X_{it} + \varepsilon_{it}$ and as its alternative the FE model: $y_{it} = \text{a} + b'X_{it} + \alpha_i + \varepsilon_{it}$ (Kunst, 2009). In other words, we test for the presence of individual effects.

The next step would be to decide whether a FE model or a RE model is more appropriate. The decision between the two models can be made based on different tests, economic reasons and/or information criteria. Baltagi suggests all of these methods; hence one can estimate both models and choose between them according to the information criteria and/or based on economic arguments. When one cannot consider the observations to be random draws from a large population—for example, if the data refers to states or provinces—it often makes sense to think of the individual effect as parameters to estimate, in which case one should use fixed effects methods (Wooldridge, 2002).

The Hausman principle can be applied to all hypothesis testing problems, in which two different estimators are available. In the case of panel models, we know that the FE estimator is consistent in the RE model as well as in the FE model. In the FE model it is even efficient, in the RE model it has good asymptotic properties. By contrast, the RE–GLS estimator cannot be used in the FE model, while it is efficient by construction in the RE model (Kunst, 2009).

Considering the case of the fixed effects model, the estimator that is mostly used is called the within estimator. It performs OLS on the mean-differenced data. Because all the observations of the mean-difference of a time-invariant variable are zero, using a time-invariant variable is not recommended.

The fixed-effects α_i can be eliminated by subtraction of the corresponding model for individual means $\bar{y}_i = \bar{x}_i'b + \bar{\varepsilon}_{it}$ leading to the within model or mean-difference model:

$$(y_{it} - \bar{y}_i) = (x_{it} - \bar{x}_i)'b + (\varepsilon_{it} - \bar{\varepsilon}_i) \tag{3}$$

The within estimator is the OLS estimator of this model. Because the fixed effects have been eliminated, OLS leads to consistent estimates of *b* even if α_i is correlated with x_{it} as is the case here.

This result is a great advantage of panel data. Consistent estimation is possible even with endogenous regressors, provided that x_{it} is correlated only with the time-invariant component of the error, α_i, and not with the time-varying component of the error, ε_{it}.

For the random-effects model, the α_i from (1) is incorporated into the error term and assumed uncorrelated with the explanatory variables. Considering this assumption, and the relations (1) and (2) we have:

$$y_{it} = x_{it}'\beta + u_{it} \qquad \text{i} = 1...\text{N}, \text{t} = 1...\text{T} \tag{4}$$

Because the α_i is incorporated in u_i in each time period, we might say that we have to deal with autocorrelation of the error. Therefore the general least squares method is used for the estimation of a RE model.

An advantage of the RE model is that it allows the use of explanatory variables that are constant over time, but a great disadvantage is that if the FE model would be more appropriate those estimates would be inconsistent.

The default standard errors assume that, after controlling for the fixed effects α_i, the error ε_{it} is independent and identically distributed (i.i.d) (Cameron and Trivedi, 2009).

Also, the model is estimated assuming the homoskedasticity of the residuals. When heteroskedasticity is present the standard errors of the estimates will be biased and one should compute robust standard errors correcting for the possible presence of heteroskedasticity. The most likely deviation from homoskedastic errors in the context of panel data is likely to be error variances specific to the cross-sectional unit. When the error process is homoskedastic within cross-sectional units, but its variance differs across units we have the so called groupwise heteroskedasticity.

Because serial correlation in linear panel-data models biases the standard errors and causes the results to be less efficient, researchers need to identify serial correlation in the idiosyncratic error term in a panel-data model. While a number of tests for serial correlation in panel-data models have been proposed, a new test discussed by Wooldridge (2002) is very attractive because it requires relatively few assumptions and is easy to implement (Drukker, 2003).

In order to account for these problems, one should estimate the regression model using robust standard errors. Some authors have provided a number of tests and estimation procedures in order to identify and solve the problems encountered. The White cross-section method (implemented in EViews) assumes that the errors are contemporaneously (cross-sectionally) correlated. The method treats the regression as a multivariate regression (with an equation for each cross-section), and computes robust standard errors for the system of equations. This estimator is robust to cross-equation (contemporaneous) correlation and heteroskedasticity.

