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PUBLIC FUNDING OF EDUCATION AS A FACTOR OF ECONOMIC GROWTH

The main approaches to the analysis of the impact of education on economic growth consist in assessing the link between economic growth indicators (GDP/GDP growth per capita) and three groups of educational indicators: quantitative ones (educational attainment – coverage of population by an education level), qualitative ones (standardized grades of students) and the amounts of educational funding. At the same time, educational attainment and the quality of knowledge obtained depend on the amount of educational funding. The article proves that there is a significant positive relationship between indicators of state funding of higher and secondary education per student and a country's total factor productivity. At the same time, there is no unified optimal scheme for the distribution of public funding between the educational levels: to accelerate the pace of economic growth, some countries prioritize primary education, others – secondary or higher education. As stated in the article, this depends on the country's technological level, the existing educational and professional structure of human capital, and such contextual factors, as the quality of institutions in the country. The article discusses practical approaches to financing various levels of education at the expense of public and private funds, where the latter are presented in the context of private funds, and state transfers to families with students – that is public-to-private transfers. The article concludes that public educational funding – both direct and in the form of public-to-private transfers – considered at various levels, indicates prioritization of the specific educational and professional composition of human capital. The results of the study indicate the need to harmonize approaches to budgetary processes in the field of educational funding with a country's technological, qualificational, and institutional prerequisites, as well as with strategic forecasts of the socio-economic development of national economies.

Keywords: *public funding of education, fiscal space, public-to-private transfers, economic growth, total factor productivity, world technological frontier*

Problem statement. Economic growth indicators today are affected by demand and supply shocks caused by the COVID-19 pandemic. The world economy has not recovered from the previous global financial crisis of 2008, which trapped it in low-growth rates, and now it is under attack again. This creates new obstacles to macro-financial stability, sustainable employment, poverty reduction and social equality, and convergence between developing and developed economies. Thus, the issue of securing growth preconditions, which already more than a decade has

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been a challenge for monetary, fiscal, social and other policies, as well for the international financial and non-financial organizations, is becoming important now.

Education is an accepted driver of economic growth. The theory describes at least three mechanisms of education affecting economic growth. Firstly, education increases human capital accumulation, embodied in the labor force, that increases labor productivity and boosts the equilibrium output (as in neoclassical growth models, for example Lucas). Secondly, education can increase the innovative potential of the economy, as the knowledge on new technologies, products and processes promotes economic growth (which is reflected, for example, in endogenous growth models by Agion-Howitt). Thirdly, education can contribute to the dissemination and transfer of knowledge needed to understand and process new information, as well as to successfully implement new technologies developed by others, which again accelerates economic growth (reflected, for example, in the Nelson-Phelps model).

Despite the expansion of private sector in education, the main source of educational funding remains government budget. At the same time, given that the fiscal space of countries is shrinking under the pressure of new shocks and the extraordinary costs of immediate measures in response to the COVID-19 pandemic come to the fore, educational funding is threatened with decline, especially in developing countries. In the current circumstances, the study of approaches to public funding of education in the context of providing the preconditions for economic growth is important.

The purpose of this article is to study approaches to public funding of various levels of education in the context of creating preconditions for economic growth in countries with different indicators of technological development and educational composition of human capital, as well as practical recommendations concerning those approaches' transformation at a time of technological change.

The analysis of publications. A common method for determining the impact of education on economic growth is cross-country regressional analysis, in which the average annual GDP growth per capita over several decades in a sample of countries is expressed as a function of educational policy and other variables. Educational factor in such regressions is usually considered in terms of statistics on:

– public expenditure on education as a percentage of GDP – which reflects public investment in human capital;

– the share of the population aged 25 and older with completed secondary education and completed higher education – which reflects educational level of the workforce;

– students' scores on standardized international tests (for example, the average score for mathematics, science and reading in the Programme for International Student Assessment PISA) – which reflects the quality of education [1, p. 15–16].

The amount of knowledge and level of qualification obtained during one year of study depends on the effectiveness of the educational system: the quality of education, educational infrastructure, curriculum, etc. Thus, a more informative educational indicator for determining the impact of education on economic growth is the number of students who actually obtained knowledge in educational institutions, compared to the total number of students enrolled. Thus, E. Hanushek and D. Kimko [2], using the data on international tests of student's performance in 1991, substantiated the statistically and economically significant positive impact of the quality of education on economic growth in 1960-90, which was much greater than the link between quantitative indicators of education and economic growth. E. Hanushek, D. Jamison and L. Wessman [3] concluded that, when applying quality of education in the assessments of economic growth, the problem of causal links between education

and economic growth qualitatively differ from applicating the number of school years, and that this considerably facilitates the interpretation of received results.

At the same time, important studies, in particular those by J. Benhabib and M. Spiegel [4], R. Griffith [5], R. Bronchini [6] and A. Eros [7], A. Krueger and M. Lindall [8], show that indicators like the number of school years and the completion of secondary and higher education are associated with an output increase due to improved total factor productivity and contribution to human capital.

The results of some empirical studies that prove positive effect of state funding of education on economic growth can serve as the basis for specific practical recommendations. Thus, in the study of K. Sala-i-Martin, J. Doppelhofer and R. Miller, in economic growth regressions for a sample of 88 countries, with 67 explanatory variables, the most stable factor influencing GDP growth per capita in the period 1960–1996 is primary education [9]. In the work of J. Wei [10] it is substantiated that investments in education, expressed by two variables – the teacher-to-student ratio and the amount of educational funding – significantly affect the total factor productivity. At the same time, the results of evaluations conducted for China differ from one region to another: increasing funding for primary education can boost total factor productivity at the national level; however, secondary education's funding should be increased in eastern regions of the country, and higher education's - in the central one.

This shows that there is no single recipe for all: in order to revive the educational driver of economic growth, countries must build sound approaches to public funding of different levels of education according to the preconditions existing in particular countries. Accordingly, the study of practical approaches to educational funding in countries with different levels of economic development is a contribution to the empirical justification of the relationship between educational funding and economic growth.

Presenting main material. The contribution of human capital to total factor productivity has increased significantly over the last sixty years: from 20–65% in 1960 to 95–115% in 2020 (Fig. 1), while the contribution of fixed capital has a smaller range of change over the corresponding period – 70–120% (Fig. 2).

