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THE ECONOMETRIC MODELING OF HIGHER EDUCATION SYSTEM IN THE MODERN LABOR MARKET

EKONOMETRYCZNE MODELOWANIE SZKOLNICTWA WYŻSZEGO NA TLE WSPÓŁCZESNEGO RYNKU PRACY

ЭКОНОМЕТРИЧЕСКОЕ МОДЕЛИРОВАНИЕ СИСТЕМЫ ВЫСШЕГО ОБРАЗОВАНИЯ В УСЛОВИЯХ СОВРЕМЕННОГО РЫНКА ТРУДА

Annotation

The article shows the main theoretical and practical results of the research of higher education system in Ukraine, which are based on the use of econometric methods and systematic approach as well as available official statistics. The basic factors of internal and external environment of the higher education system are considered and distinguished. The conceptual scheme of interaction of these factors in the operation of the higher education system of Ukraine has been offered. A number of econometric models, which describes the process of functioning of the higher education system as a whole, and also individual components of the processes i.e.recruitment and graduation of students has been proposed. On the basis of available statistical information, an econometric model of demand for higher education services has been built.

Keywords: *human capital, higher education, higher education system, econometric methods and models, linear regression, simultaneous equation system model, economic and mathematical analysis, forecasting.*

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Streszczenie

W artykule przedstawiono kluczowe kwestie problematyki teoretycznych i praktycznych wyników badań dotyczących systemu szkolnictwa wyższego na Ukrainie. Przeprowadzone badania oparto na wykorzystaniu metod ekonometrycznych i statystycznych, jak również opublikowanych danych dostępnych w oficjalnych statystykach. Poza tym w artykule opisano podstawowe wewnętrzne i zewnętrzne determinanty kształtujące system szkolnictwa wyższego. Przedstawiono koncepcję oddziaływania tych czynników na funkcjonowanie systemu szkolnictwa wyższego funkcjonującego na Ukrainie. Scharakteryzowano szereg modeli ekonometrycznych, które opisują proces funkcjonowania systemu szkolnictwa wyższego jako całości, a także poszczególnych składników tj. procesów rekrutacyjnych i dyplomowych studentów. Na podstawie dostępnych danych statystycznych przedstawiono koncepcję ekonometrycznego modelu popytu na usługi szkolnictwa wyższego.

Słowa kluczowe: kapitał ludzki, wykształcenie wyższe, system szkolnictwa wyższego, metody i modele ekonometryczne, regresja liniowa, jednoczesne równania modelowe systemu, analiza ekonomiczna i matematyczna, prognozowanie.

Аннотация

В статье представлены основные теоретические и практические результатов исследования системы высшего образования Украины, которое базируется на использовании эконометрических методов и системного подхода, а также доступной официальной статистической информации. Рассмотрены и выделены основные факторы внутренней и внешней среды системы высшего образования. Предложено концептуальную схему взаимодействия этих факторов в процессе функционирования системы высшего образования Украины. Предложено ряд эконометрических моделей, описывающих как процесс функционирования системы высшего образования в целом, так и отдельных составляющих процессов – набор (вход) и выпуск (выход). На основе доступной статистической информации построена эконометрическая модель спроса на услуги высшего образования.

Ключевые слова: человеческий капитал, высшее образование, система высшего образования, эконометрические методы и модели, линейная регрессия, симультативные модели, экономико-математический анализ, прогнозирование.

Relevance. One of the characteristic features of the phase transition to a post-industrial economy is the accumulation of human capital, which is defined as formed in the result of investments and gained by a man the certain margin of health, knowledge, skills, abilities, motivations, which is deliberately used in any sphere of social production, increases labor productivity and thus has an impact on the growth of human income [6].

