

RUSSIA'S HUMAN CAPITAL: COST ESTIMATION, ANALYSIS OF THE DYNAMICS AND STRUCTURE

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Abstract

Article discusses the results of the valuation of human capital in Russia by analyzing the dynamics of in the period from 2007 to 2012 in nominal and real terms. The changes in the value of human capital by age groups are studied, cross-country differences in the estimates of human capital are revealed. The cost of human capital is estimated via two methods: the cost method proposed by Russian scientist M.M. Kritskiy, and the income method developed by the OECD. Current study reflects on the modified OECD method, which is applicable for statistical information disaggregated by five-year age intervals. Calculations show that in 2012 the total value of the human capital in Russia amounted to 768.7 trillion rubles if counted using M.M. Kritskiy method and 504.6 trillion rubles using OECD method. In real terms, growth in comparison with 2007 was 40 percent using the first method 10 percent using OECD method. The comparison of the estimates on the value of Russia's human capital by age groups showed that the younger ages are 'richer' than those in older age groups. Comparison of macro characteristics of the Russian economy showed that the gross stock of human capital at times exceeds the GDP and the stock of physical capital.

Keywords: human capital, Russia, dynamics, age groups, cross-country comparisons

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Introduction

The historical roots of the theory of human capital can be found in the works of U. Petti, A. Smith, K. Marx, J. Mill and other economists. It is generally recognized that the accumulation of human capital (HC) is one of the main drivers of economic growth, a key factor in economic and social welfare of modern societies. Manifold benefits are of investment in HC. In these circumstances, the issue on the stock of HC and the trajectories of change over time become of great interest (Cleland, 2015; Dobrynin, Dyatlov, Tsyrenova, 1999;). According to Organization for Economic Cooperation and Development, human

capital is a certain stock human health, knowledge, skills, abilities and motivation formed as a result of investments and accumulated by a person, which is rationally used in the labor process, contributing to the growth of productivity and wages (Cadil, Petkovova, 2014; Turnovsky, S.J. 2011).

Currently, there are three main approaches to the valuation of the HC: the indicator approach; an approach based on cost accounting; an approach based on income accounting. According to the indicator approach, the stocks of HC are evaluated on the basis of indexes, but not in value terms, making these estimates comparable with the estimates of stocks of physical capital and other key economic parameters. However, the current study is focused on the valuation (i.e. cost estimate) of the HC, which can be obtained on the basis of a retrospective approach of past costs incurred during its formation, and a prospective approach based on income accounting as the future source for HC. To date there is no single methodology elaborated for the valuation of the HC, which gives universally valid evaluation.

One of the methods of HC cost estimation, applicable for the Russian Federation, is the method proposed by Kritskiy (Kritskiy, 1991). A notable method based on revenue is developed by the OECD (Liu, 2011). One of the major theoretical propositions in the approach of Kritskiy on the valuation of HC is that human capital can not only be bought and sold, but also depreciated, prepaid (i.e. investment of funds in future profits) and compensated as a fixed capital. Human capital is a long-term capital resource. It carries out a specific economic cycle, passing the appropriate stage of reproduction, and is manifested in various functional forms. The approach of Jorgenson-Fraumeni towards assessing the value of HC was chosen as a methodological basis of the OECD method (Jorgenson, Fraumeni 1989, 1992; Jorgenson, Ho, Stiroh, 2005), since it is the most practical and is consistent with the standards of a modern system of national accounting and modern economic theory.

1. Research methods

When calculating the total human capital using the Kritskiy's method requires the following inputs: structure of the population by age, the value of total consumption fund (CF), the structure of employment, including the number of people engaged in the production of consumer services (N_{pt}), the number of people employed in material production (N_t) and the number of unemployed in the production population (N_{pp}), as well as the life expectancy of the population (T).

The source of data to assess the value of human capital in Russia using the Kritskiy's method is a database of Rosstat (i.e. Federal State Statistics Service). Evaluation is carried out on the entire population as a method is based on cost accounting and assumes the cost of formation of the HC during the entire lifespan of individuals. In addition, the method takes into account the amount of consumed HC at a given time, that is, depreciation. Depreciation of HC is estimated as the aggregate of the consumption fund, fund of consumer services and fund of the productive capacity of the population. The calculations are carried out according to age intervals. Estimated is the value of the HC used during the average life expectancy, consumed in a given year and the aggregate of the HC.

