MEDIUM TERM PROJECTIONS OF DEMAND FOR LABOR WITH HIGHER EDUCATION AND OF EMPLOYED POPULATION IN ROMANIA

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Abstract:
The projection model of demand for labor with higher education (MCFMSS) and medium-term forecasts make a consistent pattern, circumscribed to the standard macroeconomic theories, which adequately reflect the peculiarities of the Romanian economy and generates plausible results. Due to its complexity, the model is a true macromodel which relates the economic growth forecast with that of growth in employment in a detailed structure. The model has as the main exogenous variables the economy-wide GDP and gross value added by sectors. Starting from a Cobb-Douglas production function, the model proposes a growth scenario of employed population mainly to achieve the Europe 2020 objectives, based on the growth of activity rate, on a moderate GDP growth and on lower

¹ The paper presents results of the sectoral project, contract No. 4S/2011-Evaluarea și prognozarea cererii de muncă potențiale pentru absolventei de învățământ superior, în structura ocupațională, la orizontul anului 2020, în vederea dezvoltării corespunzătoare a politicilor privind instruirea de nivel universitar, coordinator İNCSMPS, subcontractor IPE, 2011-2012.

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unemployment. Three scenarios were considered for all exogenous variables - reserved, moderate and optimistic, the moderate scenario being preferred because the data sets used were short.

Key words: labor demand, labor projection models, GDP and VAB forecast, employed population forecast

JEL Classification: E24, I25, J24, O15

Introduction

The projection of demand for labor with higher and the medium term forecasts represent a consistent pattern, circumscribed to the standard macroeconomic theories, which accurately reflect the peculiarities of the Romanian economy and generates plausible results. Due to its complexity, the model of demand for labor with higher education (MCFMSS) is a real macromodel that relates the economic growth forecast with the growth in employment in a detailed structure. MCFMSS is divided in blocks with relatively distinct operation, namely the block of total economy employment, the block of employment by sector, and the block of demand (employment) for/of labor force with higher education. The operation of the model has as starting point - the main exogenous variable – the economy-wide GDP and the gross value added by sectors.

For the forecast of GDP and gross value added by NACE activities, some methodological limitations and difficulties were considered:

- Medium-term GDP forecast takes into account the growth potential of the Romanian economy; the potential GDP was assessed using the EU methodology and was estimated to range from 2.5% to 3% annual real GDP growth until 2020;

- A second restriction (hypothesis) is the medium-term budgetary objective (MTO), which states the need to balance in the medium term, with a maximum in Romania of 0.7% of the GDP. This requirement can be ensured if the average actual growth does not exceed by more than 1 percentage point the potential GDP;

- Forecast of GVA by sectors was performed in two ways, depending on the existing information:
  • In conjunction with sectoral indices on production development, particularly in industrial activities;
  • In conjunction with the development of sections and subsections for the new activities individualized by NACE - Rev 2.

- The determination was based on the method of production of gross domestic product (GVA), namely its evaluation as the difference between output and intermediate consumption.

  • For the activities encountering problems, the relative constancy of rates or structures was assumed.

- Medium-term evolution reveals a high dynamics of activities with significant share of employed population with higher education, except for construction activities that depend on infrastructure projects.

  Based on these assumptions and considering a better absorption of the EU funds, which increase the gross fixed capital following, the following moderate GDP forecast results: an average annual rate of 2.9% between 2011 and 2015 and 3.5% between 2016 and 2020.

  The gross value added in (i) industry will register an average annual rate of 3.7% between 2011 and 2015 and 3.5% during the interval 2016-2020, in (ii) agriculture, forestry and fishing will record an average annual growth rate by 3.0% between 2011 and 2015 and 1.1% during the interval 2016-2020, in (iii) constructions will register an average annual rate of 4.0% between 2011 and 2015 and 4.5% between 2016 and 2020 and in (iv) services will register an average annual rate of 2.2% between 2011 and 2015 and 3.6% between 2016 and 2020.
Table 1. GDP and gross value added forecast