Formation and increasing of human capital takes place primarily in the system of education and training, one of the key components is the system (or rather sub-system) in higher education. In terms of

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human capital higher education is not seen as a type of non-productive consumption, but as an investment in human. Such investment, thus, carried out in two ways: as an investment of funds and resources, and as the time and effort, while from the point of view of a market economy, these costs are not considered as a expenses, but effective investment, the return on which is to be expected in the future as a result of active work of the owner of human capital.

Thus, the analysis and prediction of the processes is relevant which take place in higher education, due to the fact that society is aware of the need to invest in human capital. An integral part of such an analysis, of course, is to identify the main factors determining the efficiency of the higher education system and enable to find a mechanism and management tools of the system.

Allocation of unresolved problems. The system (or rather sub-system) of higher education, as part of the whole vocational education system is characterized by a fairly high degree of complexity, both the structure and processes that occur in it. An effective method for studying such systems is the economic and mathematical modeling, which uses a "weapon" of modern mathematical methods and models, which are based on the achievements of various mathematical disciplines such as mathematical programming, econometrics, graph theory, catastrophe theory, fractal theory, the theory of neural networks etc.

An analysis of the literature on the subject has shown that the issue of economic and mathematical modeling of the vocational education system stood "on the agenda" is relatively recent. As a result of this issue is devoted to a relatively small number of works of native and foreign scientists. Among the latter, we should mention the work of such scientists as D. Aystrakhanov, V. V. Dyadychev, V. V. Dodonova, M. Y. Zelenskaya, K. V. Saeva, O. A. Karpyuk, H. V. Mamonova, H. Y. Kostenko, O. A. Rozhok, Y. V. Lyfanova, T. Y. Oharenko, O. V. Pol'dyn, A. V. Rodyonov, Y. M. Romanova, V. S. Berke, Y. V. Razumova.

A critical analysis of these works allows making the following conclusions.

Firstly, the main part of the work is devoted to the mathematical modeling of the educational process at the micro level – the level of the individual higher education institution [8, 9, 11, 12, 15] and regional levels [4, 5, 10, 14, 17].

Secondly, that a small part of the works, which are devoted to the modeling of the educational process at the macro level is considered, as a rule, only a single component of the educational process in the country, namely the applicants application process to the university of Ukraine [16] (with fairly limited factors taken into account) or vocational educational institutions [1]. It should be noted that, despite some limitations of the staging of the study problem, in both works the device and methodology of econometric modeling are quite effectively used.

Thus, it should be recognized that the question of a comprehensive economic and mathematical modeling of the higher education system as an object of study as a whole at the macro level is increasingly opened and requires the continuation and expansion of research in this direction.

The purpose of the article. The purpose of this article is to present the basic theoretical and practical results of the study of higher education system in Ukraine, which is based on the use of econometric methods and systematic

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approach as well as available official statistics.

Main part. From the point of view of the system approach the higher education system of Ukraine, as noted above, is a complex system, which operation can be represented schematically as follows (Fig. 1).

The input to the system is represented by the flow of students, which is formed mainly by graduates of 11 classes of secondary schools, high schools, specialized schools, technical schools, colleges and other categories of people eligible for admission to the university of the country. The output of the system are qualified specialists (bachelors and masters), which, strictly speaking, is the ultimate goal and the result of the functioning of the higher education system.

It should be noted that the system of higher education in the proposed scheme is not seen as a "black box", and has a specific structure comprising a number of "functional units" that form the internal environment of the system of higher education, at the same time can be seen each of these "functional units" as some provision type of system.

The main functional unit (types of internal provision of higher education system) seems to be considered the following units:
1)   Financial unit (financial support);
2)   A logistic unit (logistics);
3)   An information unit (information support);
4)   An educational unit (providing the educational process);
5)   Research unit (the scientific support of the educational process).

Each of the proposed units is characterized by a set of indicators, which in terms of mathematical modeling can be seen as internal factors that affect the process of functioning of the higher education system and determine the effectiveness of its functioning. Table 1 summarizes the key indicators proposed by the authors, factors that characterize the internal environment of the higher education system.