A good way to test the validity of the econometric model is to perform out-of-sample forecast. The reported forecast error statistics are the Root Mean Squared Error, the Mean Absolute Error, the Mean Absolute Percentage Error and the Theil Inequality Coefficient. The first two forecast error statistics depend on the scale of the dependent variable. These should be used as relative measures to compare forecasts for the same series across different models; the smaller the error, the better the forecasting ability of that model according to that criterion. The remaining two statistics are scale invariant. The Theil inequality coefficient always lies between zero and one, where zero indicates a perfect fit.

The mean squared forecast error can be decomposed in: the bias proportion (states how far the mean of the forecast is from the mean of the actual series), the variance proportion (states how far the variation of the forecast is from the variation of the actual series) and the covariance proportion (measures the remaining unsystematic forecasting errors). The bias, variance and covariance proportions have to add up to one. If the forecast is "good", the bias and variance proportions should be small so that most of the bias should be concentrated on the covariance proportion.

4. Econometric Results

The general form of the employment equation that was estimated as a panel data is the following:

$$empl_{it} = cons + b_1 * mri_{it} + b_2 * br_{it} + b_3 * ur_{it} + b_4 * lwage_{it} + b_5 * educ2 + b_6 * educ3 + b_7 * netmig + \alpha_i + \varepsilon_{it}$$ w

here the i subscript refers to the 42 counties in Romania and the t subscript stands for the years 1996-2009.

The starting point for estimating the model was to test whether a pooled OLS regression is suitable for our data. After running a poolability test we rejected the null hypothesis that all α_i are zero, also meaning that the OLS estimator is biased and inconsistent and we accept the presence of the individual effects.

Next, we run a Hausman test in order to decide whether we have a random-effects model or a fixed-effects one. Based on the obtained probability, we rejected the null hypothesis that individual effect are random and that RE provides consistent estimates. Moreover, considering that we have 42 counties we cannot say that the observations are random draws from a large population and therefore a fixed effects model could be more appropriate for our analysis. Therefore, we continued with the estimation of the fixed effects model.

The necessary tests for the residuals were also performed, indicating that we are in the presence of both heteroskedasticity and serial correlation. So, a robust estimation was required in order to obtain unbiased estimates. The results are presented in table 2.

As one can see, in table 2, all the coefficients are statistically significant at 5%. Furthermore, the independent variables considered in this model explain 88% of the employment rate's variation (the adjusted R^2 is 0.88).

The influence of the mortality rate is, as expected, negative. Thus, an increase of the mortality rate with 1% will lead to a decrease in the employment rate of 0.939%. The birth rate, on the other side, has a positive and strong impact: an increase of 1% will increase the employment rate with 2.302%. Regarding the other demographic variable taken into account in our analysis, the net migration rate, its influence is positive. We have to recall that, for Romania, the net migration rate is predominantly negative, so, there are more people leaving than entering our country. This positive effect on employment can be explained through the possibility that unemployed people are more likely to get employed, as an effect of job vacancies occurrence. Another possible explanation might be the fact that the emigrants were not all employed (unemployed or self-employed in the Agriculture sector), but the immigrants are getting employed. So, an increase with 1% of the net migration rate will increase the employment rate with 1.754%.

The influence of the unemployment rate is negative, but reduced, a decrease of 1% leading to a 0.551 increase in the employment rate. This outcome is somehow natural because if the unemployment decreases it might mean that more individuals became employed.

The impact of the net average earnings is also negative: if the earnings are increasing with 1%, the employment will drop with 3.005%. A possible explanation is that a rise of wages reduces demand for labour by two effects: the scale effect, determined by the company's decision to reduce its production because of its cost increases and the substitution effect, consisting in replacing labour, which became more expensive, with the capital.

The education components have opposite effects: the secondary education graduates, as proportion from total population, have a negative impact on employment (an increase of 1% will lead to a decrease of 2.013% in the employment), while the tertiary education graduates have a positive effect (the employment will increase with 3.317% if the tertiary graduates, as proportion from total population, will increase with 1%). The negative effect of the secondary education graduates might be explained through the fact that, after high school, they are not entering the labour force, but entering the tertiary education. On the other side, the positive effect from the tertiary graduates is obvious, since they are more likely to get employed, being high skilled labour force.