The main stages of the calculation of the total value of the human capital of the population:

1) The ratio of the switching needs for consumer services K_y , as the ratio of the population engaged in the production of consumer services to the population employed in material production:

$$K_y = \frac{N_{pt}}{N_t}.$$

Next requirement is to allocate the coefficient indicating the switch in the needs of the population for preservation and development of the individual K_c , which equals the ratio of the unemployed population in the production to the total population engaged in the production of consumer services and material production:

$$K_c = \frac{N_{pp}}{N_{pt} + N_t}.$$

2) The amount of annual depreciation of aggregate human capital G_{p1} represented as a set of funds:

$$G_{p1} = CF + Y + C;$$

where the value of the total consumption fund (CF) is given, it is used to calculate the aggregate fund of consumer services (Y) and aggregate fund of performance abilities of the population (C):

$$Y = CF \cdot K_y; \quad C = K_c \cdot CF(1 + K_y).$$

The amount of annual depreciation of an average individual human capital – g_{p1} is the ratio of total annual depreciation of the human capital G_{p1} to the total population:

$$g_{p1} = \frac{G_{p1}}{N}.$$

The amount of annual depreciation of human capital for a particular age group G_{p1i} is defined as the product of the average individual annual depreciation of human capital in the population of this age group N_i :

$$G_{p1i} = g_{p1} \cdot N_i.$$

3) The value of an average aggregate human capital G_{pr} used during life expectancy is calculated as the sum of used human capital of m number of age groups:

$$G_{pr} = \sum_i^m G_{pr i},$$

where $G_{pr i}$ – applied human capital by an i age group $G_{pr i} = g_{p1} \cdot N_i \cdot T$;

m – number of age groups.

4) The quantity the total human capital G_p consumed in a given year is equal to the sum of consumed human capital by m age groups in a given year:

$$G_p = \sum_i^m G_{p i};$$

where $G_{p i}$ – applied human capital by an i age group $G_{p i} = g_{p1} \cdot N_i \cdot t_i$;

m – number of age groups; t_i – average age of the population of the i age group.

5) Estimated total human capital of the Russian population is calculated as the difference between the applicable consumption and used human capital:

$$G = G_{pr} - G_p.$$

The second method used to assess the value of the human capital is an approach developed by the OECD. In 2009, the OECD started a special project on “Measuring the Stock of Human Capital for Comparative Analysis”, devoted to the development of a unified methodology for measuring HC, while the methodological framework has been adopted from Jorgenson-Fraumeni’s approach. This approach was also used by Kapeliushnikov (Kapeliushnikov, 2012) in the valuation of human capital in Russia.

According to the methodology of the OECD, the value of HC is a discounted value of lifetime earnings of the population according to age and level of education. Therefore, the calculations are undertaken for the population of working age between 15-64. Human capital of individuals under the age of 15 are not taken into account and lifetime earnings of the population aged 65 and above are counted as zero, since the individuals fall beyond the labor force barrier.

According to the initial methodology of the project, the assessment procedure is carried out on the one-year age groups. However, detailed statistical information necessary for the evaluation of the HC is only available for the five-year intervals. In this regard, an adjustment of the original formula is required, using the correction coefficient K for the five-year age groups.

Evaluation is carried out separately for educational groups. An enlarged classification of the six levels of education is used: higher education, secondary professional education, initial vocational, secondary complete general, basic general, and the lack of basic general.

The calculations are carried out starting with the last age interval. At the age of 60-64 the HC is equal to the value of current earnings of the population, taking into account the level of employment. At the age of 40-59, an additional cost of HC is accounted in the next age range, which is a subject of survival. For the population aged 15-39 years of age, the calculation additionally includes the probability of increasing the level of education of individuals and, as a consequence, the cost of the HC.

The valuation of human capital using the OECD method requires the following input data: the number and age structure of the population; the probability of survival of the population by age group; the level of education of the population by age group; the level of employment by age and education; indicators of wages by age and level of education; coefficients of enrollment in educational institutions. The resulting formulas for calculating the value of human capital are presented below.