The growing importance of human capital corresponds to increased duration of training. Thus, in 1950, the average duration of study in developed countries was six years, and today – more than 10 years; in Africa, the average duration of study in 1950 was less than two years, and today it is more than five years. Between 1950 and 2010 in East Asia, this figure more than tripled: from two to seven years, and according to forecasts by 2050 it will reach 10 years worldwide [12].

The amount of public funding of education also increased (Table 1).

For example, while in 1913 in Germany state (hereinafter – meaning public) funding of education was 2,7% of GDP, in 2014 this figure increased up to 4,92% of GDP, in Japan state funding of education increased from 1,6% of GDP in 1913 to 3,59% of GDP in 2014, and in Spain – from 0,4% of GDP to 4,28% of GDP.

At the same time, empirical data show that additional funding of education does not in itself guarantee a significant improvement in students' scores on standardized international tests that show the quality of education. Thus, according to the OECD, there is no direct link between educational expenditures and students' scores, in particular in the field of reading: Finland, Austria and Portugal, where the share of expenditures on education in GDP is about 6,0%, differ significantly by reading scores (PISA): 540 units for

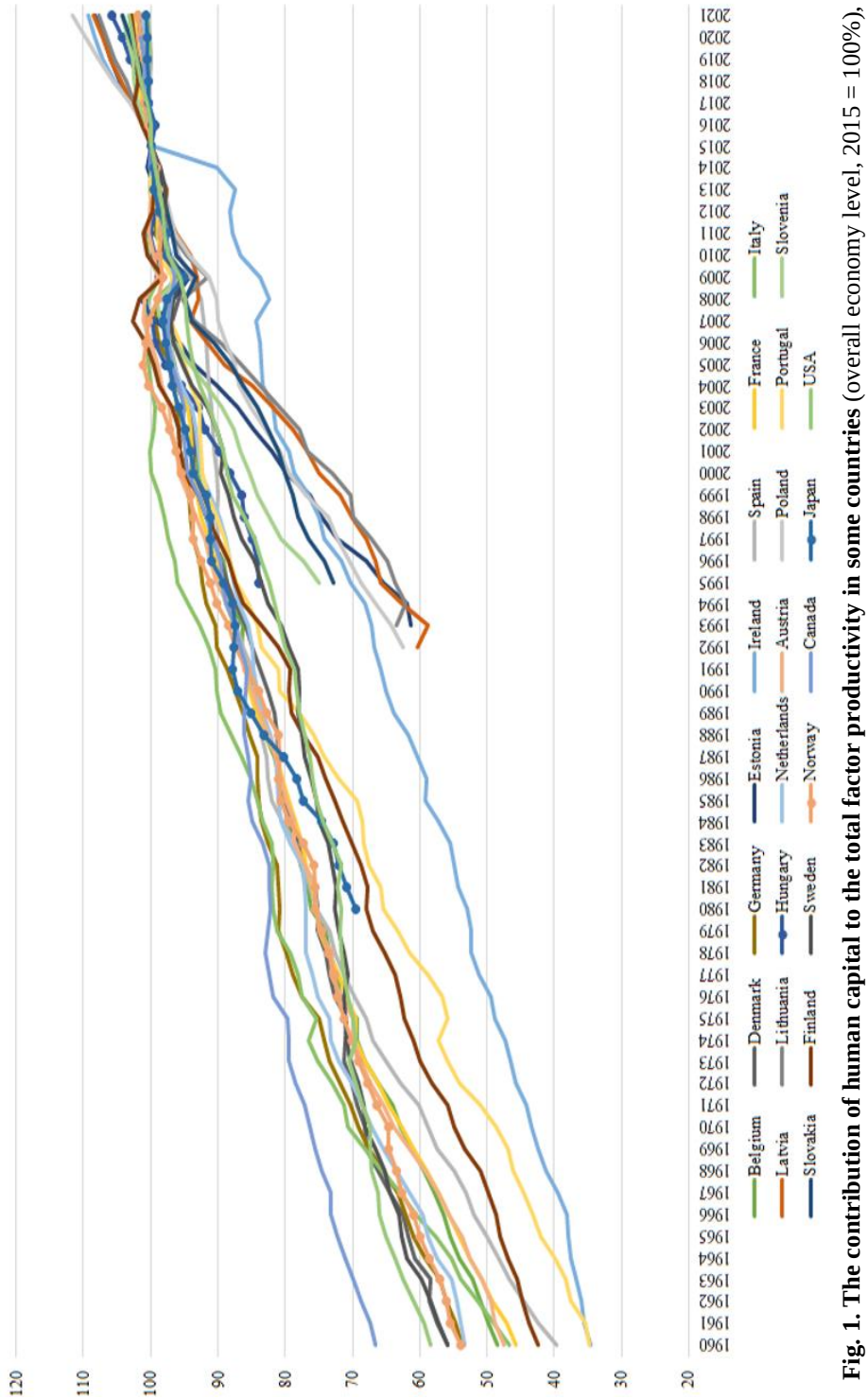

Fig. 1. The contribution of human capital to the total factor productivity in some countries (overall economy level, 2015 = 100%), **1960–2020, %**

Source: [11].

