

Economic approaches to scientific potential evaluation of St. Petersburg state polytechnical university on the basis of value-oriented approach (Edwards-Bell-Ohlson model)

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Abstract: Today scientific papers pay a lot of attention to the issues of innovation potential evaluation in different economic systems. The issues of evaluation of SPbSPU scientific and research potential correspond to the objectives of the National Research University Program when educating higher qualification specialists. The article presents the research result of economic efficiency of SPbSPU on the basis of value-oriented approach by the Edwards-Bell-Ohlson valuation method. At the same time, one of the objectives for the potential evaluation is to increase motivation, which would stimulate investors (and the government) to support universities financially. Such motivation will become much more convincing if, following the results of the public assessment, it will be possible to build up university ratings according to their investment attractiveness and, consequently, value.

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Introduction

Although the rating approach has methodological weaknesses, no decent alternative has been offered yet and most techniques for rating formation are based on finding out how important the valued indices are and on scaling each of them. Let us look into the issues of SPbSPU scientific and educational potential assessment on the basis of principles for creation of economic value added (value-oriented approach).

The issues the article examines are:

1. How can economic efficiency of a university be defined in case of budget financing and how does scientific potential of a university form?
2. How can investment (government and private one) be attracted into educational process?
3. How does the value of a university form giving due consideration to the intellectual property factor and what are specific features of EBO application for evaluation of intangible assets and intellectual property?
4. How to choose the social discount rate for projects in educational sector?

At the same time, one of the objectives for the potential evaluation is to increase motivation, which would stimulate investors (and the government) to support universities financially. The problems of efficiency for scientific and economic potential of have been researched in different times by famous scientists, such as: V. Baranchev, A. Akayev, A. Andrianov, A. Asaul, I. Blank, D. Bugrov, S. Valdaitsev, P. Vilensky, V. Volkova, V. Glukhov, A.

Gryaznova, I. Ivashkovskaya, A. Karlik, V. Kovalev, V. Livshits, M. Limitovsky, A. Chkhartishvili, O. Shcherbakova.

Definition of efficiency for scientific potential of university

In Russian and international practice, performance of a university is determined with rating assessment data. These data are used to assess economic efficiency of a university and, in particular, to analyze how rationally and efficiently the budget and private funds obtained by the university are spent. Current methods do not consider such indices among those reflecting universities' scientific performance as relation between the university's own money spent on R&D and the number of teachers and researchers, the volume of scientific work and development, its intellectual value, attitudinal capital while organizational structure of the university is formed, which, in the long run, results in formation of the university's value. In order to have a clearer view, the definitions of the terms «index» and «criterion» are given. Index is a generalized characteristic of properties of an object or process. There are:

- Quality indices, which register presence or lack of a certain property;
- Quantity indices, which register the degree of manifestation or development of a certain property.

Criterion is a factor or feature, on the basis of which quality of an object or process is assessed, a measure of such assessment. When composing a rating, it is essential to understand clearly who it is meant for, since, after all, it is the target audience which determines the type of rating and the way the results are presented. The efficiency criterion is needed to take a decision about reaching the wanted goal. This is a rule that makes it possible to compare strategies, resulting in a different degree to which a goal is reached, and consciously choosing strategies out of a possible set. The efficiency criterion is concluded on the basis of a certain concept of rational behavior (decision-making): suitability, optimization, adaptation [1, 2].

Formation of scientific and educational potential when assessing efficiency of Universities

In order to describe the approaches to efficiency assessment, it is necessary to define the conceptual framework. An index will imply quantitative characteristics of the units of some elements' multitudes and multitudes as a whole. Indices can be absolute and relative units. The system of indices will refer to a list of interrelated indices, which characterize a certain field of activities of a person or group of people.