Figure 1. Scheme of the higher education system functioning
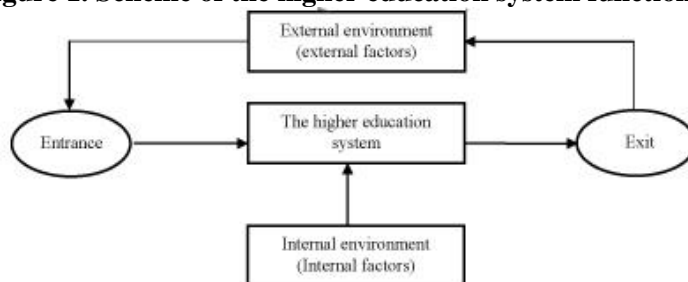
Source: Developed by the authors.

Financial unit (financial support) of higher education should be considered as the main unit, which determines the efficiency of the other units and the system as a whole. Exactly financial status of university depends directly on their logistical support and the quality of the educational process. Financial condition of university affects less on the research work, since its funding is only partially

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and insignificantly from the budget, and the main source of funding for science in Ukrainian universities, as a rule, are the economic agreement researches and designs. So it is observed opposite impact of scientific research work in university on their financial condition.

The higher level of financial support of higher education, the more positive trends and results in the field of higher education are, such as:

- improvement of the motivational component of the educational process by increasing staff salaries and scholarships;
- improvement and modernization of classroom and laboratory fund of university;
- involvement of new innovative technologies and achievements in training and research process at the best world's standards level;
- developing the educational services range;
- increase the prestige of the teaching work;
- possibility to improve the quality of the teaching staff of university by increasing the attractiveness of postgraduate and bringing talented students to educational and scientific work.

Conversely, reducing the financial capacity of university leads (and has already leaded) to such negative tendency as the reduction of the teaching and supporting staff, the rejection of the modernization of classroom and introduction of modern innovative approaches and technologies in the teaching process, folding range of educational services, increasing load for per teacher, reducing the attractiveness of the teaching work and rejection of talented students and teachers from further education in graduate and doctoral studies. All of these negative trends will ultimately lead to a significant reduction in the quality of higher education and its depreciation, a decrease of world and European rankings of Ukrainian universities.

Logistical indicators (factors) describe the logistics level of universities in the country. Logistics system of higher education includes technical and spatial resources, which are the tools used in the production of educational and other related services. This type of provision is characterized by a set of indicators that provide the conditions for the educational process: the total number of university III and IV accreditation levels, the amount of classroom fund areas and their structure in accordance with the purpose and forms of property, furniture, technical and laboratory equipment of classrooms and dean offices, directorates and departments. It should be kept in mind that in addition to classroom, educational activity necessarily requires special facilities for teachers, since the preparation and execution of their work demands adequate working conditions. A similar remark applies to the provision of student hostels. In accordance with its economic content logistics is divided into two groups of assets: fixed and working.

Information support of university is essential in the structure of the internal environment of the higher education system and is a collection of printed and electronic information sources, as well as technical and organizational resources to facilitate the acquisition of information. Powerful information resources allow intensifying assimilation of educational material, developing the independence and creativity of students, promoting their self-development and self-education, providing

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an opportunity to choose individual "trajectory" in the process of studying the discipline. Information support is characterized by such basic indicators as the provision level of universities by computers, textbooks and manuals, as well as the university library fund. It should be noted that the information resources of university, as well as logistical create the conditions for the provision of additional educational services, such as: using the Internet, the development and implementation of software products, databases, information systems, provision of library services in terms of the use of library funds, photocopying, etc. Modern material and technical base of university, combined with powerful information potential contribute to the growth and improvement of personnel potential quality of university as one of the main components of the quality of the educational process.