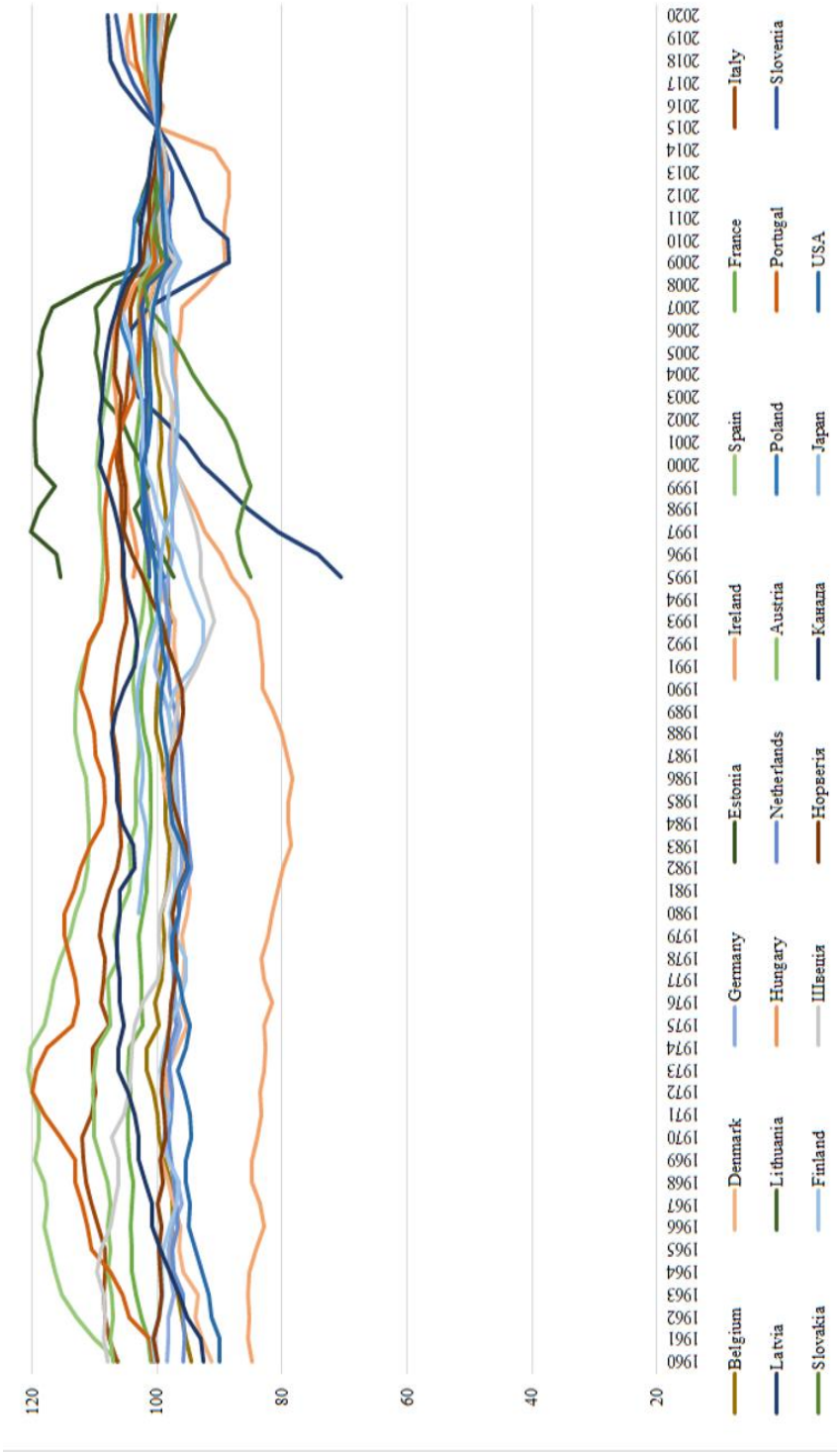

Fig. 2. The contribution of fixed capital to the total factor productivity in some countries (overall economy level, 2015 = 100%), **1960-2020,** %

Source: [11].

Finland, 490 units for Austria and 475 units for Portugal [15, p. 20–21].

Table 1

The amount of public funding of education in some OECD countries in 1913–2014,
% of GDP[2]

Country	1913	1937	1960	1980	2000	2014
Austria	н.д.	2,50	2,90	5,01	5,59	5,45
Australia	н.д.	0,70	1,40	5,65	4,89	5,16
Belgium	1,20	н.д.	4,60	5,28	н.д.	6,64
Canada	н.д.	н.д.	4,60	6,48	5,44	н.д.
France	1,50	1,30	2,40	4,31	н.д.	н.д.
Germany	2,70	н.д.	2,90	н.д.	н.д.	4,92
Italy	0,60	1,60	3,60	н.д.	4,30	4,08
Japan	1,60	2,10	4,10	н.д.	н.д.	3,59
Ireland	н.д.	3,30	3,20	5,32	4,14	4,88
Netherlands	н.д.	1,50	4,90	5,89	4,59	5,46
Norway	1,40	1,90	4,20	5,78	6,46	7,68
Spain	0,40	1,60	1,30	н.д.	4,18	4,28
Sweden	н.д.	н.д.	5,10	6,62	6,81	7,67
USA	н.д.	н.д.	4,10	н.д.	н.д.	4,96
United Kingdom	1,10	4,00	4,30	5,07	4,07	5,66

Note: n.a. – not available.
Source: [13, 14].

Relative measures of educational financing – wether it is the share of educational expenditures in GDP or in total government expenditures – are non-informative indicators for the economic growth preconditions. For example, countries with high ratios of educational funding include those with very low income: the Federated States of Micronesia (12,5% of GDP and 22,3% of total state expenditure is spent on education), Senegal (7,1 and 21,3%, respectively), and Belize (6,7 and 19,9%, respectively) [14]. Separate relative measures of educational financing are unreliable characteristics for the quality of education and the impact of education on economic growth at the national level. The quality of education significantly depends on the maintenance position of educational institutions: textbooks, means of communication and visualization, improvised consumables for practical classes, modern models of mechanisms and machines, and so on. The latter often have to be purchased on world markets at world prices, and therefore the cost of equipping educational institutions as a percentage of the country's GDP does not necessarily indicate the quality of education in that country.

In contrast to relative ratios, the cost indicators of educational financing are much more informative in the context of assessing the provision of educational institutions and pupils/students with training tools. Figure 2 summarizes the amount of public and private funding per pupil/student at different levels of education in some countries.

[2] The World Bank provides the most complete national sample of education funding for 2014

Table 2

Public and private funding per pupil/student in some countries in 2014,
constant U.S. dollars[3]

Country	Funding per pupil/student:			
	Higher education, including:		Secondary education, including:	
	state	*private*	*state*	*private*
Norway	31336,9		17947,7	
Denmark	23521,5		16981,7	
Sweden	22106,0		12344,2	
Austria	16502,8		12468,3	
Finland	15539,3		11317,4	
Germany	15497,8		9953,4	
USA	11702,2	6985,6	12365,0	1163,8
Ireland	11214,7	395,4	11069,6	
Hong Kong (China)	10223,2		8026,6	
Japan	9214,8	7147,5	9081,0	4131,1
Israel	8156,3	3224,9	6881,9	1459,5
Italy	8107,0	1948,5	6857,0	1798,2
Spain	5902,9	1744,5	4679,6	791,8
Estonia	5683,6		3583,9	20,9
Portugal	5270,7	1534,9	5747,2	958,0
Slovenia	4618,9	26,6	5280,3	337,9
Slovakia	4257,0	618,6	3082,3	509,2
Poland	3264,4	255,3	2754,5	405,3
Latvia	3067,5	807,9	3404,7	131,3
Lithuania	3066,1	520,7	2553,6	81,9
Hungary	2997,5		2963,4	
Ukraine	1022,1	412,9	713,9	40,2