We then considered the estimated model for the period 1996-2006 and performed out-of-sample forecast for the remained period (2007-2009). The forecast error statistics are presented in figure 6, together with the evolution of the actual series of the employment rate and the forecasted one.

Considering that the Theil inequality coefficient is close to zero (0.043) we can say that the model specification is appropriate. Moreover, the bias and variance proportions are also small, leaving the bias concentrated on the covariance proportion. The other forecast error statistics are also indicating that the forecast is accurate. All above indicate that the model is a good fit of the data.

5. Conclusions

This paper examined the labour supply in Romania, using data for the 42 counties, analysis conducted over the period 1996-2009. The size of the labour resources is under the influence of two main sets of factors: demographic and socio-economic factors. Therefore, the data used in this study are: the employment rate, the net monthly real average earnings, the mortality and birth rates, the unemployment rate, the net migration rate, as well as the secondary and tertiary education graduates.

From the statistical analysis we noticed that:

- the employment rate declined from about 70% in 1996 to 60.6% in 2009;
- the tertiary and secondary education graduates, as proportion from total population, have both an upward trend, but the tertiary education graduates are more than double in 2009 compared to 1996 (an increase of 149%), while the secondary education graduates had an increase of 14%;
- the net migration rate was predominant negative. At the beginning of the analysed period (1996), the net migration was -0.86 migrants per 1000 inhabitants, while in 2009 the net migration was -0.07;
- the rate of natural increase in Romania was negative during all this period, with a value of -2.5 in 1996 and reaching -1.6 in 2009;
- the national real net average earnings in Romania in 2009 were about 1300 RON (approx. 300 EUR), the highest value being registered in Bucharest (1734 RON – 409 EUR).

Regarding the econometric analysis, we estimated a fixed effects panel data model with robust standard errors, in order to ensure the unbiasedness of the estimates. The coefficients of the considered variables proved to be statistically significant. Moreover, the error statistics of the out-of-sample forecast strengthens the reliability of our model.

We found that the birth rate, the net migration rate and the tertiary education graduates have a positive influence on the employment rate. On the other side, the mortality rate, the secondary education graduates, the unemployment rate, and the real earnings turned out to have a negative impact. Our results are consistent with other empirical studies and we are confident that they bring additional insights regarding the Romanian labour market.

Considering all above, unless Romania finds a way to improve the quality of labour market it is doubtful that it will succeed in producing so high employment growth rate in the next decade, as targeted by the European Commission. Policy reforms need to focus on bringing back into employment those labour categories which are unable to take advantage of the economic growth (the youth, older workers, women and the long term unemployed). The skills with which the education system endows graduates should be in line with the expectations of the employers, therefore, a better alignment of the curricula with the demand for labour is imperative. Opening segments of the labour market to foreign workers should also be considered in order to fill the gap between the existing supply of labour and the expanding demand, together with attracting back the short term migrants.

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Annex

Core indicators	1995-1999	2000-2004	2005-2008	2009
GDP growth rate	0.6	5.4	6.4	-7.1
Output gap	-0.2	-2.5	7.0	-0.8
HICP (annual % change)	74.6	26.0	7.1	5.6
Unemployment rate (% of labour force)	5.5	7.6	6.7	6.9

Table 1 Macroeconomic indicators
Source: European Commission (2011)

