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A TOOLKIT FOR ASSESSING THE DIRECTIONS OF BUDGET FINANCING OF EDUCATION IN POST-CRISIS CONDITIONS²

Public financing of education is one of the most important fiscal instruments for responding to the challenges of post-pandemic economic recovery. Investments in higher and vocational education form the basis for the growth of total factor productivity, and therefore economic growth. At the same time, in the context of austerity, which will determine the directions of the budgetary policy of developing countries in the medium term, the key directions of fiscal intensification of the factors of economic growth require identification. It is proposed to include indicators of return on investments in various levels of education to the toolkit for assessing the directions of state financing of education as one of the most important factors of post-pandemic economic recovery in conditions of austerity. Differences in estimated returns from different educational levels can be taken into account in the development of public policy for financing education. The article offers an approbation for Ukraine of the approach of the Centre for European Economic Research for calculating the return on investment in higher and vocational education. A feature of the proposed approach is the ability to simulate a sufficient amount of data on revenues of individuals in conditions of limited information. The calculations in the article are based, in addition to data on the level of wages of persons with higher and vocational education, on the amount of budgetary expenditures on education throughout the course of study per student, personal income tax rates, unemployment benefits and state social assistance per person. The proposed approach makes it possible to carry out scenario estimates of the return on investment in education based on macroeconomic forecasts and taking into account changes in tax legislation. It is found that in Ukraine the return on investment in higher and vocational education corresponds to the average values of the corresponding indicators for the OECD countries. The author outlines the guidelines of the proposed methodological approach and prospective areas for its application.

Keywords: *public funding of education, return on investment in education, economic crisis, COVID-19 pandemic, state aid, tax revenues*

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Public spending on education is among the key areas of fiscal revitalization for economic growth in the COVID-19 pandemic [1]. The global economic crisis triggered by the coronavirus pandemic reinforced the need for active investment in education. Education must now not only provide qualitative knowledge, skills and competencies, particularly during the distance learning period, but also be aimed at meeting the demands that human capital will face in the post-pandemic world. At the same time, the response of most countries to the pandemic economic shock is a policy of strict fiscal austerity, which according to IMF will continue at least until 2025 [2]. In the post-crisis austerity environment, the task of shaping the fiscal space to activate fiscal drivers of economic growth takes on particular importance. The identification of protected areas of funding can be based on appropriate tools for assessing priority budget expenditures. Taking into account everything mentioned above, it is relevant to deepen research on the evaluation of returns on investment in education, which show how much the returns on an additional unit of investment in education exceed the cost of this investment and demonstrate strong economic and fiscal benefits of investment in education at all levels.

The return on investment in education can be seen broadly as the social return on education - taking into account all the budgetary benefits of an educated society: reduced health care costs, less expenditure on special education and grade repetition, reduced social costs of early parenthood, less financing of the penitentiary system, etc.

It is important to note that the closure of educational institutions during quarantine restrictions resulted in educational losses that would have a negative impact on the social return on education.

Taking into account the important practical value of indicators of return on investment in education, the justification of the approach for Ukraine is a relevant theoretical and methodological task.

The purpose of this article is to substantiate a toolkit for the post-crisis assessment of budget financing for education and the implementation of appropriate assessments for Ukraine.

The most widespread approach in the scientific literature to assess the rates of return on education is the method of bringing the cost of education and the benefits of education [3], according to which the *private* rate of return on education is equal to the ratio of additional earnings of an educated person (after taxes) compared to a person with a lower level of education, to the cost of education, including fees, associated costs and foregone/lost income, formula (1) [4, p. 2].

$$\sum_{t=1}^n \frac{(W_u - W_s)_t}{(1+r)^t} = \sum_{t=1}^n (W_u + C_u)_t \cdot (1+r)^t \quad (1),$$

where $W_u - W_s$ – is the difference in income between a university graduate (u) and a high school graduate (s) over a period of time n (which equals a person's potential working life); C_u is the private cost of university education (including associated costs); and W_s is the loss/lost income or indirect costs to the student.

The private rate of return on a given level of education is the discounting/adjustment rate (r) at which the flow of an individual's future income from education equals the flow of an individual's current expenditure on such education.

In contrast to private returns, estimates of the *fiscal* return on education are based on the tax revenues from personal income taxes and social contributions of an educated individual on the revenue side, and on the expenditure side – on the budgetary expenditures on the individual's education, including opportunity revenues (that would have been gained if individual preferred work over education).