Note: According to the International Standard Classification of Education, secondary education includes the first stage of secondary education (level II), which includes pupils aged 10–12 years to 14–16 years, and the second stage of secondary education (level III) – pupils aged 14–16 years to 17–18 years. Higher education includes: a short cycle of higher education (general and vocational), involving students aged 17–18, in other words, after completing level III, or aged 16 to 20, in other words, after completing level IV; the duration of short-cycle higher education programs is two years; 6 – bachelor's level of higher education involves the admission of students aged 17–18 years, in other words, after completing level III, or aged 16 to 20 years, in other words, after completing level IV, possible admission after level V, the duration of programs at this level is four years; 7 – the master's level of higher education provides for the admission of students aged 17–18 years, in other words, after level III, or aged 20 to 24 years, in other words, after level VI, the duration of programs is from one to four years,

[3] US dollars at constant prices of 2010. According to the World Bank methodology, to calculate price indicators in constant US dollars, the first step is to determine the price index as the ratio of the actual price indicator to the price indicator of the selected year - in our case, 2010 (thus, the 2010 value is equal to one). In the second step, the indexes of each year are multiplied by the actual price indicator of the corresponding year.

if the transition to level VII is after level VI, or from five to seven years, when the transition to level VII is made after level III; 8 – doctoral or equivalent level provides for the entry of applicants for the degree of higher education "Doctor of Philosophy" and "Doctor habilitatus" aged 22-28 years, the duration of the program is at least three years.
Source: [14].

Among the countries mentioned in the table, the largest amounts of public funding – both at higher and secondary education levels – is recorded in Norway: 31337 USD per one student of higher education and 17948 USD per student of secondary education. Among the old EU member states, the highest level of public funding of education is in Denmark: 23521 USD per student of higher education and 16982 USD per student of secondary education, and the lowest is in Italy: 8107 USD and 6857 USD respectively. At the same time, in Italy, in contrast to Denmark, the sources of funding for education include private funds: 1949 USD per one student of higher education, and 1798 USD per student of secondary education. One of the world's highest private funding of secondary education in recorded in Japan: 4131 USD per student, with public funding at the level of 9081 USD. In funding for higher education in Japan and the United States, private funds account for more than half. In the new EU member states, private sources of funding for higher education are widespread, but their share in the total is insignificant – from 0,6% in Slovenia to 26% in Latvia. In Ukraine, the share of private funds in the financing of higher education increased and in 2014 amounted to about 40%. At the same time, the amount of funds per student of higher education in Ukraine is very low – three times lower than in the neighboring EU countries, which indicates a low competitiveness Ukrainian higher education.

The global trend in the development of educational policy aimed at long-term economic growth is to facilitate access to education. At the same time, according to a World Bank study [16], despite the fact that almost 90% of low-income countries declare free primary education, 40% of these countries charge for the first stage of secondary education. High educational costs – both official charges and a number of implicit costs – hinders the education of children, especially of those from the most socially vulnerable groups [16, p. 117]. Household expenditures on education (school supplies, educational materials, transport, etc.), that in some countries reach 50% or more of total educational funding, raise the school attendance gap for children from poor families versus those from rich ones. Therefore, measures aimed at reducing income barriers are highly effective in terms of involving children in school education.

The analysis of practical approaches to the state support of private financing of education can serve as a basis for the substantiation of transformation of the financial mechanisms for expansion of the access to education at all levels at a time of narrowing fiscal space.

In Table 2, general public funding of education (at all budget levels) includes public transfers to families with pupils/students (public to private transfers) in the form of grants/scholarships (non-repayable subsidies), public student loans and subsidies to other private persons, and commercial and non-commercial organizations operating in the field of adult education, and subsidies to companies and organizations that implement internship programs, as well as guarantees to private and financial institutions that grant student loans. Accordingly, Table 2 shows indicators of private financing of education less the amount of public transfers and other financial assistance. The amount of private funding of education includes tuition fees, exam fees, contributions to parents' and teachers' associations and other school funds, fees for food and transportation, etc., as well as tuition costs outside educational institutions: purchase of uniforms, textbooks, educational materials, etc. It should be noted that in some countries the zero value of private funding of education is due to the fact that households can receive the same or even much more state aid than they spend on education.

The amount of these public transfers, as well as their ratio in private funds invested in education, indicate the importance of public aid to families with pupils/students. Despite the positive

impact of public-to-private transfers on reducing financial barriers to education, government support for families with pupils/students varies considerably between countries. At the same time, there are some trends in the proportions between public transfers and private funds directed to education: as a rule, the smaller the ratio of state transfers (at primary, secondary and post-secondary non-higher levels of education) to total private expenditures on education, the larger the share of private funds in the total amount of educational funding.

Quadrant IV in Figure 3 shows countries with a high share of private spending and a relatively low share of government transfers to families with pupils/students. And vice versa, countries in Quadrant I are characterized by a lower share of private spending but a higher share of government transfers to families with pupils/students.

Countries in Quadrants III and I are characterized by a lower share of private funding of education, but at the same time – by different ratios of public transfers to private financial resources directed to the educational sector. For example, in Korea and the Netherlands in 2016, the share of private funds in total funding of primary, secondary and post-secondary higher education was the same (14%). However, the contribution of public-to-private transfers in total funding of education differed significantly: 17% in Korea versus 52% in the Netherlands.

In higher educational funding, the situation is similar for countries with a relatively small share of private funding: for example, the relative contribution of public-to-private transfers in private higher educational spending is 6% in the Czech Republic and 66% in Ireland. In both countries private funding of higher education is about the same (27%) (Fig. 4).

At the same time, in countries with a high share of private funding of higher education, there is also a significant difference in the share of public-to-private transfers. For example, in New Zealand it is 60%, while in Japan it is only 20%.

Given the relative ratios of public-to-private transfers and total private funds in financing different levels of education, it is possible to assess the state's policy priority in promoting concrete educational level. As shown in Figures 3 and 4, OECD countries significantly vary in the participation of private sector in funding different levels of education. Thus, in Turkey, the contribution of private funds (after transfers) in the funding of primary, secondary and post-secondary non-higher education is higher than the OECD average, but it is lower in the financing of higher education, which indicates a considerable promotion of obtaining higher education. The opposite situation is observed in Korea and the United States, where basic and secondary education is mainly funded by the state, while private funds are greater in higher education financing.