<table>
<thead>
<tr>
<th></th>
<th>Average annual growth rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2011 - 2015</td>
</tr>
<tr>
<td><strong>Gross Domestic Product</strong></td>
<td>2.9</td>
</tr>
<tr>
<td>of which:</td>
<td></td>
</tr>
<tr>
<td><strong>Gross value added in:</strong></td>
<td></td>
</tr>
<tr>
<td>Industry</td>
<td>3.7</td>
</tr>
<tr>
<td>Agriculture, forestry, fishing</td>
<td>3.0</td>
</tr>
<tr>
<td>Constructions</td>
<td>4.0</td>
</tr>
<tr>
<td>Total services</td>
<td>2.2</td>
</tr>
</tbody>
</table>

In making the forecast of GVA by NACE activities a number of methodological difficulties are encountered, namely:

- Given the purpose of these forecasts, namely to base the employment development, the main requirement was that of **convergence of structure by activities with the employment structure**, i.e. NACE - Rev. 2;
  - The main difficulty came from this requirement: the national accounts are not updated in this new classification and, therefore, there is no statistical database for econometric processing;
  - As a result, the data series had to be reconstructed to be able to highlight the development of the new activities structured by NACE-Rev. 2, this reconstruction is based on data published by the NIS for 2008 in both NACE classifications and on the structural composition of the upper group (section or subsection).
- A second difficulty was the **construction of the data series in constant prices**, especially for the new activities, for which we opted for deflating by the price index (deflator) of the upper group.

**Trends in the evolution of gross value added by sectors**

Structural evolution of gross value added by 2020 is subject to the influence of economic phenomena and processes in progress, all subsumed under the general objective of modernization and compatibility of the Romanian economy with the economies of other European Union countries. At the same time, the future development will remain constrained by the current structural condition of both the productive apparatus and domestic production. Two examples suffice: (i) the current state of infrastructure, well below that of other countries, turning to higher priority in Romania less priority sectors in developed countries, sectors with lower shares of demand for labor with higher education; we include in this case constructions, building materials, energy, (ii) strong current energy intensive structure based on traditional activities such as the ferrous and nonferrous metallurgy, chemical fertilizer industry, etc., it is difficult to change in the medium term. As a result, the demand for educated labor force will be affected by these difficulties in upgrading the domestic production.

Specifically, by 2020 we do not see a positive high gap between activities that, in terms of technology or capital, require higher education personnel and the traditional ones. Also currently, sectors such as the pharmaceutical industry, electrical equipment or transport equipment reveal higher dynamics, but not much above the overall development. As well as regarding the services, on total and by structure they do not approach the proportions registered in the developed countries.

In this perspective, by 2020 higher growth rates of real gross value added will also register traditional activities such as constructions, food industry, metallurgy, as well as technologically modern activities: pharmaceutical industry, manufacture of computer, electronic and optical products, and electrical equipment (Table 2).
Table 2. Average annual growth rate by activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>Average annual growth rate (%)</th>
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<tbody>
<tr>
<td>Food industry</td>
<td>2.2</td>
</tr>
<tr>
<td>Manufacture of chemicals and chemical products(^1)</td>
<td>4.1</td>
</tr>
<tr>
<td>Manufacture of basic pharmaceutical products and pharmaceutical preparations</td>
<td>4.0</td>
</tr>
<tr>
<td>Metallurgy</td>
<td>-4.7</td>
</tr>
<tr>
<td>Manufacture of computers and electronic and optical products</td>
<td>4.0</td>
</tr>
<tr>
<td>Manufacture of electrical equipment</td>
<td>4.0</td>
</tr>
<tr>
<td>Constructions</td>
<td>11.7</td>
</tr>
<tr>
<td>Total services</td>
<td>2.5</td>
</tr>
<tr>
<td>Public sector</td>
<td>-6.1</td>
</tr>
<tr>
<td>Research, development</td>
<td>7.3</td>
</tr>
</tbody>
</table>

In the case of the tertiary sector, the problem stems from the fact that the public sector - the sector with the largest share of highly educated staff in total staff - will follow the path of stagnation recorded in recent years, due to the restrictions arising from the EU fiscal treaty.