Table 1. Major indices, characterizing the internal environment of the higher education system

Functional block	Indicators (internal factors), describing the unit
Financial	− university budget − average monthly salary of university staff − average scholarships size − average price of higher education services
Material and technical	− number of universities III–IV level of accreditation − value of main funds − provision level of classroom fund − provision level of training laboratories − provision level of hostel for students − provision level of housing for teachers
Information	− computerization level (number of computers per 100 students) − library fund of universities − level of providing textbooks and manuals for universities
The educational	− number of members of university III–IV accreditation level (number of teaching staff) − qualitative composition of the university III–IV accreditation level (number of doctors and candidates of sciences) − number of specialties (training fields) − average teacher load − number of applicants admitted to the university − number of graduates with a Bachelor level qualification − number of graduates with a Master's level qualification − average value of drop-out students − quality degree of the educational process in the university (Ukrainian university ranking)
Research	− number of employees in research sectors of university − contractual volumes performed by employees of scientific and research sectors or university − number of graduate and doctoral students

Source: Developed by the authors.

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Indicators of the educational process, in turn, is characterized by a quantitative and qualitative level of the country providing university teaching staff, the level of teaching labor intensity and quality of the process. The most important in the structure of the educational process is undoubtedly staffing university. This includes: the teaching staff, research staff, administrative and business services (library, accounting, planning and economic department, etc.). The teaching staff is the key person of the higher education system. This quantitative and qualitative characteristic of the teaching staff, such as the number of teaching staff of the universities, the number of doctors and candidates of sciences, determines the overall effectiveness of the higher education system. The presence of qualified staff with academic titles and degrees, except for the provision of educational services, permits to produce other products, such as: make a contract to perform research projects, grants, graduate students and postdoctoral training on a paid basis, etc. Besides teaching and educational process in the university of the country and may also be characterized by such indicators as the number of specialties, the average load per teacher, dropout rate of students, Ukrainian universities in the international educational arena.

Research unit of the internal environment of higher education, of course, has a significant impact on the efficient operation of university and characterizes the intellectual contribution of the country's university in the scientific and technical progress. In recent years in the country on the spirit of the world's best traditions background, strengthens the role of university research, which is manifested in the strengthening of the requirements of the state university in science, which unfortunately cannot be said about the appropriate financial support from the same country. The expression of new trends has been the transition from the old university faculty structure to the structure of teaching and research institutions, which underlines the importance of this part of university activities, as a scientific work. Scientific research units of universities at the same with main goal of its activity allow improving financial position and the material and technical base of university, having a positive effect on increasing their staffing.

Table 2 shows the proposed indicators that characterize the external environment of higher education. Below is shown an extended analysis of these indicators.

Economic factors are probably the major external factors that include economic indicators which characterize the degree of the economy and welfare of the population. This value of the economic factors due to the fact that state of the national economy directly affects the funding of the education system in general and the university in particular. The state funding of university is a major source of their budget and to the general economic situation in the country. At the same time, and extra-budgetary income, defined mostly students training on a contractual basis, as determined by the economic situation and the level of welfare of the population and, above all, his ability to pay. Reducing the solvency of the population is fraught with reduction in the demand for paid education services, increase – makes affordable enough paid higher education.

Demographic factors are probably the second most important factors that affect

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the higher education system of the country as a direct impact on the number of entrants (system input) and, as a consequence, the number of students in the university. Reducing birth rates, increasing mortality rates, an increase in the migratory flow of young people and those wishing to get higher education abroad has a generally negative impact on the higher education system of the country, because it leads to a decrease in the number of students, the number of university and teaching staff, as well as to a reduction of budget financing. In turn, reverse, positive trends in the demography of a positive impact on the higher education system of the country – an increase in the number of entrants, the strengthening of the financial position of higher education institutions, stability and professional development of the teaching staff, which ultimately affects the quality of educational services and improving the competitiveness of Ukrainian university graduates in the labor market.