A more detailed assessment of the impact of public funding of education on economic growth involves analysis of the structure of human capital and determination of the country's distance to the world technology frontier [18]. In the literature on the mechanisms of convergence between the countries that set the technology frontier and the countries that catch up with it, two approaches are used: macro- and microeconomic. According to the macro approach, the unit of analysis is the country or region and focus is on the process of achieving the point of technology frontier. The aim of the macro approach is to directly define the global technology frontier at the level of countries or regions and to verify the compliance of productivity growth in a particular country/region with the reduction of the existing gap relative to the global standard. The distance of the country *c* from the world technology frontier means the ratio of total factor productivity of the country *c* at time *t* to the highest value of this indicator at time *t* of a certain country in the corresponding sample [19, p. 40].

According to the Penn World Table (PWT), which measures the level of productivity of countries and places them relative to the unit, for which the US level is taken, the most productive countries in 2014 were: Norway, Ireland, France, Germany, Netherlands, Belgium,

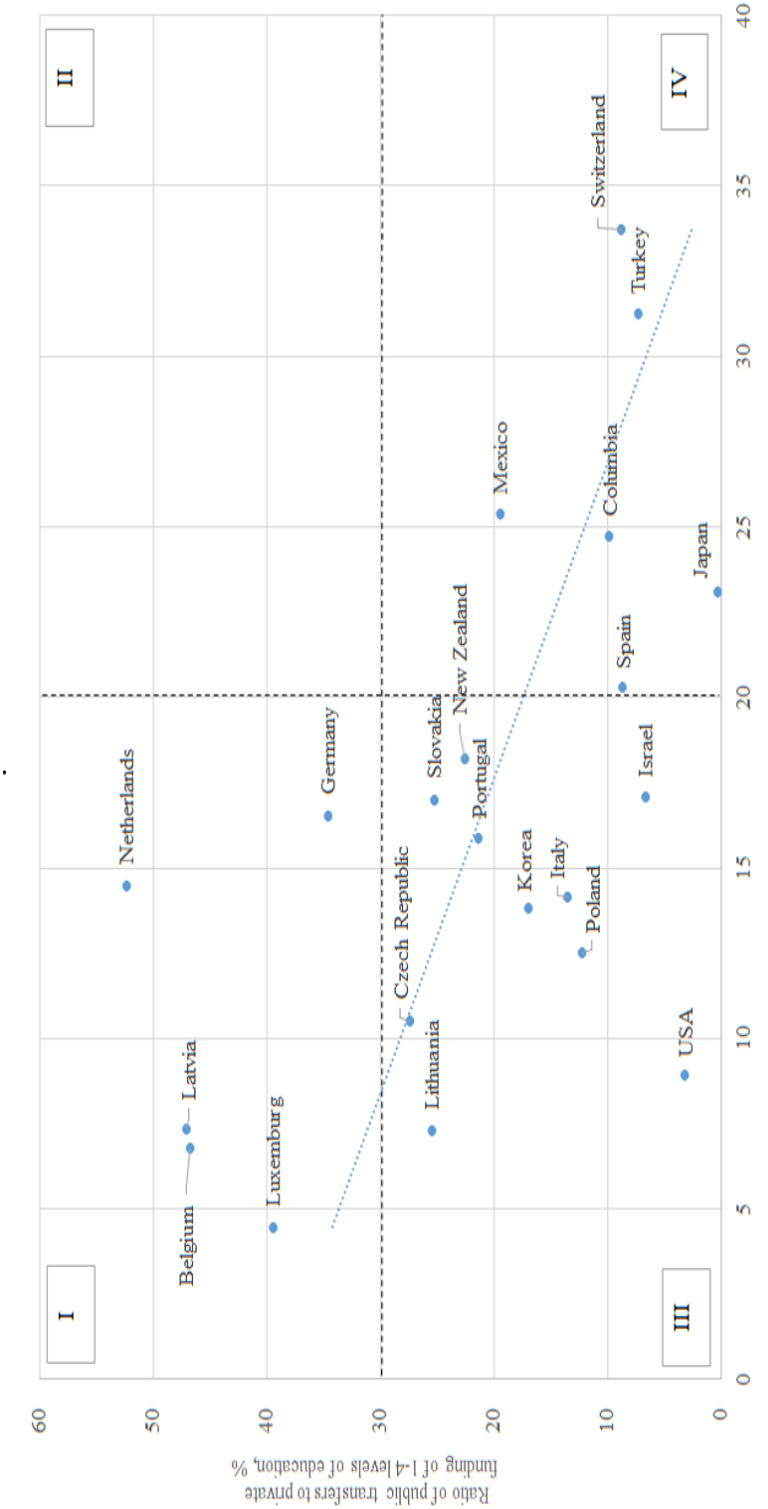

Fig. 3. Ratio of public transfers to private funding of I-IV levels of education and the share of private funding in total funding of relevant levels of education in selected OECD countries in 2016

Note: educational levels are given according to the International Standard Classification of Education, where level I is primary education, level II is the first stage of secondary education, level III is the second stage of secondary education, and level IV is post-secondary non-higher education.
Source: based on [17]..