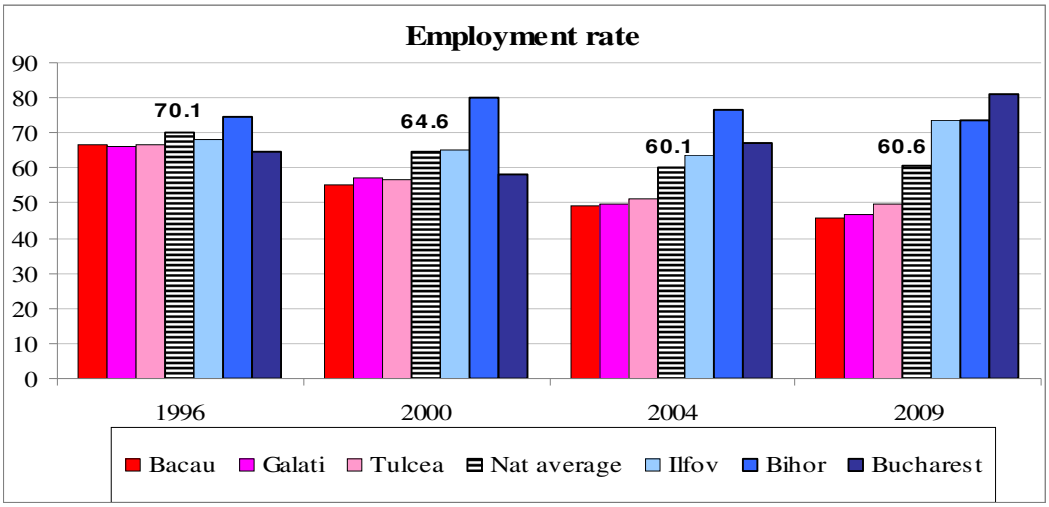

Figure 1. The employment rate, county level, 1996-2009

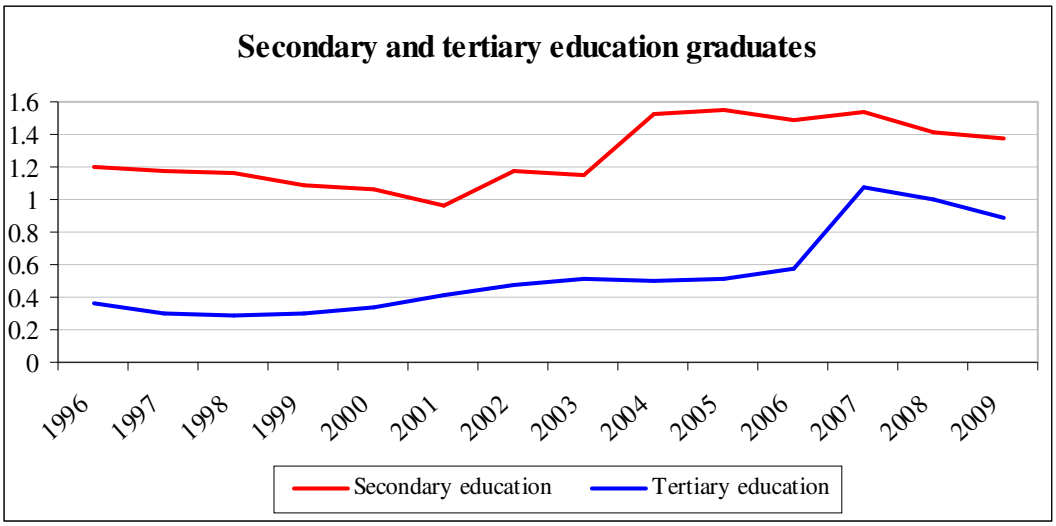

Figure 2. Secondary and tertiary education graduates, 1996-2009

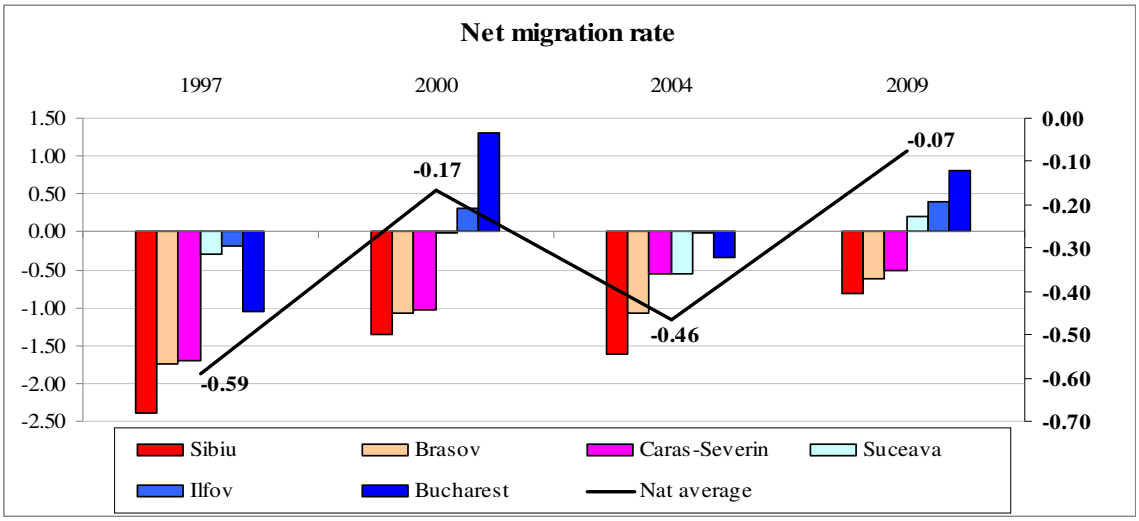

Figure 3. Net migration rate, 1996-2009

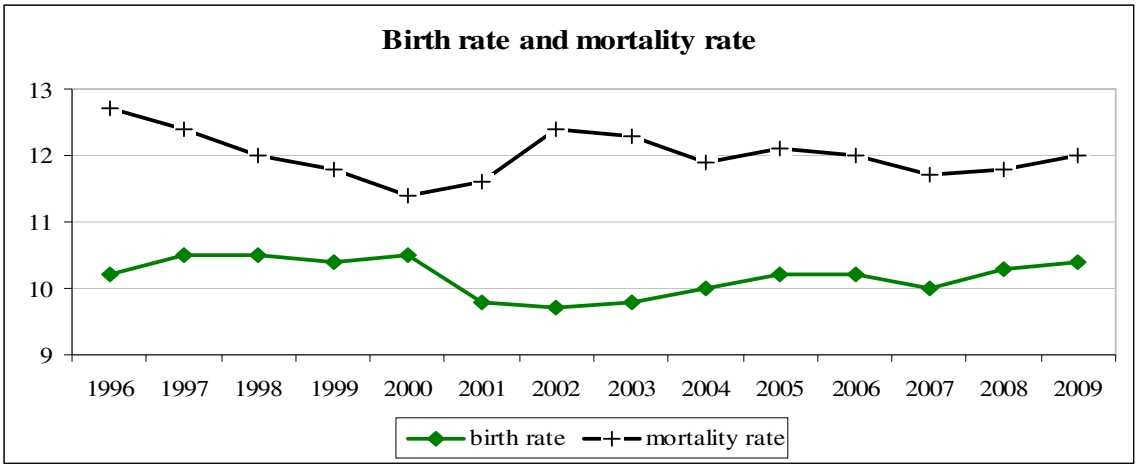

Figure 4. Birth and mortality rates, national level, 1996-2009

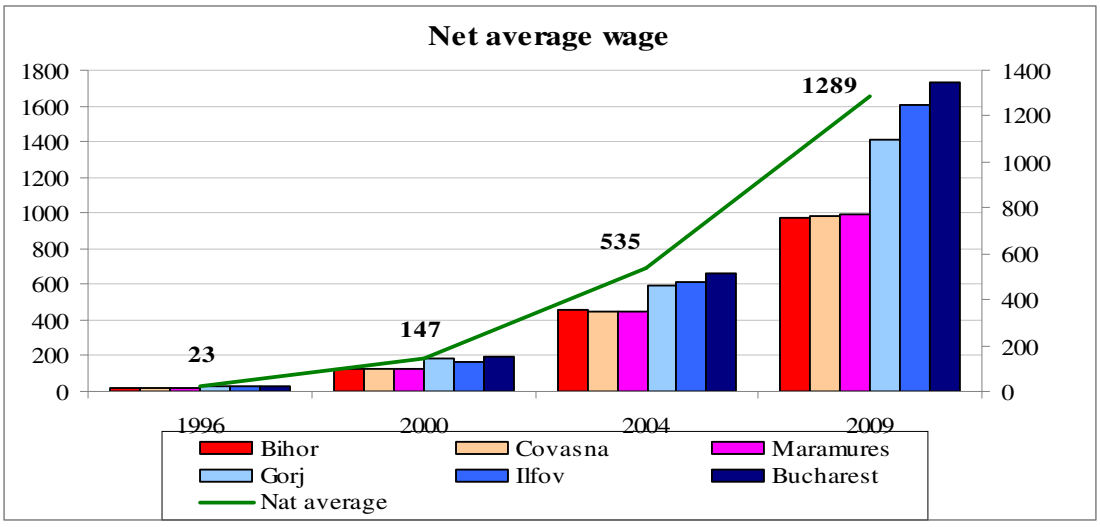