While approaches to estimating private returns on education have been widely researched, theoretical and methodological issues of fiscal returns on public investment in education remain underdeveloped. Among the works, which present such estimates, we can single out W. Nonnemann [5] (on the evaluation of the fiscal return on education in Belgium in 1992) and F. Trostel [6] (on the corresponding estimate for the USA in the early 2000s). Both studies assume synthetic life cycles based on cross-sectional data from sociological household surveys and are based on the assumption that the tax rate remains constant throughout the synthetic life cycle. Using a similar approach, the OECD regularly publishes data on the fiscal return on education by OECD country [7].

D. Flannery and C. O'Donoghue [8] in their study calculate rates of return not for the whole life cycle, but only for the marginal fiscal return from a hypothetical increase in the number of years of education for a particular individual in a particular year. C. O'Donoghue [9] also proposed a more sophisticated tax-benefit model for modelling fiscal revenues in a number of European countries (Germany, Ireland, Italy and the UK). The empirical application of A. De la Fuente's [10] approach to estimating the fiscal return on education is based on average wages, thus avoiding the problem of limited cross-sectional data and extrapolating the results of sociological surveys over the long term. The essence of the generalized approaches is to calculate the discount rate at which the flow of future tax revenues from educated workers equals the flow of public expenditure on the education of these workers (additionally taking into account the amounts of public support for those receiving education and the opportunity costs - lost taxes not paid by the students while studying).

A methodological approach to estimating the fiscal return on investment in education. Leibniz Centre for European Economic Research (ZEW) proposed a formula for calculating the fiscal return on investment in education, which can be tested for Ukraine [11, p. 4]:

$$\sum_{t=1}^T C_t \cdot (1+r)^{-t} = \sum_{\tau=1}^D R_{\tau} \cdot (1+r)^{-\tau} \quad (2),$$

where R_{τ} is the fiscal return on investment in education; τ is the period of employment of the educated individual, excluding the period of unemployment; C_t is the budget expenditure on education and social benefits in case of unemployment; t is the period over which the investment in education is made, equals to fixed-term education; r is the fiscal return on investment in education - the interest rate at which the present/discounted value of income from education equals the present/discounted value of expenditure on education³.

³ Since tax revenues and expenditure on education occur at different points in time, the revenue and expenditure streams need to be discounted in order to compare them. A reduction/discount factor is



The higher the fiscal return (r), the greater the value of the future budgetary benefits of education, compared to the current budgetary expenditure on it.

The methodological approach to estimating the fiscal return on public investment in education consists in comparing two values: the amount of budget invested for a given level of education of an individual plus the amount of tax revenue loss from the individual's study⁴, with the amount of future tax revenue from the educated individual working.

The calculations take into account employment, wages, taxes, social contributions and transfers (unemployment assistance and state social assistance) specific to workers of different qualifications starting work today and assume their long-term behavior until they reach retirement age.

Budgetary expenditures for higher education (Table 1) are calculated based on the data of the State Treasury Service of Ukraine regarding the expenditures for staff training by Higher Education Institutions (HEIs) of I-IV levels of accreditation and provision of their practice facilities and data from the statistical bulletin of the State Statistics Service of Ukraine "Main indicators of Higher Education Institutions of Ukraine" on higher education student enrollment.

Budgetary expenditure for vocational education (Table 1) is calculated on the basis of data from the State Treasury Service of Ukraine on expenditure for training of workers in vocational educational institutions and their methodological support and data from the statistical bulletin of the State Statistics Service of Ukraine "Continuing Education and Vocational Training" - on vocational education student enrollment.

Table 1

Output data for calculating the fiscal return from higher and vocational education in Ukraine

Indicator	Vocational (post-secondary non tertiary) education	Higher education
Duration of training, years	3	5
Age at the start of study, years	16	18
Direct budget expenditure on education during the whole period of study per pupil/student, UAH	2476*3=7428	12504*5=62520
Lost budgetary income/alternative budgetary expenditure, UAH	4980	41334

Note: in 2012, 996690 students studied at Higher Education Institutions of I-IV levels of accreditation at the expense of the state budget. 12463025349.69 UAH was allocated from the general state budget on the training of the personnel of Higher Education Institutions of I-IV levels of accreditation and on the provision of their practice facilities. For the training of workers in vocational schools, 1047886857.73 UAH was allocated from the general state budget and 423279 students were trained according to the state order.