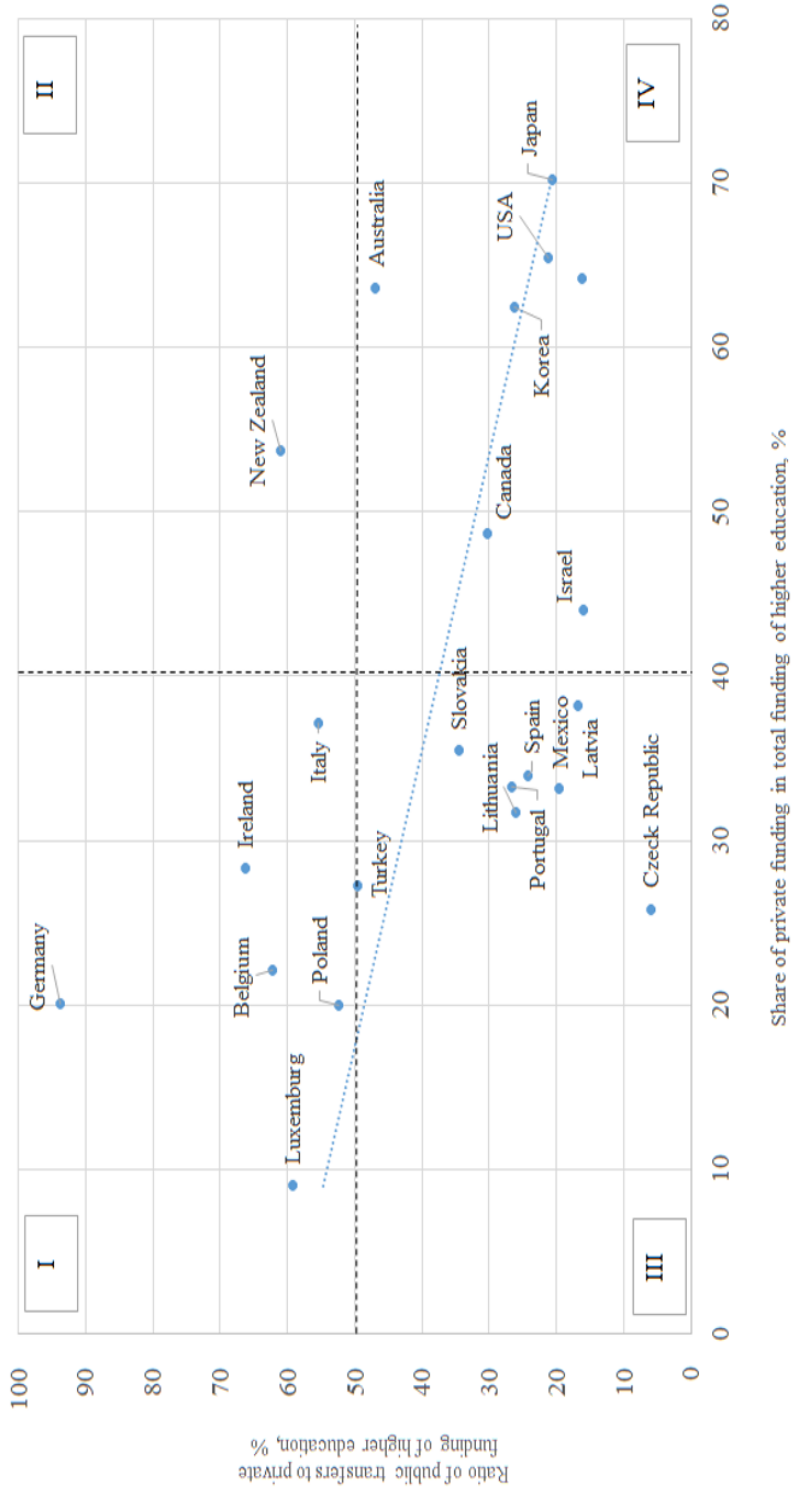

Fig. 4. The ratio of public transfers to private funding of higher education and the share of private funding in total funding of higher education in some OECD countries in 2016

Note: Higher education refers to V-VIII levels of education according to the International Standard Classification of Education.
Source: based on [17].

Denmark, Poland, Spain, Austria, Finland, etc. whose level ranged from 0,8 to 1,4. Countries that ranged from 0,6 to 0,8 included Sweden, Israel, Italy, Lithuania, Japan, Hong Kong (China), etc. Among the countries with the lowest productivity (from 0,2 to 0,5) were Ukraine, and India [20].

The macro approach is used, in particular, in the work of J. Vandenbusch, Ph. Aghion and K. Megir [21], which evaluates data from 22 OECD countries for the period 1960–2000 on higher education, the country's gap from the world technological frontier and changes in productivity. The paper substantiates that education plays an important role in providing research and development and dissemination of technologies. At the same time, manufacturers can put forward different approaches to the process of innovation: either the invention of a fundamentally new technology, or imitation/copying of the existing ones. The choice depends on the country's position in relation to the world technological frontier. Thus, countries that meet the frontier or set it themselves are forced to invent fundamentally new technologies, while developing countries can learn to produce what is already produced by developed countries and thus significantly raise their productivity. The two approaches require different knowledge, skills and experience: for the imitation/copying approach, the development of secondary and applied engineering education is important, while for the invention approach, it is important to develop higher education and science [18].

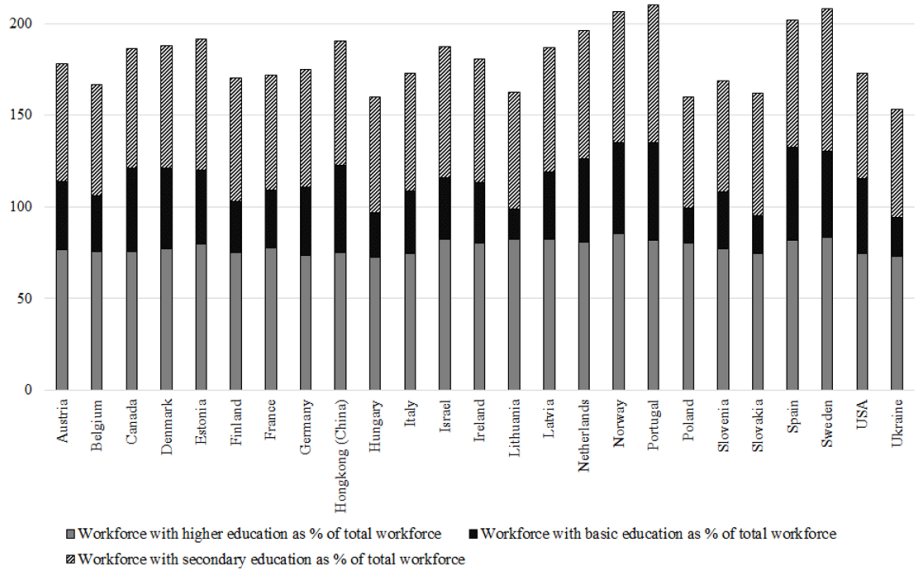

Fig. 5. The distribution of labor force by the level of education in selected countries, 2014, %

Note: The figure shows the percentage of the working age population with the appropriate level of education as share of the country's workforce. Higher education includes short-cycle higher education, a bachelor's degree or equivalent, a master's degree or equivalent, and a doctorate or equivalent. Basic education includes primary or lower secondary education. Secondary education includes secondary and post-secondary non-higher education.
Source: [14].

At the same time, in the practice of many countries the nominal educational structure of human capital is high enough to meet the needs of inventions. Thus, the share of the labor force with higher education is 73–85% (Fig. 5). In other words, judging by the indicator of the population's attendance of higher education, all the countries presented in Figure 5 can set a world technological frontier, which is not the case.

