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BARCELONA (SPAIN)
6TH - 8TH OF JULY, 2015

CONFERENCE PROCEEDINGS

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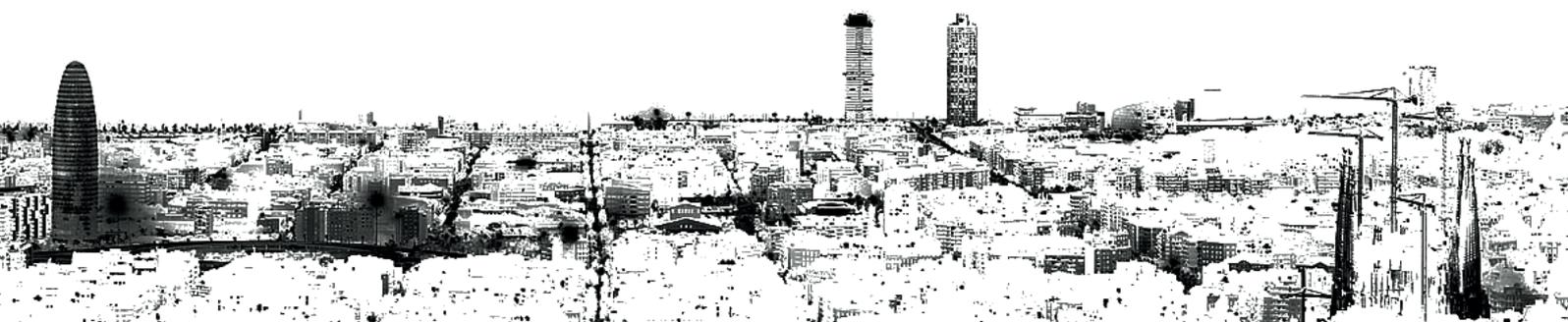6TH - 8TH OF JULY, 2015

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PROJECTION SYSTEM OF RECRUITMENT NEEDS IN RUSSIAN REGIONS

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Abstract

The article deals with quantitative projection of labour market recruitment needs aimed at sustainable development of economic growth in Russian regions. The system allows to project labour market parameters mainly of supply and demand as well as to perform scenario analysis of labour market needs in vocational education graduates in terms of occupational-qualification structure.

The project method is based upon bracketing approach embracing two types of projections – projection based upon mathematical modeling and projection based upon employers' and experts' surveys.

Keywords: recruitment needs, demand and supply, optimal key enrolment figures, labour market balance.

1 INTRODUCTION

An important issue at national level is sustainable growth of both economic brunches and industries in accordance with long-term priority areas of a state policy. In order to achieve these goals it is highly necessary to perform in advance staff training by education system in qualitative and quantitative perspectives.

Current misbalance of supply and demand in specialists on Russian labour market is one of the crucial problems nowadays. There's a shortage of specialists in technical sciences and surplus of specialists with tertiary vocational education.

In this context it is necessary to develop and implement widely scientifically based projects of recruitment needs in both administrative decision-making on training structure and content as well as individual decision-making on professional activities choice.

Best foreign practice incorporates a great number of projection methods for labour market. There are Bureau of Labour Statistics of the Department of Labour of the USA, Monash model in Australia, MDM model in the UK, INFORGE and Ifo models in Germany [1, 2].

Russian methodic on macro-economic projection of regional recruitment needs is successfully developing [3, 4].

All the mentioned above methodic and models for qualified staff demand projection possess common features. These models are aimed at recruitment needs projections at national and regional levels, application of econometric methods, approaching to "labour resources in demand", macroeconomic projection results for goods and services production in terms of economic brunches are used as input parameters.

Furthermore, we'll analyze methodic on recruitment needs projection peculiar traits and projection system based upon this methodic developed at Petrozavodsk State University [5].

2 PROJECTION SYSTEM PECULIAR TRAITS

Basic functions of projection system are:

1. Economy projection of recruitment needs based upon macroeconomic parameters of regional development including huge long-term investment projects.

2. Resources projection for satisfying economy's recruitment needs (labour market supply) in demographical perspective, vocational education systems output, re-training of population, logistics and transport accessibility, migration processes.

3. Balancing labour market demand and supply that will allow to evaluate human resources availability in the region for satisfying regional recruitment needs, to define potentially dangerous spaces from the labour deficit perspective.

4. Scientifically-based decisions development on labour resources misbalance overcoming on labour market – optimal conditions for bridging labour market, including optimal key enrollment figures on specialists training.