For those aged 60 to 64 years, the discounted value of lifetime earnings assumed to be equal to their current earnings, taking into account their level of employment:

$$LIN_{age-(age+5)}^{edu} = EMR_{age-(age+5)}^{edu} \cdot AIN_{age-(age+5)}^{edu},$$

where $LIN_{age-(age+5)}^{edu}$ – discounted value of lifetime earnings with a certain age group and education; $EMR_{age-(age+5)}^{edu}$ – probability of being employed with a certain age group and education; $AIN_{age-(age+5)}^{edu}$ – current earnings of persons with a certain age group and education.

For those aged 40 to 59 years:

$$LIN_{age-(age+5)}^{edu} = EMR_{age-(age+5)}^{edu} \cdot AIN_{age-(age+5)}^{edu} + SUR_{age+5}^{age} \cdot LIN_{(age+5)-(age+10)}^{edu} \cdot \left(\frac{1+r}{1+\delta}\right)^5,$$

where SUR_{age+5}^{age} – probability of persons with a certain age group and education to live until age+5; $LIN_{(age+5)-(age+10)}^{edu}$ – discounted value of lifetime earnings by age group with a certain education; r – the annual growth rate of real wages (5.2%); δ – discount rate (4%);

For those aged 15 to 39 years:

$$\begin{aligned}
 LIN_{age-(age+5)}^{edu} &= EMR_{age-(age+5)}^{edu} \cdot AIN_{age-(age+5)}^{edu} + SUR_{age+5}^{age} \cdot \left(\frac{1+r}{1+\delta}\right)^5 \cdot \\
 &\left(\left(1 - \sum ENR_{age-(age+5)}^{edu-edu}\right) \cdot LIN_{(age+5)-(age+10)}^{edu} + \sum ENR_{age-(age+5)}^{edu-edu} \right. \\
 &\quad \left. \cdot LIN_{(age+5)-(age+10)}^{edu} \right)
 \end{aligned}$$

where $ENR_{age-(age+5)}^{edu-edu}$ – the proportion of persons of a certain age group and education, receiving education of higher level; $LIN_{(age+5)-(age+10)}^{edu}$ – discounted value of lifetime earnings by age group with education of higher level.

2. Research results

Valuation of human capital was carried out for the population of Russia in 2007 and 2012 in nominal and real terms (Table 1) based on data of the Federal State Statistics Service of the Russian Federation .

Tab. 1: General characteristics of human capital of Russia’s population in 2007 and 2012

Indicator	Kritskiy method		OECD method	
	Gross value, trillion rub.	Average per capita level, mln. rub.	Gross value, trillion rub.	Average per capita level, mln. rub.
The cost of the HC of the Russian population in 2007	350.0	2.5	380.9	4.1
The nominal value of the HC of the Russian population in 2012	768.7	5.4	504.6	5.1
The real value of the HC of the Russian population in 2012 at 2007 prices (with deflation by the consumer price index)	496.0	3.5	420.5	4.2

Source: author’s own work

To shift from the nominal value to the real value of the HC a consumer price index is used. According to Rosstat, in 2007-2012, the cumulative increase in the CPI was 155.7%. Based on these estimates, during the study period, gross and per capita human capital of Russia is steadily increasing. In 2007, the cost of a national HC based on Kritskiy method was equal to 350 trillion rub., in 2012 Russia the amount of HC was 768.7 trillion rub. During the study period, the rated capital increased more than 2 times, and the annual growth

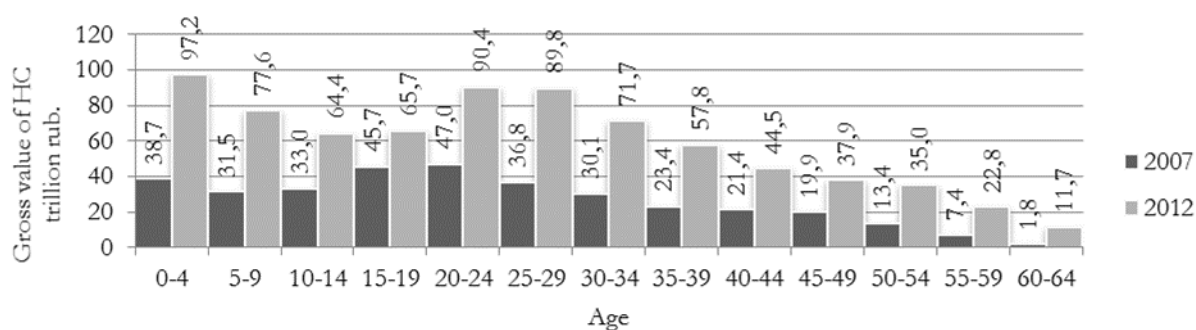
rate ranged from 10 to 30%. In 2012, gross HC of Russia approached 496 trillion rub. in real terms, exceeding its volume in 2007 by 29%. This implies that the annual growth rate of the HC in constant prices reached 9%. A similar leap is observed in the per capita indicators: while in 2007, the average Russian was the holder of the HC in the amount of 2.5 mln. rub., in 2012 the amount reached 5.4 mln. rubles in nominal terms and 3.5 mln. rubles real value.