Scientific and educational potential (SEP) is, primarily, the potential, belonging to the system of education and enclosed into educational structures, which is directed (oriented) on development of science, advancement of scientific knowledge and enhancement of scientific research work. Primarily, this concept fixes capacities and resources of an educational system which can be used to ensure generation, reproduction and development of science and scientific work. Thus, in the restricted sense of the word, the scientific and educational potential is an educational potential whose main forms of implementation are image formation and involvement of science, training of scientists, production of scientific products, organization and performance of scientific research work.

In the broad sense of the word, *scientific and educational potential* is the complex of available resources of science and education. The statistical book «Scientific potential of universities and scientific organizations of the Ministry of Education of Russia» presents the following contents of the scientific potential elements:

- structure of universities and their distribution in the economic regions and by activity profiles plus structure of scientific subdivisions of universities and scientific organizations;
- personnel potential of universities and scientific organizations;

- personnel training in universities and scientific organizations (number and distribution of students, training of higher qualification specialists);
- completion and financing of scientific research in universities and scientific organizations (compliance with the editorial calendar of research work together with distribution of finance amounts by finance sources);
- international activities of universities and scientific organizations with indication of contents and volume of financing of international projects;
- material and technical base of universities and scientific organizations;
- results of research and development work of universities and scientific organizations of the Ministry of Education of Russia.

So, the scientific potential includes the whole complex of scientific knowledge, personnel, material and technical, financial, informational and organizational means, which are used (or can be used) for development of science.

When selecting indices it is reasonable to be guided by general efficiency (does the index really characterize the aspect it has to characterize?), reliability (is the index free of error?) and ability to compare (is the index understood uniquely, independently on the type of program or university?) [1, 2, 3, 4].

Another approach to the selection of indices takes into account investment, process and results. All other conditions being equal, preference is given to indices which describe the process (i.e. quality of teaching, innovation in teaching) and the results (for example, successfulness of working career of the university graduates, presence of intellectual property). Indices which describe a process are more difficult to select and it is more costly to collect information about them. However, if they are available, very important information can be obtained about such aspects as educational environment and efficiency of teaching [5, 6]. For example, at one time, ratings of the British universities, according to the Times, included the «quality of teaching» index at different departments of universities in the UK. Also, it is worth assessing objectiveness and subjectivity of indices. The major indices are the ones which do not depend on the person involved in assessment, whereas the subjective ones are the opposite. That is why the reliability of the efficiency assessment depends a lot on the use of subjective indices. At the same time one can try economic approaches for efficiency assessment of a university. These are models of the value-oriented approach.

Formation of value of a University with consideration of intellectual property factor in the EBO model

When researching economic efficiency it is impossible to skip the issue of intellectual property (IP) and intangible assets (IA). They are innovative factors which form market value of an enterprise, since they are the results of fast-developing information technology. In order to assess and manage intellectual property and IA of an organization, which, as a rule, are not included in the financial reports, the EBO model should be applied. This model implies a probabilistic principle when defining the results and considers current assets of an enterprise. The EBO model or the Edwards-Bell-Ohlson model has been known for quite a while. Nevertheless, it was recognized due to the articles of James A. Ohlson in 1990-1995, in which he referred to the article of Edgar O. Edwards and Philip W. Bell «The Theory and Measurement of Business Income», 1961. Similar models were known much earlier and described in the papers of Williams, 1938 and Preinreich, 1938 [7, 8, 9, 10, 11, 12].

The model refers to the so-called «retiring» income modeling or RIM and its main formula represents a value assessment model (V) of an enterprise by the following formula:

$$V = B_0 + \sum_{t=1}^{\infty} \frac{E_t[\Delta x_t]}{(1+r)^t} \quad \text{or}$$

$$V_t = B_t + \sum_{t=1}^n \frac{E_t[(ROE_{t+1} - r_e) * B_{t+i-1}]}{(1+r)^t}$$

where B_t is owner capital (net assets) of an enterprise for the moment t ; $E[\dots]$ – mathematic expectation, including: r – discount rate, corresponding to the expected cost of capital maintenance;

Δx_t – difference of net profit for the moment t from the so-called «norm» (excess profit or residual income); its negative value says for insufficient efficiency.