The projection system is based upon macro-economic and micro-economic approaching. On one side, projection is based upon mathematical modeling. Input data will be macro-economic parameters - Gross Regional Product, investments included in strategies and programmes on long-term regional development and upon that recruitment needs are defined. On the other hand, input data will me micro-economic – experts', employers', youngsters' surveys for model coefficients adjustment and parameters specification on which statistics is absent.

Projection specification is performed in the following perspectives:

- productive-economic;
- organizational-territorial;
- vocational-education.

Productive-economic perspective allows to specify recruitment needs in terms of types of economic activity, economy brunches.

Organizational-territorial perspective allows to specify recruitment needs in terms of municipalities and enterprises/ organizations.

Vocational-education perspective allows to specify recruitment needs in terms of employees types, occupations, educational levels, aggregated specialty groups and majors.

Projection methodic is formalized in mathematic dynamic model which describes labour resources flows in time and in socio-economic system "education-labour market-economics". Models are presented in a system of non-linear inter-related finite difference transient equations sampling in time and taking into account more than 100 parameters and different factors.

Projection complex is combined of 4 models:

- Economic models;
- Projection models in recruitment needs;
- Projection model of labour market supply;
- Models of optimization of sources for needs covering and decision-making.

Lets analyze each of the models separately identifying the format as well as input/output data.

3 ECONOMICS MODEL

Economics model describes interrelation between key economic and demographic parameters of a region. Calculation results of the economics model are multiversion projection of socio-economic development for mid-term (3-5 years) and long-term (till 20 years) perspectives.

Economics Model peculiar features are:

- key factors of economic growth are capital accumulation rates and changes in the number of employed in the economy;
- influence of goods and services production assessment on investments in capital stock;
- investment projects parameters are taken into account under key economic parameters projection;
- scenario approach implementation («What if…»).

Endogenous variables (to be projected) of the Economics Model are – Gross Regional product, total investments in capital stock, value of fixed assets for the full value, accrued wages of all employees, etc.

Exogenous variables are international, macro-economic, regional factors defining socio-economic regional development in mid-term and long-term perspectives – global prices on exporting goods; GDP, production, dynamics of the ruble's rate to the dollar; investment projects parameters.

Basic types of applied economic-mathematical models are linear and non-linear regressions (linear and non-linear less squared method), determined equations (identical equations).

4 PROJECTION MODEL OF RECRUITMENT NEEDS

Based upon parameters (GRP, investments) projection model of recruitment needs allows to calculate cumulative and annual additional economy's recruitment needs.

Cumulative economy's recruitment needs is an optimal number of occupied necessary in order to provide economy functioning on a chosen scenario of socio-economic development. Thus, projection of a cumulative economy's recruitment needs is a projection of optimal annual average of occupied in economy.

Annual additional economy's recruitment needs is a required annual increment to the existing number of labor resources to its optimum amount or the annual demand required by economy's parameters.

Annual additional economy's recruitment needs functions:

1. Compensate labour resources annual replacement (natural decline, dismissal, voluntary severance etc) – need «to replace».
2. Provide labour resources with job places arising due to the expansion of existing facilities - need «to grow».
3. Provide with trained staff new work places at the expense of new productions opening, investment projects implementation - need «to develop».

Totally, items 1-3 provide economy development in a prescribed pace [6].

4.1 Cumulative recruitment needs

In accordance with the projection methodic optimal number calculation of occupied in economy is embracing several stages.

First stage. Number of occupied in economy is calculated based upon production function. All types of economic activity are divided into productive and social. Productive types of economic activity are those dealing with goods production. Social types of economic activity are linked to services production.

Calculations of occupied numbers in productive types of economic activity are made taking into account investments and productivity parameters based upon production functions (Cobb-Douglas, Harrod, Tinbergen, Mankiw, Romer, Weil, CES production functions). Calculations of occupied numbers in social types of economic activity are made taking into account correlations with population at working age [7].

In order to raise projection accuracy, calculations of cumulative recruitment needs for long-term period is to perform taking into account employers', experts', staffing companies' surveys. Surveys' results implementation will allow to specify projection parameters (retirement rate, growth) as well as to forecast structural shifts in occupational-qualification structures.

In this connection, the second stage is including calculations of occupied numbers based upon employers' surveys (social projection). Obtained data results in numbers of working places to be reduced and to be introduced. Based upon the difference growth coefficient is calculated allowing to calculate presupposed numbers of occupied.

Third stage includes calculation of combined average projections which consists of measured combination of 2 previous projections. Thus, the simulation of parameters is carried out by mutual complement of objective statistical data and subjective results of the survey.