Table 2. Main indicators characterizing the environment of higher education

Groups (units) of factors	Indicators (external factors)
Economic	GDP (per capita GDP) per capita income consumer price index average monthly nominal salary investment in fixed assets in the field of education the share of expenditure on education in the consolidated budget of the country (universities)
Demographic	country population natural population movement (childbirth and mortality balance) mechanical population movement (migration, immigration) age structure of population the number of 11 classes graduates of secondary schools that have received a certificate of general secondary education the number of outstanding professionals who have graduated from educational institutions I–II levels of accreditation
The situation at the labor market	number of employed people (employment rate) number of unemployed people (unemployment rate) employment of registered unemployed people
Social	education rate social stability level
Political	government education policy (the number of public procurement places) political stability level
Legal	legal support level in the education field
Scientific and technological	number of organizations engaged in research and development volume of scientific and technical developments costs of research and development in the consolidated budget of the country

Source: Developed by the authors.

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The situation at the labor market, along with economic and demographic factors, is also one of the most important indicators characterizing the degree of development of a system of vocational education in general and higher education in particular. The labor market is a system of socio-economic relations, which have agreed to the interests of employers and hired labor. The main suppliers of labor in the labor market are the educational institutions that train specialists to supplement the structure of employment and the labor force. A special role is played by higher education institutions in the preparation of highly qualified specialists. Current market situation both in Ukraine and in the world as a whole, determines the presence of the high requirements for the quality of the labor force, which should have a significant educational and professional qualification potential to be mobile enough. An important indicator that requires regulation is lagging behind the vocational education system to labor market needs. Priority focus of educational institutions on the existing conjuncture of professions and specialties contributes to an excess of graduates in some of them, while in other professions there is shortage of specialists [2].

Therefore, the main requirement for the system of higher education in modern conditions is bringing its level to the needs of the modern labor market. In addition, it's necessary to consider that the situation aggravate the problems associated with the transition of the higher education system in the two-stage model (bachelor – master) [7]. In the minds of the overwhelming majority of the public is not the bachelor, "a full–fledged specialist with higher education." The European education program has a clear distinction between teaching, for those who will practice the knowledge gained in the workplace (bachelors), and those who will continue to the end of university research activities (masters). Hence, the higher education system and the labor market are two important factors in the formation of human capital. One of the key factors that affects on the formation of human capital, is the level of education, because it allows you to purchase a significant amount of knowledge that can be used optimally in the labor market. Higher education makes it easier to adapt to the changing conditions of the labor market, has a beneficial effect on working conditions. The level and quality of education contribute to the modernization of the economy. Another factor influencing the formation of human capital is the condition of the labor market. In fact, the labor market determines the direction of education system development [19].

Social factors characterize the effect of social stability level in the society, the existing social structure and social protection of the population in the development of vocational education system in general and higher in particular in the country. These factors can be both positive and negative. Positive factors create conditions for a relatively stable functioning and development of the higher education system. The absence of social tension in society makes it possible to predict the development of higher education system for a long period and to identify perspective directions of development of educational services of the country's universities that focus on modern requirements for university graduates in the labor market. Increasing social significance and prestige of higher education, understanding that education is a major factor in improving the

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competitiveness of the labor market, undoubtedly contributes to the further development of vocational education in the country.

Political factors are determined by the position and directions of internal and foreign policy of the country, the degree of development of the political system. The state policy in the field of education can have both positive and negative effects on the system of vocational education. In Ukraine, there are political and legal basis for a diversified higher education system in which coexist and actually compete with both public and private university. Thus, it is created a real competitive environment of educational institutions of different ownership forms that should contribute to improving the quality and level of education objectively. At the same time Ukraine's openness to the outside world, commitment to democratic European values allows for international cooperation in higher education in numerous educational programs and contracts.

Legal factors determine the regulatory and legal framework of educational institutions. The negative manifestation of the influence of legal factors in the higher education system is reflected in the lack of elaboration of legal acts regulating the activities of producers of educational services of different forms of ownership, in the presence of gaps in the legal regulation of the education system.