Source: [12-16].

To estimate the fiscal return on investment in education, it is necessary to compare the expenditure over the whole period of education, which is five

applied to bring the future value of tax revenues (Rt) to the present value of the budgetary investment in education (C_t). For the calculations in the article, the discount rate is 1.5%.

⁴ Alternative expenditure.



years in Ukrainian higher education and three years in vocational education, with tax revenues over the working life, in other words, up to the age of 65.

The starting age for studies in Higher Education Institutions may be between 16 and 20 years, and between 15 and 18 years in vocational schools [12-14]. For calculations, the starting age for studies at a higher education institution is 18, and the starting age for studies at a vocational institution is 16.

The budgetary expenditure for higher and vocational education (C_t) in formula (2) consists of the sum of direct budgetary expenditure and lost budgetary revenues.

Lost budgetary revenues. It is assumed that no tax-relevant income is generated during training. The lost tax revenues and social security contributions that students would pay, if they worked, from a fiscal point of view represent lost revenues or opportunity costs from investment in education. For vocational education, the alternative budgetary expenditure consists of taxes and social contributions of persons with secondary education, paid at the age of 17. For higher education, the alternative budget expenditure consists of taxes and social contributions of persons with secondary education, paid at the age of 18-22 years (Table 1). The lost budgetary revenues in the article are calculated on the basis of wage data of persons of the indicated age with full secondary education and current tax legislation.

The most comprehensive information concerning the level of wages of people with different levels of education is contained in the Ukrainian Longitudinal Monitoring Survey (ULMS) [15], which in Ukraine was conducted by the Institute of Labor Economics (IZA) in 2003, 2004, 2007 and 2012. It compiles data on employment, unemployment, education and income of the Ukrainian population aged 15 and over. For the calculations, the article uses the most recent data for 2012.

Budgetary revenues (R_t) in formula (2) are modelled on data regarding the wages of individuals with higher and vocational education and current tax legislation.

To model the fiscal returns on investment in higher education, it is necessary to look at the likely employment history of a graduate who starts work at age 23 and ends work at age 65. To synthesize this information, the ULMS cross-sectional data sample randomly selected university graduates in each age group: the first one was 23 in 2012, the second one was 24, the third one was 25, ..., and the 43rd one was 65 years old. The result is 43 age-education combinations, for each of which a basic sample of annual wage data is generated (Table 2, 2nd column). At the same time, the average value of wages in the synthesized sample with ULMS and the amount of taxes and social contributions paid on this basis is not sufficient to draw conclusions about the fiscal return on investment in higher education. In practice, some higher education graduates of the labor market turn out to be more successful than others. Therefore, in order to estimate the fiscal return on investment in higher education, the statistics of the probability distribution of the return on investment in higher education of a larger number of synthetic employment histories should be determined. For this purpose, multiple samples were generated by bootstrap re-sampling (250 times⁵), based on the baseline sample from ULMS-2012 (Table 2, pp. 3-6).

⁵ The minimum number of combinations is 50. It is optimal if the number of combinations is at least $n * (\log(n))^2$, where n is the base sample size.

Table 2

Synthesis of employment history of graduates from ULMS-2012 cross-tabulated data and sample generation obtained by extracting indicators with return

Age of university graduate in 2012	Annual salary of a graduate of a certain age, benchmark sample	Bootstrap sample 1	Bootstrap sample 2	...	Bootstrap sample 250
1	2	3	4	5	6
65	66168	9600	19200	...	0
64	0	48000	27600	...	22800
63	8640	12000	12000	...	48000
62	20400	21600	55200	...	36000
61	36000	0	36000	...	30000
60	24000	0	16800	...	20400
59	24000	20400	0	...	55200
58	120000	20400	0	...	26400
57	9600	36000	0	...	0
56	22800	27600	8640	...	20400
55	48000	27600	22800	...	55200
54	36000	48000	19200	...	26400
53	30000	36000	8640	...	24000
52	20400	36000	36000	...	24000
51	55200	0	20400	...	12000
50	26400	18000	30000	...	9600
49	27600	42000	16800	...	0
48	30000	20400	120000	...	25200
47	21600	18000	55200	...	18000
46	18000	42000	18000	...	66168
45	16800	20400	54000	...	21600
44	36000	36000	19200	...	18000
43	24000	55200	20400	...	16800
42	24000	22800	48000	...	36000
41	12000	0	9600	...	24000
40	19200	22800	19200	...	24000
39	21600	36000		...	12000
38	24000	18000	30000	...	21600
37	48000	120000	36000	...	66168
36	36000	20400	21600	...	120000
35	25200	19200	48000	...	0
34	18000	36000	0	...	120000
33	21600	42000	18000	...	21600
32	0	54000	20400	...	25200
31	42000	55200	19200	...	18000
30	36000	18000	120000	...	120000
29	36000	6000	54000	...	25200
28	18000	36000	20400	...	6000
27	20400	22800	36000	...	120000
26	36000	42000	21600	...	21600
25	6000	36000	0	...	25200
24	54000	36000	48000	...	6000
23	18000	54000	36000	...	0