Such approach is highly important to implement on various projection stages. Experts assessments are more crucial in short-term and mid-term assessments of projection parameters dynamics at the same time normative approach is more topical in trends dynamics evaluation for the mid-term and long-term perspectives.

Combined approach is implemented with data variable:

$$L = (1-\alpha) \cdot L_1 + \alpha \cdot L_2,$$

L_1 – indicator values based upon macro-economic approach;

L_2 – indicator values based upon surveys results;

α – coefficient of surveys importance ($0 < \alpha < 1$).

Parameter α regulates constraint force between projections. Where $\alpha = 0,5$ is influence of each of the projections on a final result similarly, with $\alpha \to 1$ surveys are more important, and with $\alpha \to 0$ normative projection is more important.

4.2 Annual additional economy's recruitment needs

In accordance with the projection methodic an annual additional economy's recruitment needs is calculated as a sum of 3 components – to replace, to grow, to develop.

With the aim of juxtaposition of the results of annual additional economy's recruitment needs and the projected numbers of vocational education graduates, an annual additional economy's recruitment needs shall be recalculated taking into account types of economic activities, aggregated specialties groups for each level of vocational education.

In order to achieve this goal normative matrix of occupation-qualification correspondence is widely used. Rows of matrix correspond to types of economic activities, matrix columns to aggregated groups of specialties. Matrix elements correspond to the percentage of specialists with a major in the corresponding column, which traditionally brought to work in a type of economic activity of the corresponding row and obtained from employers and experts surveys.

5 PROJECTION MODEL OF LABOUR MARKET SUPPLY

Chief projection parameter – labour force supply on regional labour market – full-time graduates of vocational education system, numbers of labour migrants (foreign and inter-regional migration), numbers of unemployed, numbers of obtained employment .

Labour market model takes into account the following basic processes of labour force flows:

- Birth/death rates.
- Enrollment, contingency, graduation;
- employability (difficulties and opportunities);
- dismissal (job cuts);
- retirement;
- disability;
- sectorial shifts;
- re-training;
- migration;
- ageing (age shifts);

Model is presented with a system of non-linear inter-related finite-difference transient equation with time discretization.

6 MODELS OF OPTIMIZATION OF SOURCES FOR NEEDS COVERING AND DECISION-MAKING

Recruitment needs, optimal structure of citizens to be enrolled in vocational education institutions, different scenarios for regional social-economic development analysis are based upon projected labour forces demand and supply in a labour market.

The model of decision-making is corresponding with the economics model and labour market model changing input data and models parameters, afterwards it compares the obtained results before and after correcting the projection results.

The decision-making model results in:

- Balance for recruitment needs projection various scenarios of regional socio-economic development;
- Optimal key enrollment figures for educational institutions for full-time students.

Balance for recruitment needs is projected in terms of aggregated groups of specialties, it may have both positive and negative value:

- Negative misbalance value witness staff shortage;
- Positive misbalance value witness staff surplus.

Balance in recruitment needs will allow to evaluate satisfaction with labour resources at regional level.

The priority in recruitment needs satisfaction is given to graduates of regional educational institutions. In case regional educational system is not powerful enough, training might be organized in other regions.

The misbalance between recruitment needs and educational system output is supposed to be covered with unemployed firstly and only after that with attraction of labour migration. In this context another important model's result is a calculation of an optimal number of migrants (foreign and inter-regional), numbers of migration quotas and re-training volumes for required production rates till 2025.

6.1 Model of optimal key enrollment figures

Educational flows adjustment aimed at necessary quantity of graduates training for a desired year is solved based upon balance sheets [8]. This requires consideration of possible restrictions on perspective students' resource. In the situation of resources deficit, economy's recruitment needs will be satisfied not in full, this will result in so called "manual guidance" – necessity to redistribute enrollment figures based upon experience and beliefs of decision-makers in the field of education. However, expert assessment will be ineffective in such situations because of complexity and multifactorial settled goal.

Basic ideas of the model are [9]

- numbers of graduates flows for each level of vocational education in the planning year in terms of aggregated groups of specialties shall correspond to the economy's needs in the experts of adequate level of the pointed out aggregated groups of specialties for this year, a balance should be found between supply and demand in the labor market;
- increasing numbers of enrolled in some specialties and reduction of numbers in other specialties shall take place gradually, taking into account the constraints of the time rate and adaptation of a teaching staff to a new working conditions;
- variation in the number of graduates streams resulted from increasing or reducing number of entrants in relevant professions and levels of education;
- prioritized groups of specialties and prioritized types of economic activities in the region are considered firstly while solving the problem of optimal distribution of enrolled in terms of applicants' shortage.