Scientific and technological factors influence the pace of development of vocational education system, the structure and the number of the graduates. As a result of these factors, there is a demand for specialists in new fields and expanding demand in old fields, there is an objective progress in the field of education, due to advances in science (change of scientific

paradigms, concepts, and ideas to a more modern, the emergence of new disciplines and scientific fields, specialties, knowledge areas, etc.).

Conceptual diagram of the interaction of the main indicators of external and internal environment of the higher education system is shown in Fig. 2.

For the construction of potential econometric models that reflect the relationship and interaction factors, we introduce the following symbols of the various blocks (groups) of factors and the factors themselves:

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Dependent variables

U – number of applicants admitted to the universities;

W – number of graduates of universities;

External environment blocks

E – economic situation;

D –social and demographic situation;

L – situation at the labor market;

P – political and legal situation;

R – scientific and technical situation;

External environment factors

x_{ej} – factors that describe the economic situation;

x_{dj} – factors that describe the socio-demographic situation;

x_{lj} – factors that describe the situation at the labor market;

x_{pj} – factors that describe the political and legal situation;

x_{rj} – factors that describe the scientific and technical situation;

Internal environment blocks

M – logistical support;

F – financial support (financing of university);

S – teaching and educational provision;

I – information support;

N (research provision;

Internal environment factors

x_{mj} – factors that describe the logistical support of the higher education system;

x_{fj} – factors that describe the financial support of the higher education system;

x_{sj} – factors that describe the educational process in higher education;

x_{ij} – factors that describe the information support of the higher education system;

x_{nj} – factors that describe the educational process in higher education.

Figure 2. Conceptual diagram of the interaction of various factors in the operation of the higher education system

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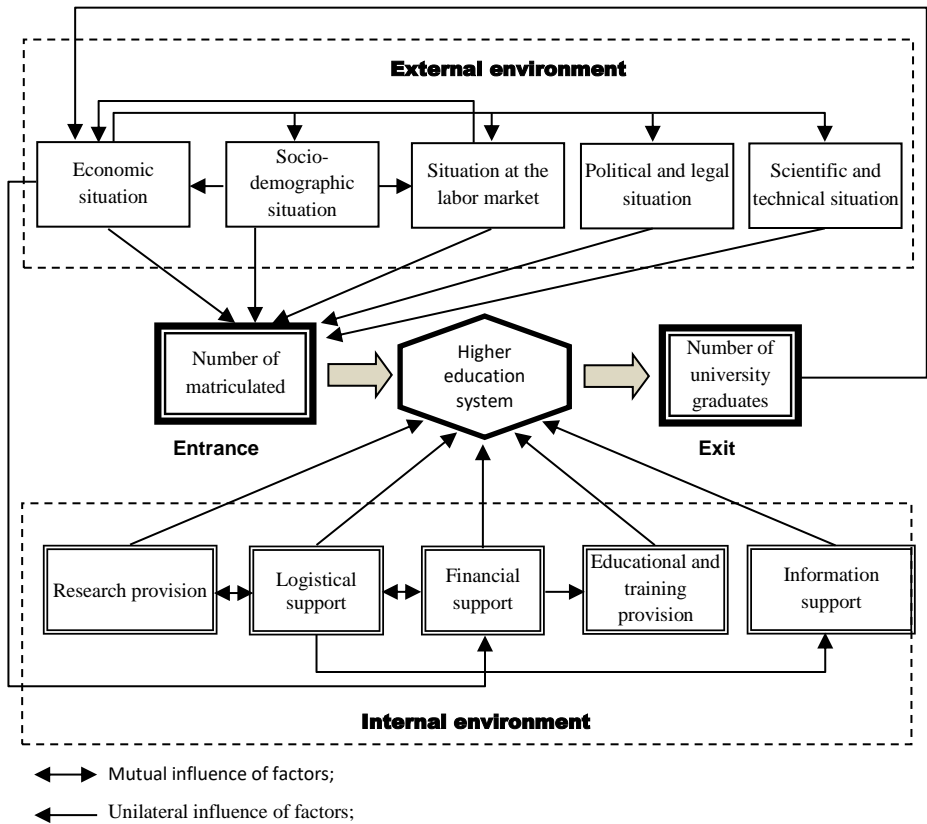
Source: Developed by the authors.