Source: author's calculations.

For each of the 250 samples generated, the fiscal return on investment in education is calculated (r). The average of the resulting estimates will characterize the overall level of fiscal return on investment in education in the country.

The probable employment history combines different questionnaires of a sociological survey, so that according to it a university graduate does not work one year, earns very well the next year, but the following year earns below the average. This construction of synthetic employment histories based on cross-sectional data can lead to greater income dispersion than in a longitudinal estimation. The most important advantage of this approach is that a sufficient number of (synthetic) life cycles can be created in the context of limited source data.

For a vocational graduate, the probable employment history covers ages 19 to 65, in other words, it contains 47 age-education combinations, for each of which, similarly to the case with a university graduate, the annual earnings are found using ULMS cross-sectional data.

Results of the fiscal return on investment in education in Ukraine

The calculations for Ukraine are based on tax rates, unemployment benefits and state social assistance per person. In 2012, the personal income tax rate in Ukraine was 15% and the unified social contribution amounted to 34.7%. In calculations, unemployment benefit in 2012 is 544 UAH, and state social assistance per person – 1129.7 UAH. The data on the assistance received by vocational graduates are taken from the ULMS. Assistance is included in public expenditure (C_i) in formula (2).

The estimated fiscal return on investment in vocational education and training in Ukraine in 2012 based on the proposed approach is 7.4%, which is the average of 250 estimates obtained for each of the generated employment histories of a vocational graduate. The variation in these estimates within the 95% confidence interval for the 250 synthetic employment histories generated is shown in Figure 1. For investments in vocational education, the 5th percentile return is 6.3% and the 95th percentile return is 8.5%.

The estimated fiscal return on investment in higher education in Ukraine in 2012, based on the proposed approach, is 3.8%. The spread of these estimates within the confidence interval for the 250 synthetic employment histories generated is shown in Figure 2. For investment in higher education, the 5th percentile fiscal return is 3.0% and the 95th percentile is 4.6%.

The range of variation in the fiscal return on investment in higher education in Ukraine is larger than the corresponding range for vocational education. In general, the range of fiscal return values for different possible employment histories is due to changes in employment status, as well as taxes and social contributions paid and transfers received under this status.

The proposed approach allows for a scenario-based assessment of the fiscal return on investment in education, which are based on projections of wage levels and the amount of public investment in education, and can also take into account changes in tax rates and social contributions. Given that after 2012 Ukraine increased wages and changed public funding for education and established new personal income tax and unified social contribution rates, it is useful to apply the proposed approach to estimate the fiscal return on investment in education as of 2020.