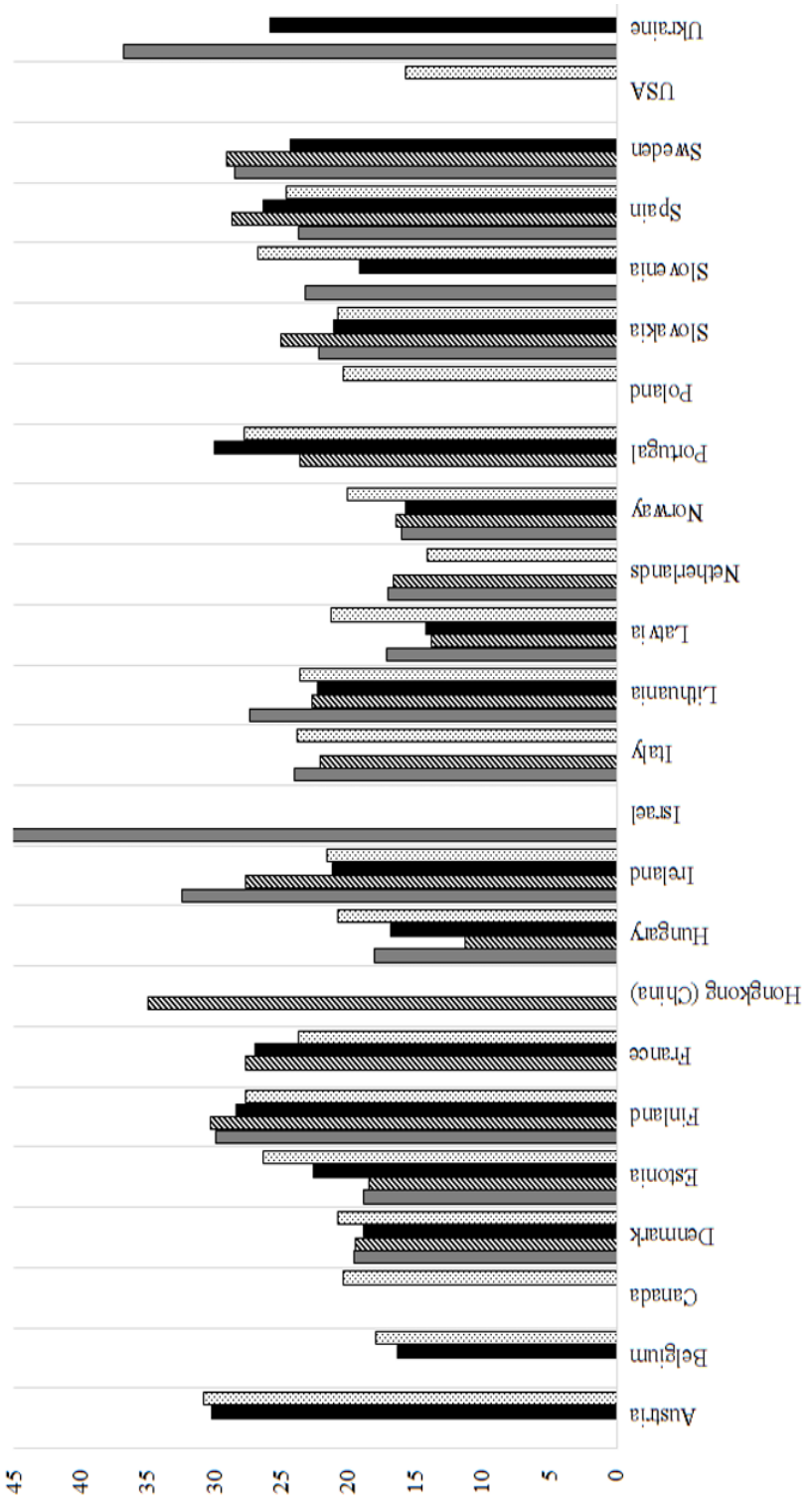

Fig. 6. Percentage of graduates from science, technology, engineering and mathematics programmes in tertiary education in selected countries in 1999, 2004, 2009 and 2014,%

Source: [14].

Professional composition of university graduates is one of the distinctive features of the country's achievement of the world technological frontier. Thus, countries that set a technological frontier can afford to raise the share of graduates of law and finance and economics, while developing countries are interested in increasing the share of graduates of engineering and technological sciences. At the same time, as can be seen in Fig. 6, this is not confirmed in practice. In particular, in 1999 in Ukraine the number of higher education graduates in technical, engineering and mathematical sciences was second only to Israel (among the 24 countries studied). While at the same time Ukraine had a high unemployment rate and belonged to transition economies.

Thus, it is only possible to draw conclusions about the prospects of convergence between countries with different technological capabilities, even in a format narrowed to human capital, when you have a comprehensive picture of the volume and structure of funding of different levels of education, and for different professional and educational compositions of the population, as well as a number of other ("context") factors, the most important of which is the institutional framework of the economy [22, 23]. Differences in the rates and even trajectories of economic growth in different countries are due to the fact that they have created different institutions, some of which promote growth (inclusive institutions), and others suppress growth (extractive institutions).

The macro-approach to defining convergence mechanisms between countries that set technology frontier and countries that catch up with it assumes that all companies in a country or region move to the point of technology frontier, ignoring the heterogeneity in productive efficiency between the companies, and that the selection of mechanisms and relocation of labor, as well as uncertainty, affect economic growth.

On the other hand, the micro-approach aims to eliminate some of these limitations. The unit of analysis is the company itself. Accordingly, at the company level, a national technology frontier reflects the most advanced technology in the country/industry. The micro approach consists in assessing the impact of the company's gap from the technological frontier on its performance. To determine the "marginal" company that sets the frontier, research analyzes the key characteristics of companies: the average age of workers, the number of workers in the company, value added, capital intensity, income, profit and average wage per worker.

The literature on convergence at the company level suggests that a national technology frontier, which is essentially the indicator of "best practice" in a country, can serve as an indicator of a global technology frontier. However, it should be noted that while studies based on data from one country may explain the heterogeneity in performance between firms, as well as clarify the differences in the impact of convergence on different types of firms, there is a high probability of misidentification of the true global technology frontier.

There is a growing number of studies highlighting a high degree of heterogeneity in productive efficiency over time, both between countries and between companies in individual industries. The difference in the productivity of companies within an industry may be even more pronounced than between industries. One of the determining factors for the existence of differences in productivity, as well as one of the reasons for their constant character, is the depreciation of knowledge. Thus, according to L. Bankard [24], almost 40% of the knowledge is depreciated every year, which is due to technological progress, which transforms employment conditions and causes significant changes in the requirements for the qualification of the workforce.