Then, depending on the purpose and scope of the simulation may be considered following conceptual econometric models in the study of the functioning of the higher education system:

1. simultaneous equation system model of functioning of the higher education system of Ukraine

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$$U = f_1(E, D, L, P, R, \varepsilon_1), \qquad (1)$$
$$E = f_2(x_{ej}, D, \varepsilon_2), \qquad (2)$$
$$D = f_3(x_{dj}, E, \varepsilon_3), \qquad (3)$$
$$L = f_4(x_{lj}, D, E, \varepsilon_4), \qquad (4)$$
$$P = f_5(x_{pj}, E, \varepsilon_5), \qquad (5)$$
$$R = f_6(x_{rj}, E, \varepsilon_6), \qquad (6)$$
$$W = f_7(U, F, M, S, I, N, \varepsilon_7), \qquad (7)$$
$$M = f_8(x_{mj}, F, \varepsilon_8), \qquad (8)$$

$$F = f_9(x_{fj}, E, M, N, I, \varepsilon_9), \qquad (9)$$
$$S = f_{10}(x_{sj}, F, N, \varepsilon_{10}), \qquad (10)$$
$$I = f_{11}(x_{ij}, F, M, \varepsilon_{11}), \qquad (11)$$
$$N = f_{12}(x_{nj}, F, M, S, \varepsilon_{12}) \qquad (12)$$

2. Model of demand for higher education services

$$U = f(x_{ej}, x_{dj}, x_{lj}, x_{pj}, x_{rj}, \varepsilon). \qquad (13)$$

3. Model of offers of specialists with higher education in the labor market

$$W = f(x_{uj}, x_{fj}, x_{mj}, x_{sj}, x_{ij}, x_{nj}, \varepsilon). \qquad (14)$$

Practical implementation of the presented conceptual econometric models will be available with adequate statistical base of indicators given in Table. 1 and Table. 2. Unfortunately, the analysis of statistical data presented on the website of the State Service of Statistics of Ukraine [18] showed the absence of a number of necessary indicators, which does not allow to fully implement the model (1) – (12).

Therefore, as a first approximation, based on available statistics for the period 2000–2015, it was constructed a linear model of demand for higher education services (13) and held its economic analysis which was carried out correlation analysis of statistical indicators characterizing the environment of higher education system. Available data for statistical analysis are presented in Table 3.

Table 3. Summary of statistical indicators characterizing the demand for higher education services in Ukraine

Units of factors	Variables of models	Statistical indicators
Economic	x_{e1}	GDP (per capita GDP)
	x_{e2}	per capita income
	x_{e3}	consumer price index
	x_{e4}	average monthly nominal salary
	x_{e5}	investment in fixed assets in the field of education
	x_{e6}	the share of expenditure on education in the consolidated budget of the country (universities)
Socio-demographic	x_{d1}	country population
	x_{d2}	natural population movement (childbirth and mortality balance)
	x_{d3}	mechanical population movement (migration, immigration)
	x_{d4}	the number of 11 classes graduates of secondary schools that have received a certificate of general secondary education
	x_{d5}	the number of outstanding professionals who have graduated from educational institutions I–II levels of accreditation
The situation at the labor market	x_{l1}	number of employed people (employment rate)
	x_{l2}	number of unemployed people (unemployment rate)

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	x_{l3}	employment of registered unemployed people
Political and legal	x_{p1}	number of students in the university for the initial cycle of the state budget
Scientific and technological	x_{r1}	number of organizations engaged in research and development
	x_{r2}	volume of scientific and technical developments

Data source: [18].