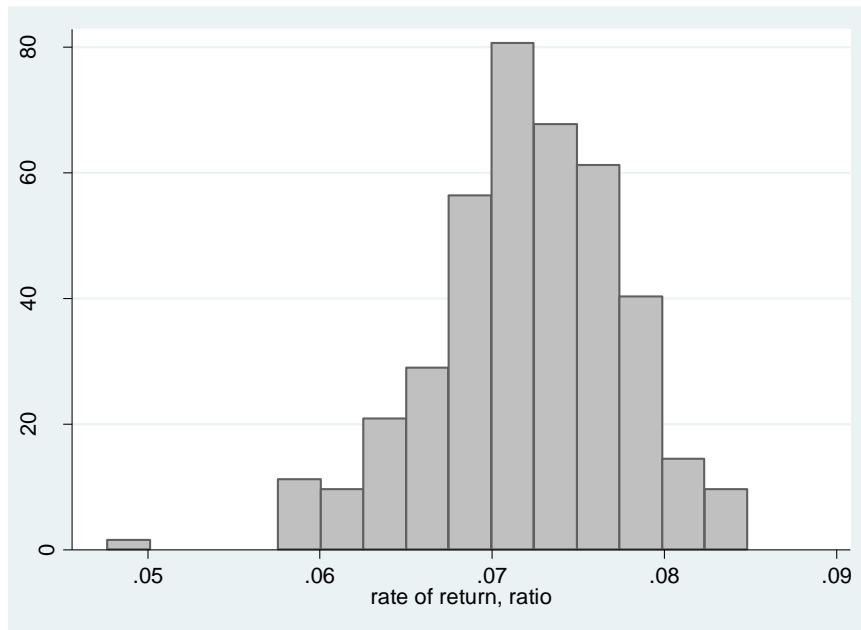


Figure 1. Dispersion of fiscal return on investment in Ukrainian vocational education in 2012

Source: based on the author's calculations.

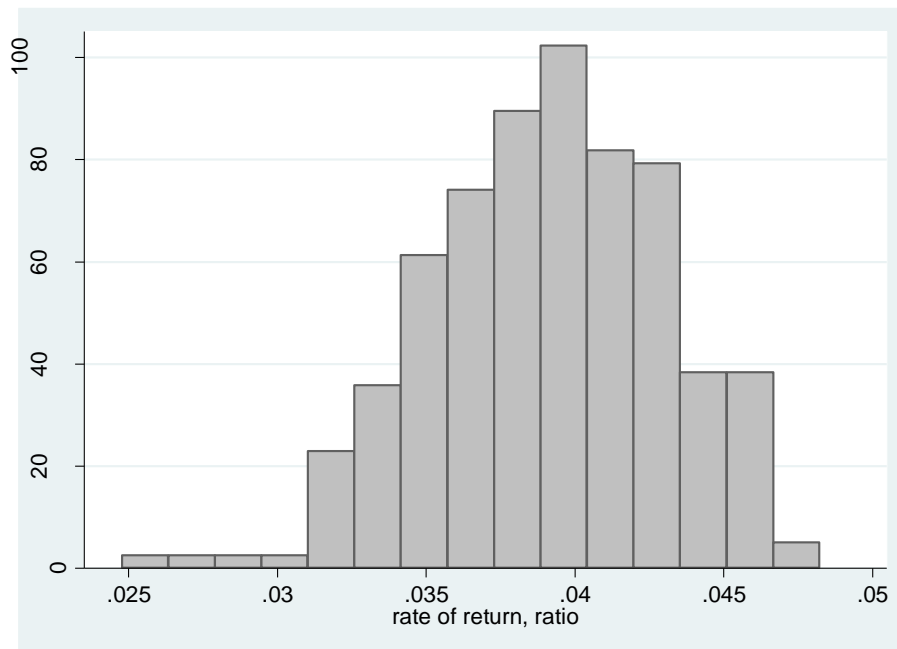


Figure 2. Dispersion of fiscal return on investment in Ukrainian higher education in 2012

Source: based on the author's calculations.

473509 students studied at High Educational Institutions of I-IV levels of accreditation at the expense of budget funds in 2020. 17709742589.83 UAH was allocated from the general state budget for training personnel of High Educational Institutions of I-IV levels of accreditation and ensuring their practice facilities operation. In order to provide vocational (technical and vocational) education in state-owned social rehabilitation and adaptation educational institutions, methodological support for vocational (technical and vocational) education institutions, as well as for staff training by vocational higher education institutions, the state budget allocated a total of 4098610357.47 UAH, and 246900 pupils were trained under the state order.

The minimum wage in 2020 is 4.4 times higher than in 2012. Personal income tax in 2020 was 18%, the war tax was 1.5%, and the single social contribution was 22%.

Taking these changes into account, the fiscal return on investment in vocational education and training in 2020 is 6.5%, which is by 1.1 percentage points lower than in 2012 (the variance of the respective values is presented in Figure 3). For investments in vocational education, the 5th percentile return is 5.5% and the 95th percentile return is 7.6%.