According to the calculations made using the method of the OECD, the HC of Russia in 2007 was equal to 380.9 trillion rub., while in 2012 – 504.6 trillion rub. In the five years period, its nominal margin increased by a third, which implies an annual growth rate of about 7.3%. In real terms, the volume of Russian HC since 2007 to 2012 increased by 9.4% to 420.5 trillion rub. Annual growth rate of approximately 2.5%. The average Russian citizen in 2007 was the holder of the HC in the amount of 4.1 mln. rubles. In 2012 the amount was 5.1 mln. rubles in nominal terms and 4.2 mln. rubles at constant prices.

The significant gap in the results obtained, as mentioned earlier, is caused by the fundamental differences in the methods of valuation of the HC. Thus, according to the first method, the holders of the human capital were 142.2 mln. people in 2007 and 143.2 mln. people in 2012; to the second method, 101.6 mln. people in 2007 and 103 mln. people in 2012.

Moreover, there is a clear differentiation in the distribution of the gross volume of Russia's human capital by age groups during the study period. The distribution of human capital produced by the Kritskiy method is largely affected by population of age groups, causing jumps in the volume of HC held by younger cohorts (Fig. 1).

Fig. 1: Gross valuation of HC by age groups using Kritskiy method

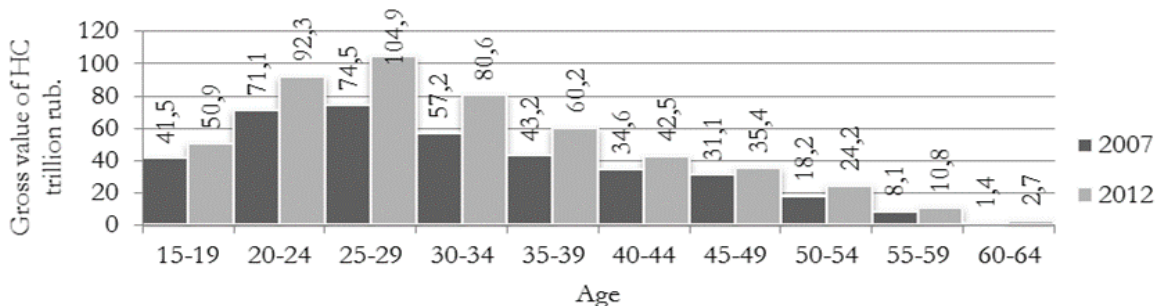


Source: author's own work

According to the results of calculations in accordance with the methodology of the OECD, a number of interesting conclusions can be made. With age, the gross figures of

human capital increase (due to higher levels of education and, consequently, an increase in the cost of human capital), reaching a peak at the age of 25-29 years and then consistently decrease (Fig. 2).

Fig. 2: Gross valuation of HC by age groups using OECD method



Source: author's own work

For example, in 2007 the amount of human capital in age group of 25-29 years exceeded the amount of the age group 60-64 years by 50 times, and in 2012 by 40. In 2007, the proportion of the population aged 25-29 years accounted for 19.6% of the total value of human capital, while the population aged 60-64 years accounted for only 0.4%. In 2012 these figures were, respectively, 20.8% and 0.5%. Noted gap caused by a number of reasons, such as: best educational characteristics belong to younger generations; longer forthcoming service of the human capital for younger people; higher expected growth rate of real wages, affecting the amount of human capital of the younger generations; while for older generations this factor has no affect due to upcoming retirement.