The value of the norm is defined as expected cost of owner capital maintenance:

$$\Delta x_t = \Delta x_t - r * \Delta B_{t-1}, \quad \text{where } x_t - \text{profit index}$$

for period t .

Since any organization is an integral system of interrelated resources and structures with unique qualities which its separate assets (resources) do not possess. Therefore, the market value can be considerably higher due to the synergy effects, business reputation, human capital and intellectual property.

The advantages of this model are: the model establishes formal relations between assessment and accounting data; versatility of the model and facility to use it to analyze differences in national record-keeping systems.

The EBO model can be a basis for elaboration of principles for ideal record-keeping system with further convergence of national record-keeping systems into the direction, stipulated by the model. The analysis on the basis of the EBO model reveals existence of a considerable statistic relation: according to the research by Frankel and Lee, 1996, for most countries, which were analyzed, the assessment on the basis of the residual income model accounted for more than 70% of cross-sectional differences in prices.

Other fundamental economic indices, which are not used in the EBO model, do not affect significantly the formation of the internal value of an enterprise. According to Hand and Landsman, 1998, initial variables, used in the EBO model: net assets, net profit and dividends define more than 80% of dispersion. High potential of the model, which makes it possible to explain how the value of a business is formed, can be used when choosing development strategy for an organization. If maximization of the value of an organization is chosen as an efficiency criterion, the Ohlson model becomes a definite tool for calculation of efficiency with reference to the real balance data.

Application features of the EBO model for valuation of intangible assets and intellectual property

The Ohlson model (Edwards-Bell-Ohlson valuation model, the EBO model) is one of the most promising contemporary developments in the theory of value assessment of an organization. It lets us use the advantages of income and costs approaches, minimizing, to an extent, their drawbacks. According to this model, the value of an organization is expressed through current (balance) cost of the capital and discount flow of excess income (differences of profits from «normal» ones, i.e. average value for the sector). The data for calculation were taken from the balance sheet of SPbSPU [13] for years 2010-2011, financial highlights for 2010-2011. An interesting point in the value assessment of scientific and education potential of SPbSPU on the basis of the EBO model was about the choice of discount rate. Since we look into a public university, which is financed with the funds of the federal budget and private funding sources, the social discount rate was accepted as the discount rate.

Table 1. Value assessment of the scientific and educational potential of SPbSPU according to the EBO method

Indices	2010	2011	E2012	E 2013	Projection for 2014
Book value of assets, RUR.	2 490 922 289	2 780 685 923,79			
Profit performance for period t , RUR.	3 317 200 000	4 111 500 000			
Evaluation of excess profit, RUR.		701 731 596	1 191 779 780	1 191 779 780	1 191 779 780
Discount rate, %		5,00%			
Value of organization V by the EBO method, RUR.		5 736 434 226			

Assessment of the value of the SPbSPU scientific and educational potential corresponds to the expected level, which proves the validity of the calculations made and actual significant contribution of the scientific and educational potential into the market value of the university.

The estimated excess profit for 2011 with the discount rate $r=5\%$ equals to 701 731 596,45 RUR. The actual difference of the profit for 2010-2011 is 794 300 000 RUR. Thus, it is fair to say that the parameters, chosen for calculation, are accurate and the amount of the defined excess profit reflects the actual increase in the value of the university, formed due to the scientific and educational potential.

Justification for choice of «Social» discount rate

Efficient spending of the public funds is the precondition to reach the priority goals for the country, region, education. Efficiency assessment of public sector projects, which refer to socially significant projects that are implemented using budget funds, implies application of a tool that helps to compare costs and benefits of projects that appear at different time moments. The methods, used in the regions of Russia for public sector project assessment, recommendations on time comparison of costs and benefits are not suggested. In practice, corresponding flows are not discounted, which results in overvaluation of net current value of the assessed projects. The discount rate should be reasoned and available for such comparisons. It should become the border line for cutting off inefficient projects in the public sector and it should make it possible to compare competing projects which have different distribution of effects in time. The issue is that the market discount rate is not suitable for evaluation of the public sector projects, since, in many cases, there is either no product/service market or there are market failures, which result in the situation when market prices do not reflect the marginal benefits and costs for the community [14]. At the same time, government action is particularly important in the spheres where the market fails. That is why it is essential to develop methods for evaluation of the social (public) discount rate.