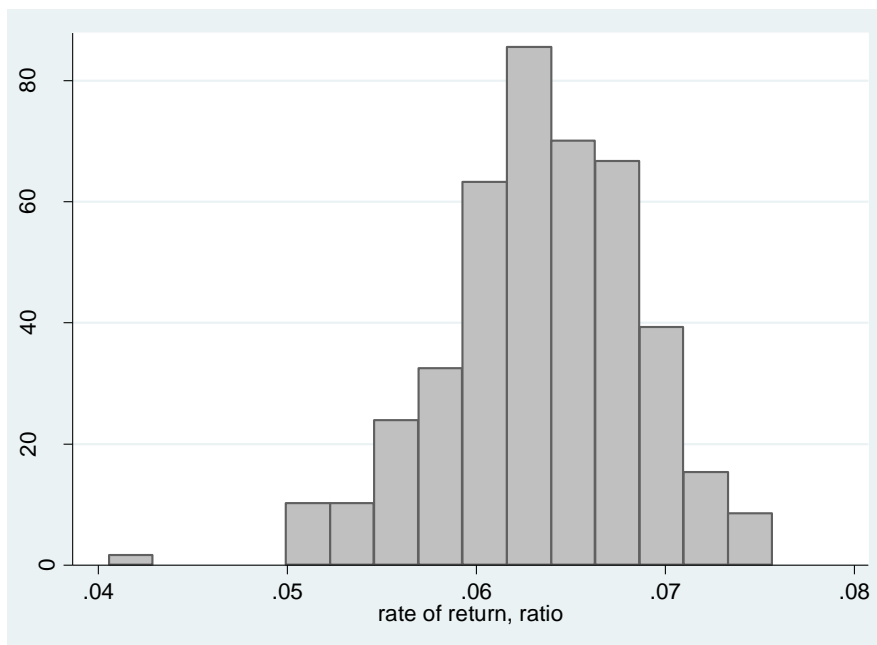


Figure 3. Dispersion of fiscal return on investment in Ukrainian vocational education in 2020

Source: based on the author's calculations.

The fiscal return on investment in higher education in 2020 is 4.2%, which is by 0.4 percentage points higher than in 2012. The spread of the 2020 estimates within the confidence interval for the 250 synthetic employment histories generated is shown in Figure 4. For investment in higher education, the 5th percentile of the fiscal return is 3.3% and the 95th percentile is 5.0%.

In Ukraine, the fiscal return from higher education in 2012 was 3.8%, while that from vocational education was almost twice as high (7.4%). The difference is primarily due

to lower public expenditure on vocational education, as well as the longer employment history of individuals with vocational education. Forecasts for 2020 indicate that the fiscal return on investment in higher education increased by 0.4 percentage points compared to 2012, while the fiscal return on vocational education decreased by 1.1 percentage points. The increase in the level of returns to tertiary education in 2020 indicates an increase in the benefits of investing in tertiary education and the labor market advantages of higher education graduates. Estimates for Ukraine correspond to the average indicators obtained in the OECD study [7, pp. -103].

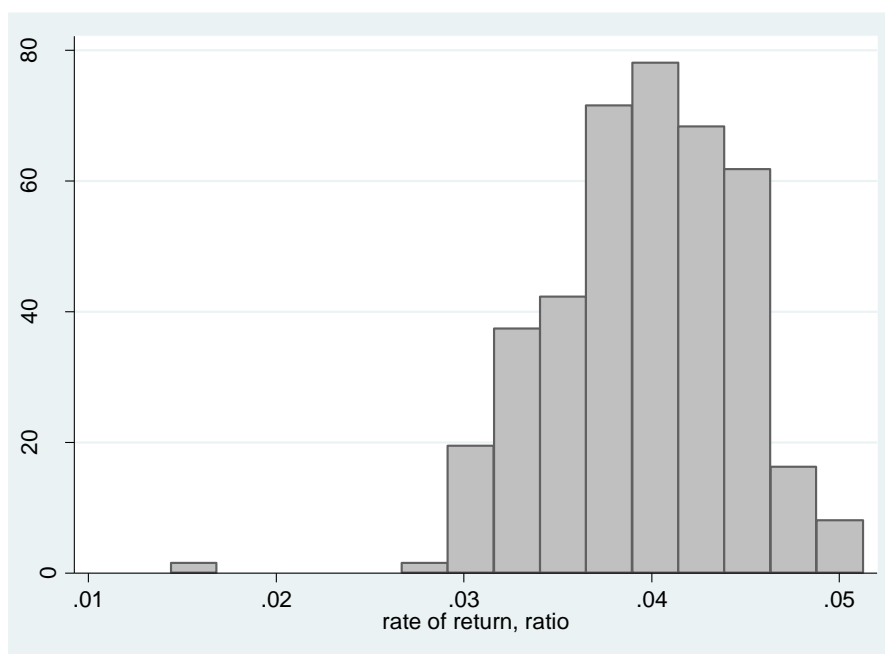


Figure 4. Dispersion of fiscal return on investment in Ukrainian higher education in 2020

Source: based on the author's calculations.