According to the Kritskiy method, per capita indicators of human capital are maximized between the ages of 0 to 4 years and decrease monotonically in scale throughout the age. Obviously, there is a huge gap in per capita indicators of human capital between older and younger age groups. In 2007 the capital of the youngest age group (0-4 years), equal to 7.7 million rubles, exceeded the level of human capital of the oldest age group by 13 times. In 2012, average per capita indicators of human capital of the younger age groups exceeded the older groups by 21 times. The level of human capital of the population aged 0-4 years was 11.4 mln. rubles. These differences are caused by the upcoming long life service of the human capital in younger age groups compared to older, as well as the growth of consumption of human capital with increasing age.

According to the methodology of the OECD, with age per capita indicators of the HC increase, similar to the gross values, reaching a peak at the age of 25-29 years and then

consistently decrease. In per capita indicators of human capital the younger age groups were also far ahead compared with the older groups: 9 mln. rubles versus 0.4 mln. rubles in 2007, 7.3 mln. rubles as against 0.3 mln. rubles in 2012. Between 2007 and 2012, the amount of human capital a multiple times exceeded the GDP (Table 2). According to the Kritskiy method, these disproportion was 10.5 times in 2007, 12.3 times in 2012. According to the methodology of the OECD: 11.5 times in 2007, and 8.1 times in 2012.

Tab. 2: Human capital and macro characteristics of the economy of the Russian Federation

Indicators	Kritskiy method		OECD method	
	2007	2012	2007	2012
Gross human capital, bln.rub.	349,973	768,745	380,938	504,578
GDP, bln.rub.	33,248	62,600	33,248	62,600
Ratio of gross human capital to GDP, times	10.5	12.3	11.5	8.1
Volume of physical capital, mln. rub.	70,827	136,448	70,827	136,448
Ratio of gross human capital to the amount of physical capital, times	4.9	5.6	5.4	3.8

Source: author's own work

The correlation between alternative types of capital – human and physical – are also in favor of the former. According to Kritskiy (Kritskiy, 1991), in 2007 the gross human capital surpassed the amount of physical capital by 4.9 times, and in 2012 by 5.6 times. According to the methodology of the OECD, these figures are 5.4 times in 2007 and 3.8 times in 2012. Similar macro proportions can be considered quite ‘normal’ for the economies of the modern type, as the ratio of human capital / GDP fits in the range of 8 to 16 times, and the ratio of human capital / physical capital varies from 3.5 to 7 times.

To convert the estimates from the national currency to US dollars, the value of PPPs for private consumption was used, which according to the OECD amounted to 13.98 rubles per USD in in 2007 and 18.49 in 2012. During the reporting period, the gross volume of the Russian human capital, measured in US dollars at PPP by the Kritskiy method, increased from 25 to 41.6 bln. USD. Applying the procedure of the OECD shows the values of 26.2 to 27.3 bln. USD. As for per capita indicators, there is the rise from 178.8 to 292.1 thousand

USD using Kritskiy method and 275.1 to 293.2 thousand USD as derived from applying the OECD method.

It should be emphasized that by international standards the level of average per capita cost of Russia's human capital being equal to 292 thousand USD is a considerable value. Although it is significantly less than in the US – 792.5 thous. USD using Kritskiy method and 741 USD using the OECD method. However, the value of Russian HC is comparable with that of most other developed countries, and much higher than for the post-socialist countries such as Poland (approx. 210 thous. USD) and Romania (approx. 80 thous. USD).

3. Conclusion

The resulting estimates for Russia correspond with those estimates available for other countries. In 2012, the total value of the human capital of Russia amounted to 768.7 trillion rub. using Kritskiy method and 504.6 trillion rub. Using OECD method. Every Russian holds average human assets of approximately 5.4 and 5.1 million rubles.

In Russian conditions, human capital is not evenly distributed across different age groups. From this perspective, the younger ages are wealthier than the representatives of the elderly group are. In real terms, for the 2007-2012 period, Russian human capital increased by 29% by the method of Kritskiy and 9.4% using OECD approach. The gross human capital at times exceed the country's GDP and the stock of physical capital. Similar macro proportions are normal for the economies of the modern type. It should be noted that the data on macro proportions indicate that with time the Russian economy is becoming more and more 'human capitalistic'. PPP value of human capital of Russia exceeds 41 trillion US dollars (Kritskiy method) and 27 trillion US dollars (OECD method), and the per capita level reaches 290 thousand US dollars. Based on these estimates, we can conclude that by the degree of equipping with human capital, Russia is well ahead of post-socialist countries, being behind only some developed countries (e.g. the USA, Great Britain, and Norway).

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