According to World Bank experts [25], even successful educational systems fail to provide skills necessary to compete in today's labor markets. The mismatch between supply and

demand of skills undermines opportunities for economic growth. Today, the demand for analytical and non-standard skills outweighs the demand for operational/manual skills. The most important impact of technological change on the workplace is the changed nature of the tasks that workers will perform as part of their activities with the growing impact of non-traditional and cognitive tasks and a decrease in the importance of routine and manual ones.

Success in a changing job market requires, in addition to job-specific technical skills, also advanced cognitive skills (such as critical thinking and problem solving) and socio-emotional skills (such as honesty, focus, and teamwork). Strong cognitive and socio-emotional skills help workers become more compatible with technology and resistant to change, increasing their ability to learn and adapt and to solve problems and interact well with people. Cognitive and socio-emotional skills are formed from an early age. This means that pre-school, primary and secondary education provide a critical foundation for vocational, higher and lifelong learning, which is so much needed in the face of technological change.

These transformations of knowledge, skills and experience project on educational financing approaches that differ in levels. While the primary and first stages of secondary education are usually financed by the state, at the post-secondary and higher educational levels, the government's responsibility is to provide proper conditions and opportunities for the population to access education. In particular, it is advisable to apply innovative approaches to the higher education financing, for example, to assign the payments for higher education onto the student's future income (calculations of payments can be based on appropriate wage statistics). Regarding preschool education financing, the current trend is to expand the boundaries of public sector's participation in financing early childhood development – both via direct provision of preschool education and via direct and indirect support for families with children [26].

Conclusions

Educational level of the population and the quality of acquired knowledge depends on the amount of public funding of education, whose ratio in total financing remains dominant. The financial capacity to ensure high quantitative and, most importantly, qualitative indicators of education is evidenced by the absolute amount of educational funding, which, in contrast to relative indicators, shows the possibility to create an effective educational environment. Estimates of public funding of education should take into account not only direct public funding, but also public-to-private transfers, which in some countries can reach more than 90% of private financing of education. The high share of transfers makes it possible to reduce income barriers to education, which has a positive effect on economic growth.

At the same time, in order to enhance the educational driver of economic growth, in addition to a high level of educational funding, there must be ensured such educational and professional structure of human capital, which corresponds to the technological level of the economy. Therefore, in the formation of state policy of specialization of higher education graduates, it is necessary to take into account not only the country's current position on the map of technological capacity, but also institutional and political preconditions and forecasts of the national economy.

Constant technological change, which enables economic growth, requires a transformation of knowledge, skills and experience and requires workers of all professions to increase their cognitive and social skills. The development of the educational sphere, resistant to technological changes, involves a transformation of approaches to educational funding with the priority of preschool education and early childhood development programs, as well as lifelong learning.

Prospects for further research. The World Bank's Human Capital Index, which shows the amount of human capital a child born today can accumulate before the age of 18, adjusted

for the risk of poor health and education in the country of birth, indicates a future decline of labor productivity in all countries. The index consists of three components: (1) the survival rate of children from birth to school age (5 years); (2) the expected number of years of schooling, adjusted for the quality of this education – the indicator combines information on the volume and quality of education and is calculated as the ratio between testing in the country and the best test in the world, multiplied by the projected number of years at school in the country; (3) two broad indicators of health – the prevalence of childhood shortness and adult survival [27, p. 55–62]. The components of the index are designed to illustrate how improving current educational and health outcomes will affect the productivity of the next generation of workers.

According to the World Bank, children born in 2018 in countries with a low expected number of schoolyears adjusted for the quality of education will have only 51% of the benchmark productivity (which equals to 100%), while children born in 2018 in countries with a high expected number of schoolyears, adjusted for the quality of education, will have 76% of the benchmark productivity.

At the same time, these assessments do not take into account the negative impact on the quality of education of the unexpected transition to distance learning during the current global pandemic. Even highly developed countries have not been able to provide all school-age children with access to home schooling: both communication and Internet coverage have been insufficient. Although the situation is currently unprecedented, it may become episodic or even chronic, at least for the next 1,5 to 2 years, until an effective vaccine is invented. These changes in education will have an impact on future human capital and labor productivity. The spread of the new dangerous disease will also affect human health. Therefore, promising areas of research include the re-evaluation of future productivity based on the Human Capital Index, with due consideration of the impact of the COVID-19 pandemic on education and human health.

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ДЕРЖАВНЕ ФІНАНСУВАННЯ ОСВІТИ ЯК ФАКТОР ЕКОНОМІЧНОГО ЗРОСТАННЯ

Основні підходи до аналізу впливу освіти на економічне зростання полягають в оцінці щільності зв'язку між показниками економічного зростання (приростом ВВП/ВВП на душу населення) і трьома групами освітніх індикаторів: кількісними (охоплення населення певним рівнем освіти), якісними (стандартизовані бальні оцінки учнів) та обсягами фінансування освіти. Водночас від обсягів фінансування освіти залежить охоплення населення освітою та якість здобутих знань. У статті доведено, що між показниками державного фінансування вищої і середньої освіти у розрахунку на одного учня/студента та загальною факторною продуктивністю країн існує суттєвий позитивний зв'язок. При цьому не існує єдино вірної схеми розподілу державного фінансування між освітніми рівнями для утворення стійких передумов економічного зростання: одні країни для пришвидшення темпів економічного зростання мають більше коштів спрямовувати в початкову освіту, інші – в середню або вищу. Як показано у статті, це залежить від технологічного рівня країни, наявної освітньо-професійної структури людського капіталу, а також контекстних факторів – як-от якість створених у країні інститутів.

Розглянуто практичні підходи до фінансування різних рівнів освіти за рахунок державних і приватних коштів, де останні представлені у розрізі приватних фондів та державних трансфертів сім'ям з учнями/студентами. Зроблено висновок про те, що рівнева структура державного фінансування освіти – прямого і у вигляді державних трансфертів сім'ям з учнями/студентами – свідчить про пріоритетизацію

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конкретного освітньо-професійного складу людського капіталу. Результати дослідження підводять до необхідності узгодження підходів до розроблення бюджетної політики у сфері фінансування освіти зі стратегічними прогнозами соціально-економічного розвитку національних економік, а також зважаючи на технологічні, кваліфікаційні, інституціональні передумови, які складаються в країнах.

Ключові слова: *державне фінансування освіти, бюджетний простір, державні трансферти, економічне зростання, загальна факторна продуктивність, світовий технологічний стандарт*