Forecast of employed population, at national level

Starting from a classical production function model, in order to estimate the total employed population we propose an econometric model as follows:

\[
\log(pocup) = c + \log\left(\frac{IPIB}{IPIB(-1)}\right) + \log(r_{activ(-2)}) + \log(r_{somaj(-1)}) \tag{1}
\]

where:

* \(\log(pocup)\) = is the dependent variable and represents the logarithmic value of total employment (for predicting this variable we used data from the National Institute of Statistics, for the period 1991-2011, while for the estimated period 2012-2020, data are the results of the model);

* \(\log\left(\frac{IPIB}{IPIB(-1)}\right)\) = is the logarithm of ratio of the IPIB index to IPIB a year ago, where IPIB is the GDP index (calculated as the ratio of 2 consecutive values of GDP, namely GDP (t)/GDP (t-1), the GDP values were expressed in 2005 constant prices, IPIB being used as to keep only the dynamics of this variable);

* \(\log(r_{activ(-2)})\) = is the logarithm of activity rate (the ratio of working population to total population aged 15 to 64 years; the values were taken with a delay of two years, mainly due to delayed impact this variable projects, but also for the consistency of some statistical tests of the model);

* \(\log(r_{somaj(-1)})\) = is the log of unemployment rate (calculated as the ratio of the number of unemployed to working population, values were taken with a delay of one year, mainly due to delayed impact this variable projects, but also for the consistency of some statistical tests of the model).

In the case of a Cobb-Douglas production function, as the one used in this model, we used non-negativity constraints in terms of exogenous variables (GDP, unemployment rate and activity rate). Once this model was simulated by estimating the total employment for the period 2012-2020, we tested a number of statistical assumptions (assumption of normal distribution of residues, the error autocorrelation hypothesis, the assumptions of heteroskedasticity of residues), then the statistical significances of the macroeconomic variables used in this model were tested, the correlation between the macroeconomic variables in the model was studied and the validity of the model was tested.

Why such a model was necessary?

So far, there is no consensus among economists on how best to measure the human...
capital stock. Difficulties arise, first, from the lack of available data (most data, at least in Romania, are recorded since 1991, and in some cases we have even less data due to changes in methodology, making it impossible to reconstitute a longer series). Currently, the method used is the quantification of attended school years (enrollment ratio at secondary school level). In the medium term, it is expected that the level of education continues its positive trend. Although recent trends show that enrollment at primary and secondary levels show decreases due to difficulties caused by the economic crisis, the highest gains will be achieved in the future by increasing the number of students.

Thus, after determining the trajectory of total employed population according to the model, and taking into account the proportion of highly educated people we may determine the trajectory of employed population with higher education.

In this model, we propose a scenario of employment growth, mainly to achieve the Europe 2020 objectives. Obviously, this can be achieved given the nature and power of influence of the exogenous variables used in the model. Thus, employed population growth is ensured in the model by rising the activity rate, also by moderate GDP growth and, ultimately, by lower unemployment. We may see how the explanatory variable described by the activity rate has the greatest influence on employment for the period under review; this is somewhat normal, mainly due to the direct link between the activity rate and employment rate of the population. But what is important is to note the positive influence of the higher GDP, which manages to counteract the negative influence of unemployment.

In order to estimate the future dynamics, simulation of the model is required, which involves first its calibration. The calibration of dynamic models has become lately one fundamental step of macroeconomic simulations. Calibration in this case was the exogenous setting of values for certain parameters of the model. Obviously, this setting was made on theoretical and empirical grounds.

Based on the three exogenous variables used in the model, we may determine the trajectory of employed population for the next eight years, until 2020. To find the solution of such linear regression problem we need to know the initial conditions of GDP (1991, expressed in constant 2005 prices), of activity rate (1991) and unemployment rate (1991); thus, in the case of these variables data recorded so far in the 1991-2011 period were used, after which the trajectories for the period 2012-2020 were estimated. For the trajectories of these indicators we may also use various techniques for determining the trend of the linear series.