From the perspective of the efficiency assessment of spending funds in the public sector of the economy, the use of social rate will improve the quality of project analysis and result in more

reasoned decisions. Today, among the well-known methods for assessment of social rate on should mention the following ones: social rate of time preferences (SRTP), social opportunity cost of capital (SOC) and shadow price of capital (SPC) [14]. According to the SRTP method, social discount rate reflects the readiness of the community to turn down the consumption now for the sake of consumption in future. This method has been researched by such economists as: F. Ramsey, W. Baumol, N. Sterne, M. Scott, M. Spackman, R. Blundell, D. Newbery, J. Jones, F. Cowell, K. Gardner, J. Pierce, D. Evans, E. Kula, U. Lopez, S. Azar, M. Percoco, etc. In the method of social opportunity cost of capital (SOC), the social rate is considered to be an alternative profitability for individuals as investors. This is «the norm of return from the best alternative with a similar risk, which had to be rejected in order to implement a certain project». The SOC method application was studied by S. Marglin, W. Baumol, P. Diamond, R. Haveman, S. Asan, J. Pierce, J. Cater, L. Yang, L. Lew, etc. The method, based on the evaluation of the shadow price of capital (SPC) is used to solve the problem of inequality of the SRTP and SOC rates: in the conditions of the perfect capital market, values of social rate, obtained after application of the SRTP and SOC methods, should coincide, but it does not happen in practice. The shadow price of capital represents discounted value of consumption flows, which happen as a result of private investment. The biggest contribution into development of this method was provided by O. Eckstein, K. Arrow, M. Kurtz, M. Feldstein, R. Lind, D. Bradford, J. Sharaga, M. Spackman, R. Lion, W. Klain, J. Pierce, M. Boscolo. It has been revealed that the SRTP method makes it possible to assess time preferences of the society regarding consumption with the available statistics information, whereas the SOC method is used to assess investment which may be implemented both in public and private sectors. The given validations define the choice of the social discount rate by the method of social opportunity cost of capital (SOC), defined in the paper [5]. Thus, to assess the value of the scientific and educational potential of SPbSPU the following discount rate has been chosen: $r=5\%$. We will assume that the discount rate will remain constant during the forecast period.

Conclusions

One of the important results of the work is the evaluation of the scientific and educational potential of SPbSPU, which has been carried out according to the Edwards-Bell-Ohlson method. The choice in favor of the EBO method is justified by the fact that when researching the problem of economic efficiency, it is not possible to avoid the issue of

formation of intellectual property and intangible assets. They represent innovative factors of the market value formation of an organization since they are the product of fast-developing information technology. In order to evaluate and manage intellectual property and intangible assets of an organization, which, as a rule, are not included into financial reports, it is reasonable to apply the EBO model, implying the probabilistic principle to define results and consider current assets of an enterprise.

The EBO model is one of the most promising contemporary advances in the theory of evaluation of an organization. The model makes it possible to use the advantages of income and cost approaches and, to an extent, minimizes their drawbacks. According to this model, the value of an organization is expressed through current (balance) cost of the capital and discount flow of excess profits (difference of profit from «normal» one, i.e. average value in the sector).

It is worth mentioning, that when using the EBO model for evaluation of the scientific and educational potential of SPbSPU, some research has been done, which concerned the choice of the discount rate. The relevance of such research is connected with the fact that the studied object is a state budget organization, which is why the market discount rate cannot be applied. The paper provides reasons for choosing the social discount rate, which, from the position of assessment of spending efficiency in the public sector, is going to improve the quality of the project analysis and increase reasonability of decisions that are made.

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