Conclusions

The approach proposed in the article makes it possible to estimate the fiscal return on investment in education at different levels, in particular in vocational and higher education. The resulting estimates have practical applications. Taking into account that the reform of the education system continues in Ukraine, which aims at solving the issues of cost of contract education in higher education institutions, changes in the proportions of public and private funds in financing higher education, and optimization and expansion of the network of vocational education institutions with an increase in their funding, the obtained estimates can be included in the indicators of justification of the reform measures.

A relevant area for the development of the toolkit proposed in the article is its application to assess the social returns of education, which should include the impact of education on economic growth, health, security, its participation in democratic processes, etc. The social rate of return includes the full value of the investment - the direct costs to government and private organizations, the lost income to learners, and

the non-monetary benefits of education (e.g. the number of lives saved due to improved sanitation because more women were educated). Presently, the question of assessing the public impact of education remains open.

Improving the educational level of the population is among the global development goals that require increased public investment in countries' educational systems. With the global economic crisis brought on by the coronavirus pandemic, the issue of effective investment in education became more acute. The COVID-19 pandemic created multidimensional challenges for the education sector, highlighting the lack of preparedness of the current education systems for the digital transfer of knowledge, and exacerbating the already existing structural imbalances. Consequently, there is a need for proactive investment in education aimed at developing more resilient education systems that are able to respond and adapt to future crises. Positive returns on public investment in education in this context demonstrate the space for fiscal maneuver.

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ІНСТРУМЕНТАРІЙ ОЦІНКИ НАПРЯМІВ БЮДЖЕТНОГО ФІНАНСУВАННЯ ОСВІТИ У ПОСТКРИЗОВИХ УМОВАХ

Державне фінансування освіти належить до найважливіших фіскальних інструментів реагування на виклики постпандемічного відновлення економіки. Інвестиції у вищу та професійну освіту формують основу для зростання загальної факторної продуктивності, а отже – й економічного зростання. Водночас в умовах жорсткої бюджетної економії, яка визначатиме напрями бюджетної політики країн, що розвиваються, у середньостроковій перспективі, потребують ідентифікації ключові напрями фіскальної активізації чинників економічного зростання. До інструментарію оцінки напрямів державного фінансування освіти як одного з найважливіших чинників постпандемічного економічного відновлення в умовах жорсткої бюджетної економії запропоновано віднести показники віддачі від інвестицій в освіту різних рівнів. Різниця в оцінках віддачі від різних освітніх рівнів можуть бути враховані при розробленні державної політики фінансування освіти.

У статті здійснено апробацію для України підходу Центру європейських економічних досліджень до розрахунку віддачі від інвестицій у вищу та професійно-технічну освіту. Особливістю запропонованого підходу є можливість симуляції достатньої кількості

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даних щодо рівня доходів фізичних осіб в умовах обмеженої інформації. Окрім даних щодо рівня заробітної плати осіб з вищою та професійно-технічною освітою, розрахунки у статті базуються на розмірах бюджетних видатків на освіту протягом усього навчання у розрахунку на одного учня/студента, ставках податків з доходів фізичних осіб, сум допомоги по безробіттю і державної соціальної допомоги на одну особу. Запропонований підхід дозволяє здійснювати сценарні оцінки віддачі від інвестицій в освіту, які базуються на макроекономічних прогнозах та враховують зміни у податковому законодавстві. З'ясовано, що в Україні віддача від інвестицій у вищу та професійну освіту відповідає середнім показникам країн ОЕСР. Окреслено напрями розвитку запропонованого методичного підходу та визначено актуальні сфери для його застосування⁷.

Ключові слова: бюджетне фінансування освіти, віддача від інвестицій в освіту, економічна криза, пандемія COVID-19, державна допомога, податкові надходження

⁷ Публікацію підготовлено в рамках виконання НДР "Розвиток фіскального простору для забезпечення економічного зростання" (№ держреєстрації 0119U003650).