Figure 5. Net average wage, 1996-2009

Sample 1996-2009					
Periods included: 14					
Cross-sections included: 42					
White cross-section standard errors and covariance (d.f. corrected)					
Variable	*Coefficient*	*Std. Error*	*Prob.*		
C	*73.903*	*4.567909*	*0.0000*	*R-squared*	*0.89*
MR	*-0.939*	*0.433084*	*0.0307*	*Adjusted R-squared*	*0.88*
BR	*2.302*	*0.337980*	*0.0000*	*F-statistic*	*75.59*
UR	*-0.551*	*0.066914*	*0.0000*	*Prob(F-statistic)*	*0.00*
LWAGE	*-3.005*	*0.289366*	*0.0000*	*Akaike info criterion*	*4.77*
EDUC2	*-2.013*	*0.788509*	*0.0110*	*Schwarz criterion*	*5.18*
EDUC3	*3.317*	*0.978675*	*0.0008*	*Hannan-Quinn criter.*	*4.93*
NETMIG	*1.754*	*0.708799*	*0.0137*	*Durbin-Watson stat*	*1.01*

Table 2 Fixed effects robust estimation

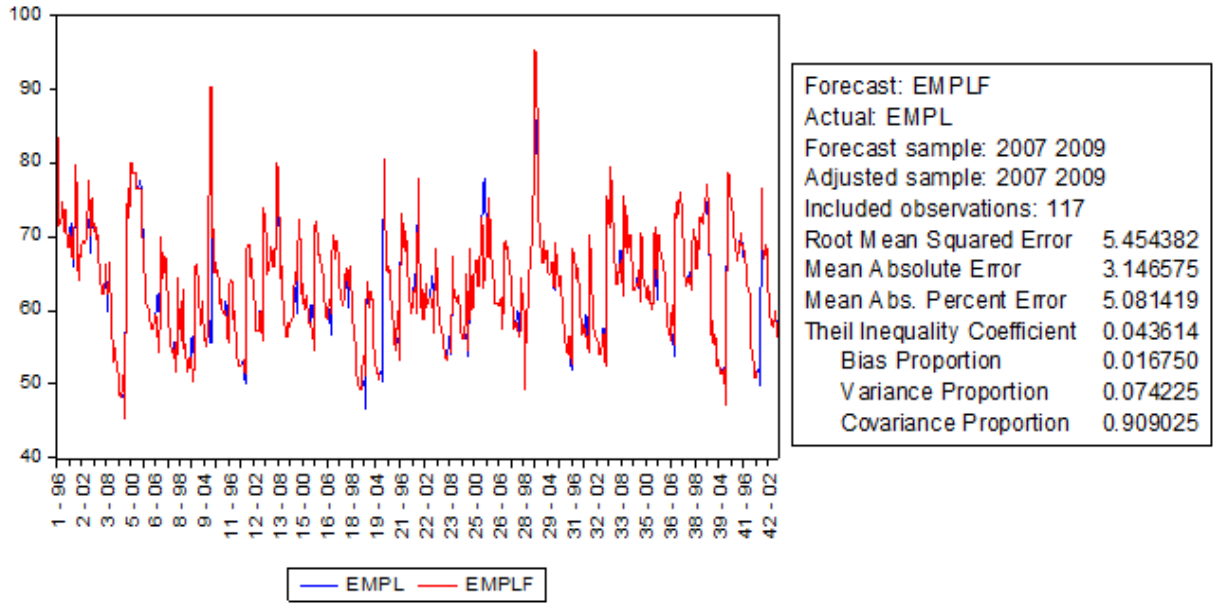

Figure 6. Out-of sample forecast of the employment rate