In this model, we attempted to quantify also the links between population aging and the basic factors of economic growth, namely labor and capital. If we consider the total population, we may divide it into three structures: a) young people, below the age of 15, adults, aged 15 to 64 years and elderly people, of 65 and over. In the adult population, if we eliminate unemployment we might thus consider the workforce potential (employment rate), which represents the basic factor in achieving the GDP.

Thus, the GDP (at current 2005 prices) was used as an index in the model in order to more clearly express its dynamics and influence on employment. The growth scenario is, however, a moderate one, taking into account the objectives set for the next period.

In the case of activity rate (here calculated as the ratio of the active population to the adult population between 15 and 64 years), we find a very slight upward tendency since 2011 that will continue until 2020. This is due to an increase between 0.5 and 1 percentage points until 2020 estimated for the active population. The apparent decline in the total population is due to the negative natural growth that Romania registered since 1992. In the case of migration, the expected effects are reduced, mainly because this phenomenon is already consumed; moreover, with further crisis in the highly developed states correlated with high unemployment in these countries, the Romanian population has increasing difficulty in finding stable jobs. If we consider the phenomenon of convergence for the EU2020 Strategy objectives, in the case of Romania it is possible that the Romanians consider again attractive the job supply on the Romanian market and return home, thereby increasing employment.

In the case of unemployment (here calculated as the ratio of the number of unemployed to the working population), we find a decrease from 2011 that will continue until 2020. This may be explained by several factors, but here we consider only the policies and programs that are already in place or next to be implemented, especially to reach the EU2020 Strategy targets.
The simulations have considered the following scenarios for all three exogenous variables, as follows:

- For the GDP explanatory variable three scenarios were considered - reserved, moderate and optimistic (with growth levels ranging from 0.5% to 5%);
- For the \( r_{\text{activ}} \) explanatory variable (activity rate) three scenarios were considered - reserved, moderate and optimistic (with growth levels ranging between 0.05% and 1%);
- For the \( r_{\text{omaj}} \) explanatory variable (unemployment rate) three scenarios were considered - reserved, moderate and optimistic (with levels decreasing from 0.02% to 0.05%).

Finally, it was found that a moderate scenario is preferable, especially due to the fact that the data sets used were too short.

Thus, in the case of total employed population projected by a moderate scenario, a slight but constant growth is found over the interval 2012-2020 (Figure 1).

\[ \text{Figure 1. Forecast of total employed population} \]

Conclusions

The projection model of demand for labor with higher and the medium term forecasts accurately reflect the particularities of the Romanian economy and generate plausible results. Due to its complexity, the model of demand for labor with higher education is a true macromodel which relates the economic growth forecast with growth in employment in a detailed structure.

Structural evolution of gross value added until 2020, placed under the influence of economic phenomena and processes in progress, subsumed to the general objective of modernization and compatibility of the Romanian economy with the economies of other European Union countries, as well as the current structural constraints on both the production apparatus and national production will influence also in the medium term the demand for highly educated labor force. Specifically, until 2020 no positive very high gap between the activities that in terms of technology or capital require higher education personnel and the traditional ones is foreseen. In the case of the tertiary sector, the problem stems from the fact that the public sector - the sector with the largest share of highly educated staff in total staff - will follow the path of stagnation recorded in recent years, due to the restrictions arising from the EU fiscal treaty.

Starting from a model based on the Cobb-Douglas production function, the authors propose a scenario for increasing employment to achieve the Europe 2020 objectives, based on growth of activity rate, on moderate GDP growth and on lower unemployment. One may notice that the activity rate has the greatest influence on employment over the analyzed period, which is quite normal because of the direct link between the activity rate and the employment rate of the
population. Important is, however, the fact that the higher positive affect of GDP manages to counteract the negative influence of unemployment. Also, the model has tried to quantify the link between population aging and the basic factors of economic growth, namely labor and capital. The simulations considered three scenarios for all exogenous variables - reserved, moderate and optimistic – and the moderate scenario (projecting a slight, but continuous increase in employed population) was finally preferred, mainly because the data sets used in the model were short.