Correlation analysis allowed to select variable econometric models within each block, between which would have prevented the possibility of multicollinearity.

$$U = b_0 + b_1 \cdot x_{e1} + b_2 \cdot x_{e4} + b_3 \cdot x_{d1} + b_4 \cdot x_{d6} + b_5 \cdot x_{l3} + b_6 \cdot x_{r1} + \varepsilon$$,

where, x_{d6} – generalized indicator of the number of graduates of 11 classes of secondary schools that have received a certificate of general secondary education and specialists who have graduated from educational institutions I–II levels of accreditation,

$$x_{d6} = x_{d4} + x_{d5}$$

The estimated model of demand for higher education services has the form

$$U = 1466{,}074 + 0{,}004 \cdot x_{e1} - 0{,}054 \cdot x_{e4} - 0{,}029 \cdot x_{d1} + 0{,}427 \cdot x_{d6} + 0{,}185 \cdot x_{l3} - 0{,}054 \cdot x_{r1} + \varepsilon$$

Quality parameters of the model testify to its sufficient correctness: the correlation coefficient is 0,97; coefficient of determination – 0,94; Estimated value of Fisher's criterion – 22,44; critical Fisher criterion – 3,37. In this case it turned out to be statistically significant only two parameters – b_4 and b_5.

As a consequence, it was received a final estimated model of the demand for higher education services as a result of applying the method of exclusion to build an econometric model

$$U = 99{,}91 + 0{,}19 \cdot x_{d6} + 0{,}24 \cdot x_{l3} + \varepsilon$$. (15)

Quality parameters of the model: the correlation coefficient – 0,95; coefficient of determination – 0,90; estimated value of Fisher's criterion – 59,79; critical Fisher criterion – 3,81; all parameters are statistically significant.

Thus, we can say the following:

1) with an increase in the total number of graduates of 11 classes of secondary schools that have received a certificate of general secondary education and specialists who have graduated from educational institutions I–II levels of accreditation to one thousand people with an unchanged number of employed of registered unemployed, the number of students admitted to universities in average may increase by 190 people; and in case of increase in the number of employed of registered unemployed per one thousand people with an unchanged total number of graduates of 11 classes of secondary schools that have received a

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certificate of general secondary education and specialists who have graduated from educational institutions I–II levels of accreditation, the number of applicants admitted to universities, in average may increase by 240 people;

2) with an increase in the total number of graduates of 11 classes of secondary schools that have received a certificate of general secondary education and specialists who have graduated from educational institutions I–II levels of accreditation by 1 % at constant number of employed of registered unemployed, the number of students admitted to universities in average may increase by 0,26 %; and in case of increase in the number of employed of registered unemployed by 1 % at constant total number of graduates of 11 classes of secondary schools that have received a certificate of general secondary education and specialists who have graduated from educational institutions I–II levels of accreditation, the number of students admitted to universities in average may increase by 0,49 %;

3) standardized coefficients of regression are, respectively: $b_{d6}^* = 0,35$ and $b_{la}^* = 0,68$. Consequently, the number of students admitted to

universities, is primarily determined by the employment factor of registered unemployed, and the second – the total number of graduates of 11 classes of secondary schools that have received a certificate of general secondary education and specialists who have graduated from educational institutions I–II levels accreditation.

Conclusions. Thus, the proposed conceptual econometric models are enough powerful arm of control that affect the higher education system and enable them to use in today's labor market. Deep quantitative econometric analysis of phenomena and processes, which is the basis to make informed and effective quality management decisions at all levels of the higher education system, will yield significant results in order to increase its effectiveness.

In conclusion, it should be noted that the study results presented are not intended to be comprehensive problems of economic and mathematical modeling of the higher education system. The authors suggest to continue them in the direction of constructing a model of supply of specialists with higher education in the labor market (14), as well as simultaneous equation system model (1) – (12).

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