For the optimal key enrollment figures calculation the following algorithm is suggested.

Number of graduates in terms of aggregated groups of specialties on a last retrospective period admission to vocational education institutions taking into account the coefficient of drop-out rates is defined. Obtained graduation outputs are compared with the annual additional demand of economy in recruitment needs by the end of the forecasting period. Thus, it is defined how the graduation outputs shall be modified in order to bridge demand and supply on a labor market.

Based upon calculated numbers of graduates covering additional needs by means of a multiplying coefficients, a corresponding demanded admission figures into vocational education institutions are found. Such admission figures are optimal in case perspective students' resource is sufficient.

In the situation of perspective students' deficit, admissions to educational institutions are then calculated based upon main criteria selection which is preferring one of the two opposite approaches.

Depending upon accents stressed there are taken into consideration either educational priorities aimed at preserving specialties from the social point of view or economy' priorities aimed at preserving leading brunches of regional economy and demanding staff with corresponding qualification.

In case social accent is taken into account then prioritized specialties are selected. The perspective students' resource is distributed in admissions in order to get maximum annual additional economy's recruitment need of vocational training system to the last year of the planning horizon. The rest of perspective students' resources is distributed in accordance with the additional needs structure. This results in a variety of admissions in educational institutions that maximally cover economy's additional recruitment need.

In case economic accent is taken, then prioritized types of economic activities are selected as well as matrix on occupational-qualification structure is implemented. Values for a variety of admissions are defined in accordance with the economy structure for a prioritized types of economic activity.

Based upon calculation of optimal enrollment figures, it is possible to elaborate the projection draft for the key enrollment figures. Key enrollment figures is a subset of optimal figures, training on which is provided fully by public finances. Coefficients equal to admissions shares on a full-time training are identified for a retrospective period basing upon statistics data, and for a projection period the coefficients are defined thanks to retrospective values extrapolation either defined by experts if necessary.

7   CONCLUSION

Projection system of labour market in qualified staff allows to calculate cumulative and annual additional economy's recruitment needs for a long-term perspective. The projection system is based upon methodic that takes into account macroeconomic data on social and economic development of regions (long-term economy strategies, long-term targeted programmes, investment projects) as well as micro-economic data (surveys of employees flows at concrete enterprises obtained as a result of sampling).

The methodic is implemented in a software "Prognosis" which allows to define annual additional economy's recruitment needs for vocational education levels as well as develop projections for a vocational education system development.

Obtained projections on recruitment needs could be implemented in decision-making on staff training demanded by economy. This will allow in the future to bridge labour market demand and supply, to make the process of labour resources development more efficient.

REFERENCES

[1]   DIXON, Peter B., RIMMER, Maureen T. (1998). Forecasting and Policy Analysis with a Dynamic CGE Model of Australia. Centre of Policy Studies Monash University. Preliminary Working, pp. OP-90.

[2]   Lutz, Christian; Distelkamp, Martin; Meyer, Bernd; Wolter, Marc Ingo. (2003). Forecasting the Interindustry Development of the German Economy: The Model INFORGE. GWS Discussion pp. 2.

[3]   Korovkin, A.G. (2001). Employment dynamics and labour market. Issues of macroeconomic analysis and projeciton. Moscow, MAKC Press, 320 p.

[4]   Kosorukov, O.A., Musikhin, S.N., Makarov, A.N., Mysina, K.A. (2012). Complex approach to labour market modelling. Scientific bulletin of Plekhanov 1(1), pp. 071–080.

[5]   Pitukhin, E.A., Gurtov, V.A. (2006). Mathematical modeling of dynamic processes in the system of «economy – labour market – vocational education». St.Petersburg University Press, 349 p.

[6]   Sigova, S.V. (2009). Recruitment needs satisfaction on a labour market of Russia. Petrozavodsk State University Press, 188 p.

[7]   Gurtov, V.A., Pitukhin, E.A., Serova, L.M., Sigova, S.V. (2010). Prognosis of labour market demand dynamics on different stages of crisis in Russian economics. Studies on Russian Economic Development 21(2), pp. 169–179.

[8]   Pitukhin, E.A., Moroz, D.M. (2014). Development of methodic on specialists training for vocational education system in terms of perspective student deficit. University management: practice and analysis 3, pp. 81-90.

[9]   Voronin, A.V., Gurtov, V.A., Serova, L.M. (2015). Graduates employability: methodology, monitoring and analysis. Moscow, Economics, 372 p.